

GREAT LAKES FISHERY COMMISSION

1989 Project Completion Report¹

Public Opinion of Sea Lamprey in the Great Lakes

by:

Meyer Resources, Inc. Davis California

In Association with
R. Ben Peyton
Michigan State University

May 1989

¹Project completion reports of Commission-sponsored research are made available to the Commission's Cooperators in the interest of rapid dissemination of information that may be useful in Great Lakes fishery management, research, or administration. The reader should be aware that project completion reports have not been through a peer review process and that sponsorship of the project by the Commission does not necessarily imply that the findings or conclusions are endorsed by the Commission.

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in the Great Lakes

A Report to the
Great Lakes Fishery Commission

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Research Completion Report *

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I. Executive Summary

Michigan and Ontario respondents to this survey concerning Sea Lamprey displayed strong views on the importance of protecting and restoring natural features in the Great Lakes, on public health issues, and concerning potential problems associated with use of chemicals in the Lakes and associated streams. With respect to this latter issue, there is broad sentiment against using TFM, and for finding alternative control methods. Persons who know about the Sea Lamprey and/or who have a fishing history in the Great Lakes are more likely to accept use of TFM because it is "proven", but this does not alter the view of respondents in general that alternative control methods should be developed and implemented.

Our data suggest that respondents in Michigan and Ontario would support an increased tax for this purpose of at least 10 cents per Great Lakes household, equivalent to a Great Lakes Fishery Commission budget of \$9 million. In Ontario, support is even stronger, and may reach 50 cents per household - or a GLFC budgetary equivalent of \$15 million. In Michigan, support is lower, but likely reaches 25 cents of additional tax per household - and a GLFC budgetary equivalent of \$11 million. These conclusions hold regardless of the underlying characteristics of sampled respondents.

Finally, our sample indicated that 75 percent of Michigan respondents and 68 percent of Ontario respondents have heard of the Sea Lamprey, and that 31 percent of Michigan residents and 22 percent of Ontario residents had heard of the Great Lakes Fishery Commission. We have no way of verifying whether these respondents are over-represented in our sample.

II. Discussion of Procedures

1. Survey Design

The primary informational objectives of our Public Opinion Survey on Sea Lamprey in the Great Lakes were identified via discussion with Great Lakes Fishery Commission (GLFC) staff.

- i) How many respondents have heard of Sea Lamprey and what do they know about them?
- ii) How many respondents have heard about the GLFC?
- iii) How do respondents view present control procedures employing the chemical TFM, and what is their opinion of this method relative to other potential control procedures?
- iv) Would respondents be prepared to pay a nominal addition to their taxes to enhance Sea Lamprey controls in the Great Lakes?

The survey also sought explanation of the reasons underlying respondent preferences, as well as data on variables that might serve as predictors of the responses received.

Initial survey design was developed by Meyer Resources, Inc. (MRI), in consultation with Dr. Ben Peyton of Michigan State University, in the fall of 1987. In early 1988, peer review comments to the draft design was received from seven technical experts chosen by GLFC. These comments were tabulated and design adjustments made. A final review of the draft design was conducted with GLFC staff in April of 1988. The final survey design is presented in Appendix A.

2. Fielding the Survey

Preparation for fielding the survey began in mid-1988, with the first actual mailout on October 20, 1988. The schedule for mailing is provided in Table 1.

Table 1
Schedule of Survey Mailout - Great Lakes
Sea Lamprey Public Opinion Survey

<u>Survey Wave</u>	<u>Michigan</u>	<u>Ontario</u>
1st mailout	October 20, 1988	October 20, 1988
Post card follow-up	November 3, 1988	November 3, 1988
Final repeat mailout	December 15, 1988	January 5, 1988
Response cutoff	February 10, 1989	February 10, 1989

Michigan residents were randomly sampled, using address lists from Donnally Marketing Services' DQI² data base, a consumer data base covering 3,021,856 Michigan households. Ontario residents in the following counties were randomly sampled, using address lists provided by Canadian Lists and Data.

- | | |
|------------------------------------|--|
| - Frontenac | - Wellington |
| - Lennox and Addington | - Huron |
| - Hastings | - Regional Municipality of Waterloo |
| - Prince Edward | - Perth |
| - Peterborough | - Hamilton |
| - Northumberland | - Wentworth |
| - Victoria | - Regional Municipality of Niagra |
| - Regional Municipality of Durham | - Oxford |
| - Regional Municipality of York | - Brant |
| - Regional Municipality of Peel | - Regional Municipality of Haldimand-Norfolk |
| - Regional Municipality of Halton | - Parry Sound |
| - Dufferin | - Nipissing |
| - Grey | - Algoma |
| - Lambton | - Sudbury |
| - Middlesex | - Manitoulin |
| - Elgin | - Thunder Bay |
| - Essex | - Kent |
| - District Municipality of Muskoka | - Simcoe |

The survey mailout process was difficult. Restrictions on project funding dictated a collaborative mailout between MRI and GLFC staff, purchase of respondent address listings from commercial vendors, and a mail survey, as opposed to one conducted by telephone or in person. Limited project financing also prohibited pre or post survey contact with targeted respondents. The predictable results of these circumstances were a lowering of response rate and a slowing of actual survey process. Anomalies in the Canadian postal system also acted to reduce rates of response. Finally, use of purchased lists resulted in some under representation of rural areas in both Michigan and Ontario. Even with these difficulties, actual response rates were within bounds expected for mail-out surveys. Response rates achieved are identified in Table 2. Responses, by zip code, are provided in Appendix B.

Table 2
Response Rates for Great Lakes Sea Lamprey
Public Opinion Survey

	<u>Michigan</u>		<u>Ontario</u>	
	<u>No. of Responses</u>	<u>Percent</u>	<u>No. of Responses</u>	<u>Percent</u>
Total mailout	1,500	---	1,500	---
Returned undeliverable	141	9.4	327*	21.8*
Total effective mailout	1,359	100.0	1,173	100.0
Responses	631	46.4	486	41.4

* A significant number of Ontario mailouts were returned as undeliverable during post-card and final mailing. This suggests an unexplained anomaly in the Canadian postal service.

Comparison of our samples with age and income profiles for Michigan and Ontario respectively indicate our returns over represent people 30 years of age and over in both jurisdictions, and under represent poorer households in Michigan (Appendix C). The issue of sampling representation will be explicitly discussed with respect to each major finding of this report. In most cases, we have found that our results would not be substantially altered by shifts in underlying sampling characteristics. Consequently, the conclusions presented in Section III are judged to be substantive, and capable of supporting policy decisions by GLFC.

III. Study Results in Detail

Our procedure in this section will be to first report frequency data for each survey enquiry. We will then examine statistical association between responses received and underlying characteristics of sampled respondents. Finally, we will discuss potential biases that could affect the results obtained.

1. Respondent Knowledge of Sea Lamprey

Seventy-five percent of Michigan respondents and 68.3 percent of Ontario respondents indicated that they had heard of Sea Lamprey. Results are displayed in Table 3.

Table 3
Great Lakes Respondents Who Have Heard
of the Sea Lamprey

	<u>Michigan</u>		<u>Ontario</u>	
	<u>Freq.</u> <u>#</u>	<u>Percent</u> <u>%</u>	<u>Freq.</u> <u>#</u>	<u>Percent</u> <u>%</u>
Yes	454	75.0	316	68.3
No	151	25.0	147	31.7
Total Responses	<u>605</u>	<u>100.0</u>	<u>463</u>	<u>100.0</u>

These results surprised some commentators. It is possible that responses are correlated with "interest" so that respondents with knowledge of Sea Lamprey are over represented in the sample. It is possible that some respondents could have claimed knowledge they did not possess. We have no way of testing "interest" bias in our samples without post-survey contact with the non-respondents in our targeted sample groups, however. We will consequently pay explicit attention to results differentiated by

knowledge of Sea Lamprey in our analysis of subsequent survey responses.

Cross-tabular analysis indicates a significant relationship between claimed knowledge of Sea Lamprey and responses to several subsequent questions in the survey. This consistency suggests that, at least for the broad sub-samples differentiated by knowledge of Sea Lamprey, responses are generally reflective of presence, or alternatively, lack of a knowledge base.

Survey Question (2) was restricted to respondents who did claim a knowledge of Sea Lamprey, and sought to identify what it was they knew. Results are presented in Table 4. These results represent the frequency with which each category was mentioned by respondents. They should not be interpreted as profiles of understanding or belief structures held by respondents. Question (2) was open ended, so that multiple responses were possible and categories overlap to some extent. The percentage calculations in Table 4 are based on $n = 454$ for Michigan, and $n = 316$ for Ontario.

Table 4
Great Lakes Respondents' Perceptions Concerning
the Sea Lamprey *

<u>Perception</u>	<u>Michigan</u>		<u>Ontario</u>	
	<u>Freq.</u> #	<u>Percent</u> %	<u>Freq.</u> #	<u>Percent</u> %
Sea Lamprey kills trout, salmon and other fish.	305	67.2	214	67.7
Sea Lamprey attach themselves to fish like a parasite	216	47.6	154	48.7
Sea Lamprey are eel-like animals	46	10.1	54	17.1
Sea Lamprey scar or harm other fishes	40	8.8	16	5.1
Sea Lamprey are useless and/or a parasite	16	3.5	15	4.7
Sea Lamprey spawn in rivers of the Great Lakes	16	3.5	---	---
Respondent provides some history of Sea Lamprey	82	18.1	57	18.0
Sub-sample n	454		316	

* Residents who claimed prior knowledge of Sea Lamprey only.

These data further substantiate our opinion that most respondents answering "yes" to our initial question concerning knowledge of Sea Lamprey were, in fact, answering truthfully. Readers can also note the considerable similarity between Ontario and Michigan results.

Survey Question (3) probed respondent knowledge further, enquiring about perceptions concerning measures available to control Sea Lamprey. Proceeding with the same Michigan and Ontario sub-samples as in Question 2, results are reported in Table 5. Again, this question was open ended and multiple responses were possible.

Table 5
Great Lakes Residents' Awareness of Control
Measures for Sea Lamprey*

<u>Control Measures</u>	<u>Michigan</u>		<u>Ontario</u>	
	<u>Freq.</u> <u>#</u>	<u>Percent</u> <u>%</u>	<u>Freq.</u> <u>#</u>	<u>Percent</u> <u>%</u>
Chemicals	106	23.3	46	14.6
Poisons	32	7.0	13	4.1
Traps	75	16.5	59	18.7
Weirs	49	10.8	3	0.9
Dams	11	2.4	16	5.1
Predatory Fish	13	2.9	8	2.5
Sterilization	5	1.1	---	---
Studies of Sea Lamprey	4	0.9	---	---
Sub-sample n	454		316	

* Residents who claimed prior knowledge of Sea Lamprey only.

It can be observed that, predictably, respondent knowledge of available control measures is less than knowledge concerning the Sea Lamprey itself.

In Question (4), we enquired as to how many times respondents had heard about Sea Lamprey in the media, over a previous 12 month period. Results are displayed in Table 6. Percentages reported here are based on the sum of those respondents who answered "no" to Question (1) and those responding to Question (4).

Table 6
Number of Times Great Lakes Residents Have
Heard of Sea Lamprey in the Media -
Past 12 Months

<u>Number of Occurrences</u>	<u>Michigan</u>			<u>Ontario</u>		
	<u>Freq.</u> #	<u>Per.</u> %	<u>Cum. Per.</u> %	<u>Freq.</u> #	<u>Per.</u> %	<u>Cum. Per.</u> %
50	3	0.5	0.5	1	0.2	0.2
20	3	0.5	1.0	---	---	0.2
15	2	0.3	1.3	---	---	0.2
14	1	0.2	1.5	---	---	0.2
12	7	1.2	2.7	2	0.4	0.6
10	6	1.0	3.7	1	0.2	0.8
7	1	0.2	3.9	1	0.2	1.0
6	12	2.0	5.9	---	---	1.0
5	9	1.5	7.4	5	1.1	2.1
4	14	2.4	9.8	7	1.5	3.6
3	37	6.3	16.1	13	2.8	6.4
2	83	14.1	30.2	41	9.0	15.4
1	66	11.2	41.4	57	12.4	27.8
0	192	32.7	74.1	183	40.0	67.8
Never heard	151	25.7	99.8	147	32.1	99.9
Total	587			458		

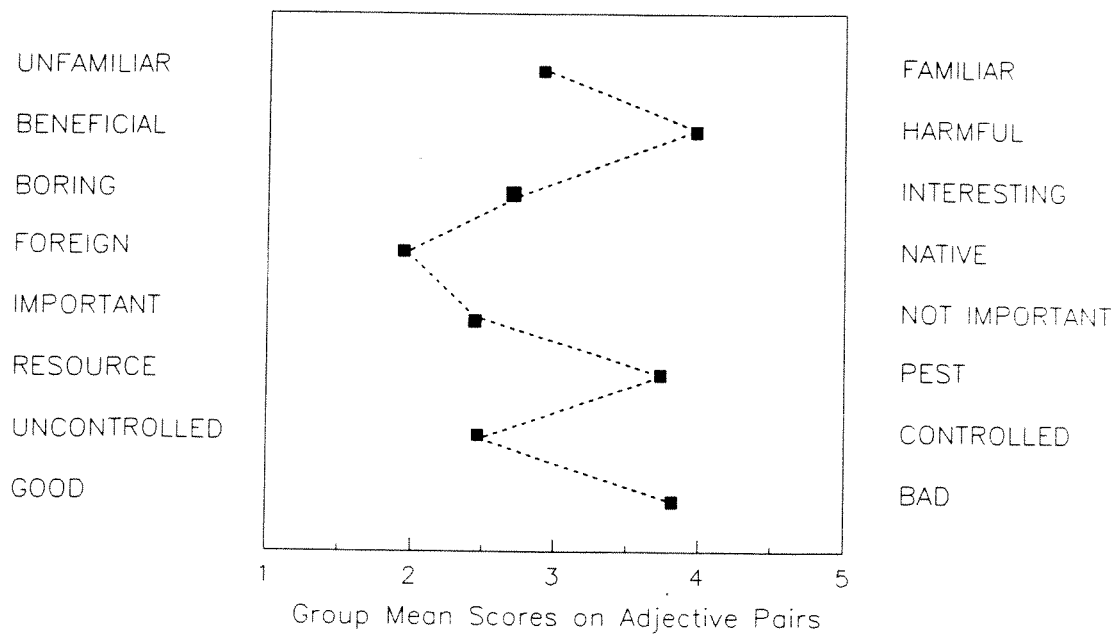
If these responses are indicative, there appears to have been more media coverage of Sea Lamprey in Michigan than in Ontario during 1988.

Finally, Question (5) utilized a "semantic differential scaling" technique to obtain further information with respect to respondent knowledge of Sea Lamprey. Again, only those residents who reported some previous knowledge of the lamprey responded to this question. Profiles of the two sets of attitudes are only slightly different and can be interpreted as one group (Figure 1). Frequency data are presented in Table 7 for Michigan and Table 8 for Ontario.

Respondents generally feel the Sea Lamprey topic is moderately familiar to them but not very interesting. The Sea Lamprey is considered somewhat important by the two groups. The Lamprey is accurately perceived as a foreign member of the Great Lakes ecological community and is considered a harmful pest which is uncontrolled. To a large majority of respondents, the Sea Lamprey is best described as "bad".

Figure 1

Profile of Michigan Respondent Attitudes Toward Sea Lamprey



Profile of Ontario Respondent Attitudes Toward Sea Lamprey

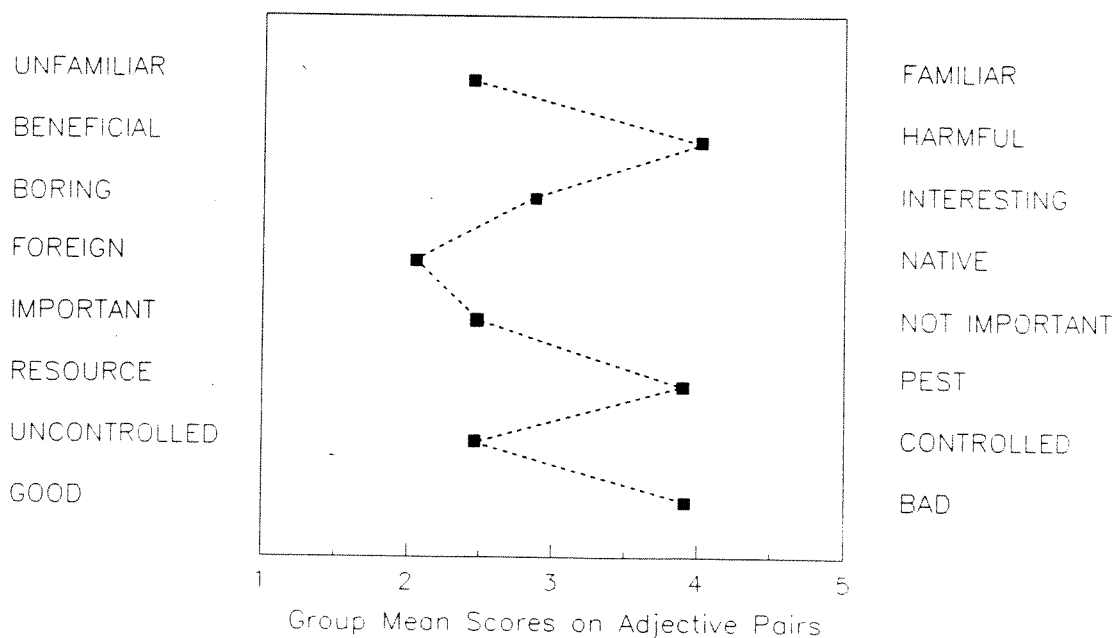


Table 7

Michigan Residents' Semantic Description
of Sea Lamprey

<u>Attribute</u>	Percentage Responses by Rating Scale					<u>Opposite Attribute</u>	No <u>Opinion</u> 0 %
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>		
	----- in percent -----						
Unfamiliar	9.0	14.1	28.5	17.0	22.4	Familiar	9.0
Beneficial	7.6	2.0	1.5	7.8	68.5	Harmful	12.7
Boring	5.8	6.5	28.6	18.0	23.3	Interesting	17.8
Foreign	40.3	7.1	11.6	5.8	17.6	Native	17.6
Important	36.0	7.6	10.6	8.8	25.7	Not Important	11.3
Resource	5.1	1.7	4.2	6.9	67.9	Pest	14.2
Uncontrolled	17.6	21.5	28.0	9.5	13.2	Controlled	10.2
Good	5.4	1.5	4.2	10.6	64.6	Bad	13.8

Table 8

Ontario Residents' Semantic Description
of Sea Lamprey

<u>Attribute</u>	Percentage Responses by Rating Scale					<u>Opposite Attribute</u>	No <u>Opinion</u> 0 %
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>		
	----- in percent -----						
Unfamiliar	12.0	20.0	29.5	16.0	12.0	Familiar	10.5
Beneficial	4.5	0.3	1.4	10.5	73.8	Harmful	9.4
Boring	7.0	3.7	29.8	19.9	21.3	Interesting	18.4
Foreign	30.4	8.9	13.9	5.4	21.8	Native	19.6
Important	33.1	10.0	13.2	8.2	26.3	Not Important	9.3
Resource	5.1	1.5	3.3	10.9	69.7	Pest	9.5
Uncontrolled	19.6	15.7	23.9	10.7	17.5	Controlled	12.5
Good	3.8	0.3	3.5	9.8	69.7	Bad	12.9

2. Respondent Knowledge of the Great Lakes Fishery Commission

Survey Question (6) inquired whether respondents had heard of the Great Lakes Fishery Commission. Results are presented in Table 9.

Table 9

Great Lakes Residents Who Know About the
Great Lakes Fishery Commission

	Michigan		Ontario	
	<u>Freq.</u> #	<u>Percent</u> %	<u>Freq.</u> #	<u>Percent</u> %
Know	192	31.3	106	21.8
Don't Know	421	68.7	380	78.2

As in Question (1), the representativeness of these results may be affected by "interest" bias. We have no method within present study constraints of verifying whether this is the case.

3. The Importance of Controlling Sea Lamprey in the Great Lakes

Respondents in Ontario and Michigan were not given any information by our questionnaire prior to answering Questions (1) through (6). This procedure was used to obtain an initial unbiased indication of their knowledge in the subject area. After Question (6), a more focused questioning approach was utilized. Specifically, in Question (7), respondents were given the following information in the questionnaire.

"The Sea Lamprey is an eighteen inch eel-like fish that has found its way into the Great Lakes. Today, they kill significant numbers of lake trout, salmon and whitefish. In some areas, Sea Lamprey kill as many lake trout as are caught by fishermen."

This information has the consequent potential to affect responses to Questions (7) through (15), following. In Question 7, respondents were asked to indicate the importance of controlling Sea Lamprey in the Great Lakes. Results are provided in Table 10.

Table 10
Great Lakes Residents' View on Importance
of Controlling Sea Lamprey

	<u>Michigan</u>		<u>Ontario</u>	
	<u>Freq.</u>	<u>Percent</u>	<u>Freq.</u>	<u>Percent</u>
	#	%	#	%
No Opinion	9	1.5	5	1.1
Not Important	4	0.7	4	0.8
Somewhat Important	23	3.8	19	4.0
Fairly Important	128	21.4	87	18.3
Very Important	434	72.5	361	75.8

It can be observed that respondents placed considerable importance on control of Sea Lamprey in the Great Lakes, and that responses were markedly similar in the two sampled jurisdictions.

As we indicated earlier, it is also important to consider whether potential biases associated with the representativeness of our two samples could have affected results, and to what degree. Sample representativeness can be defined with respect to standard variables, such as age and household income. Profiles for these characteristics, comparing our samples to data for Ontario and Michigan as a whole, are provided in Appendix C. As noted in our discussion of Question (1), respondent interest in particular survey subject matter - in this case Sea Lamprey in

the Great Lakes - may also affect the representativeness of data obtained. Our procedure here was to run cross-tab analysis of potential linkages between answers obtained in our survey and respondent characteristics, using SPSS-X statistics package(1). Results were then examined for significance using a non-parametric Pearson Chi-Square test. Results for Question (7) are presented in Table 11. It will be recognized that these tests can indicate existence of a statistical linkage between variables, but are not directional. Direction of linkage was derived from observation of cross-tab frequencies, and is included in our tables on that basis.

Table 11
Potential Factors Affecting Respondent Opinion
on the Importance of Controlling Sea Lamprey
in the Great Lakes (Question 7)

Respondent Char.	Linkage to Question 7 Responses							
	Michigan				Ontario			
	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.
Knowledge of Sea Lamprey	17.4	.0039	Yes	+	15.9	.0032	Yes	+
Age	55.1	.0035	Yes	+	20.7	.6552	No	
Income	35.3	.2330	No		49.5	.0016	Yes	?
Fished in past year	23.7	.0002	Yes	+	20.4	.0004	Yes	+
Fished ever	20.2	.0012	Yes	+	8.5	.0757	No	

The data in Table 11 indicate that for Michigan respondents, importance placed on control of Sea Lamprey appears positively related to knowledge of Sea Lamprey, to age, and to past fishing

experience. We further analyzed the three response sub-groups which were least supportive of Sea Lamprey control to identify the bounds of variance in opinion among groups and to provide a basis for evaluating the importance of Chi-Square test results. These "boundary" data are presented, for Michigan, in Table 12.

Table 12

Boundary Sub-Groups Who Consider Control of Sea Lamprey Least Important - Michigan Sample

<u>Degree of Importance</u>	<u>Michigan Sub-Groups</u>				
	<u>Full Michigan Sample</u>	<u>No Prior Sea Lamprey Knowledge</u>	<u>Age Group 50-59*</u> in percent	<u>Not Fished in Past Yr.</u>	<u>Never Fished</u>
No Opinion	1.5	2.7	3.0	1.8	6.0
Not Important	0.7	1.3	1.0	0.7	2.4
Somewhat Important	3.8	8.0	2.0	6.4	10.8
Fairly Important	21.4	25.3	20.8	26.4	25.3
Very Important	72.5	62.7	72.3	64.3	55.4

* Age group 15-19 was not considered due to only 6 observations.

For Ontario, results from Table 11 indicate that importance associated with control of Sea Lamprey can be affected by prior knowledge, fishing experience in the past year and by income—although the direction of the income effect is obscure. Proceeding as in Table 12, we display the Ontario knowledge, income and fishing experience subsets attributing least importance to control of Sea Lamprey in Table 13.

Table 13

Boundary Sub-Groups Who Consider Control of Sea Lamprey
Least Important - Ontario Sample

<u>Degree of Importance</u>	<u>Ontario Sub-Groups</u>			
	<u>Full Michigan Sample</u>	<u>No Prior Sea Lamprey Knowledge</u>	<u>Income Group \$75K+ *</u>	<u>Not Fished in Past Yr.</u>
	----- in percent -----			
No Opinion	1.1	2.1	---	1.8
Not Important	0.8	1.4	2.5	1.1
Somewhat Important	4.0	6.2	5.0	4.6
Fairly Important	18.3	26.0	27.5	23.7
Very Important	75.8	64.4	65.0	68.9

* Sub-group earning less than \$5,000 was not considered due to only 8 observations

Considering Tables 12 and 13, we conclude that even under the most adverse sampling redistribution conceptually available, there is still strong support from both Michigan and Ontario residents for control of Sea Lamprey in the Great Lakes. This conclusion is sustained, irrespective of variant characteristics between the samples drawn here and characteristics of Ontario and Michigan residents as a whole.

4. The Importance of Sea Lamprey Control Relative to Other Issues Affecting the Great Lakes

Survey Question (8) explored the importance of controlling Sea Lamprey, relative to several other issues affecting the Great Lakes. Results are displayed in Table 14 for Michigan, and in Table 15 for Ontario.

Table 14

Michigan Respondents' View of Great Lakes Issues

<u>Great Lakes Issue</u>	<u>Relative Scale of Importance</u>					<u>Undecided</u>
	<u>Not Important</u>		<u>Critical</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	
	----- in percent -----					
Reduce levels of toxic contamination	0.2	0.7	1.8	9.4	87.6	0.3
Reduce acid rain	0.5	1.4	10.2	18.1	66.9	2.9
Rehabilitate Great Lakes to natural state	1.0	1.0	8.4	21.2	66.2	2.2
Control Sea Lamprey	0.7	1.9	10.6	30.3	54.9	1.7
Establish natural trout populations	1.7	6.6	25.1	30.9	32.4	3.4
Increase salmon size and numbers	5.5	12.7	32.6	23.7	20.9	4.6

Table 15

Ontario Respondents' View of Great Lakes Issues

<u>Great Lakes Issue</u>	<u>Relative Scale of Importance</u>					<u>Undecided</u>
	<u>Not Important</u>		<u>3</u>	<u>Critical</u>		
	<u>1</u>	<u>2</u>		<u>4</u>	<u>5</u>	
	----- in percent -----					<u>0</u>
Reduce levels of toxic contamination	0.4	0.4	---	3.4	95.1	0.6
Reduce acid rain	0.2	0.6	1.9	6.8	89.9	0.6
Rehabilitate Great Lakes to natural state	0.2	1.3	3.4	15.0	79.1	1.1
Control Sea Lamprey	0.4	2.8	11.9	30.1	53.2	1.7
Establish natural trout populations	2.8	4.3	23.7	35.1	30.0	2.2
Increase salmon size and numbers	5.6	9.1	35.1	26.3	20.9	3.0

Reducing levels of toxic contamination, reducing acid rain and rehabilitating natural characteristics of the Great Lakes stand out strongly as important issues, both in Ontario and in Michigan. Control of Sea Lamprey follows in importance, and receives substantial support in both jurisdictions. Establishing natural trout populations and increasing salmon size and numbers are also considered important by a majority of respondents, but follow the other four listed issues in terms of relative priority. This is not unexpected, as we move from general issues of potential interest to all Great Lakes residents, to more specific issues that may have greater focus on commercial and sport fishing concerns.

Examining cross-tab analysis of these issue responses, with respect to potential effects of prior knowledge of Sea Lamprey, age, income, and fishing experience, we found that the following three issues posed are invariate with respect to underlying sampling characteristics:

- Reducing acid rain,
- Reducing levels of toxic contamination,
- Rehabilitating the Great Lakes to their natural state.

The other issues, more directly relating to fisheries, show some linkage between response priorities and underlying sampling characteristics. Linkages are summarized in Table 16 for Michigan, and in Table 17 for Ontario. The reader is referred to detailed printouts held by GLFC for further specification.

Table 16

Factors Affecting Respondent Opinion on the Relative
Importance of Selected Great Lakes Issues
- Michigan Respondents -

<u>Respondent</u> <u>Characteristic</u>	<u>Great Lakes Issue</u>		
	<u>Control</u> <u>Sea Lamprey</u>	<u>Increase Salmon</u> <u>Size & Numbers</u>	<u>Natural Pops.</u> <u>of Lake Trout</u>
Knowledge of Sea Lamprey	Yes	No	No
Age	Yes	No	Yes
Income	Yes	Yes	Yes
Fished in past year	Yes	Yes	No
Fished ever	Yes	Yes	No

Table 17

Factors Affecting Respondent Opinion on the Relative
Importance of Selected Great Lakes Issues
- Ontario Respondents -

<u>Respondent Characteristic</u>	<u>Great Lakes Issue</u>		
	<u>Control Sea Lamprey</u>	<u>Increase Salmon Size & Numbers</u>	<u>Natural Pops. of Lake Trout</u>
Knowledge of Sea Lamprey	Yes	No	No
Age	Yes	Yes	Yes
Income	Yes	No	Yes
Fished in past year	Yes	No	No
Fished ever	No	No	No

5. Options for Control of Sea Lamprey in the Great Lakes

a) General Description of Control Preferences

Options for control of Sea Lamprey in the Great Lakes are considered in Questions (9) through (14). Question (9) assessed respondent preference with respect to four alternative control procedures, and also posed a "no control" option. Results are reported in Table 18 for Michigan and Table 19 for Ontario.

Table 18

Michigan Residents' View of Acceptable
Controls for Sea Lamprey

<u>Control Measure</u>	<u>Degree of Acceptability</u>				
	<u>Not Acceptable</u>		<u>No Opinion</u>		<u>Completely Acceptable</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
	----- in percent -----				
Sterilization	3.5	7.1	12.0	27.3	50.2
Special dams/traps	6.9	14.1	10.3	21.6	47.1
Reduce reproductive senses	8.7	9.7	14.7	33.4	33.4
Use TFM	11.9	13.7	12.5	31.4	30.4
Not controlling Sea Lamprey	85.0	6.8	3.5	1.4	3.3

Table 19

Ontario Residents' View of Acceptable
Controls for Sea Lamprey

<u>Control Measure</u>	<u>Degree of Acceptability</u>				
	<u>Not Acceptable</u>		<u>No Opinion</u>		<u>Completely Acceptable</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
	----- in percent -----				
Sterilization	3.9	6.7	14.0	23.5	51.9
Special dams/traps	6.9	10.5	5.4	23.0	54.3
Reduce reproductive senses	11.5	17.2	12.4	27.9	30.9
Use TFM	20.5	20.7	11.1	23.1	24.6
Not controlling Sea Lamprey	81.3	10.0	4.8	0.9	3.0

It can be observed that alternative control measures to TFM are preferred by both Ontario and Michigan residents. Abandoning controls is not considered a viable option.

Further focus is provided on these issues by Question (10) identifying "most preferred" single control options, and Question (12) identifying "least preferred" single options. Results from these two questions are presented in Tables 20 and 21.

Table 20

Control Measure for Sea Lamprey that Great Lakes
Residents Most Prefer

<u>Control Measure</u>	<u>Michigan</u>		<u>Ontario</u>	
	<u>Freq.</u> #	<u>Percent</u> %	<u>Freq.</u> #	<u>Percent</u> %
Special dams/traps	186	36.1	191	45.3
Sterilization	146	28.3	118	28.0
TFM	138	26.8	76	18.0
Reduce reproductive senses	41	8.0	33	7.8
No control	4	0.8	4	0.9

Table 21
Least Preferred Control Measure for Sea Lamprey -
Great Lakes Residents

<u>Control Measure</u>	<u>Michigan</u>		<u>Ontario</u>	
	<u>Freq.</u> #	<u>Percent</u> %	<u>Freq.</u> #	<u>Percent</u> %
TFM	247	48.4	244	58.7
No control	117	22.9	79	19.0
Special dams/traps	107	21.0	52	12.5
Reduce reproductive senses	25	4.9	26	6.3
Sterilization	14	2.7	15	3.6

When respondents were asked to select a single most preferred control measure, TFM rated slightly better than in Question (9), although the percentage of respondents selecting this alternative was relatively low (26.8 percent in Michigan; 18.0 percent in Ontario). When respondents were asked what option was least preferable, TFM was selected by 48.4 percent of Michigan respondents and 58.7 percent of Ontario respondents, however.

Question (11), which provides principal rationale for the preferred control measures identified in Question (10), and Question (13), which provides principal rationale for the least preferred measures identified in Question (12), further illuminate respondent control preferences. Results are reported in Table 22 for Michigan residents, and in Table 23 for Ontario residents. Rationale for least preferred control measures are presented in Table 24 for Michigan residents and in Table 25 for Ontario residents. These tables should be read vertically, a

column at a time. They prioritize reasons for control preference for each measure separately, and reasons associated with each particular method should not be cross-compared horizontally in the tables.

Table 22

Reasons for Control Preference - Michigan Residents

<u>Reason for Preference</u>	<u>Control Measures</u>				
	<u>Special dams/traps</u>	<u>Steril-ization</u>	<u>TFM</u> in percent	<u>Reduce reprod.</u>	<u>No control</u>
Method is proven	---	---	66.1	---	---
Less harmful side effects	17.4	46.7	---	30.3	---
No chemicals	72.5	26.7	---	---	50.0
More humane	---	5.7	---	---	---
Less cost	---	8.6	12.8	---	50.0
Other reasons	10.1	12.3	21.1	69.7	---

Table 23

Reasons for Control Preference - Ontario Residents

<u>Reason for Preference</u>	<u>Control Measures</u>				
	<u>Special dams/traps</u>	<u>Steril-ization</u>	<u>TFM</u> in percent	<u>Reduce reprod.</u>	<u>No control</u>
Method is proven	---	---	56.9	---	---
Less harmful side effects	17.1	30.0	---	34.5	---
No chemicals	65.7	40.4	---	---	66.7
More humane	---	---	---	---	---
Less cost	---	5.3	6.9	---	33.3
Other reasons	17.2	24.3	36.2	65.5	---

Table 24

Reasons Why Control Least Preferred -
Michigan Residents

<u>Reason for Avoidance</u>	<u>Control Measure</u>				
	<u>TFM</u>	<u>No control</u>	<u>Special dams/traps</u>	<u>Reduce reprod.</u>	<u>Sterilization</u>
			in percent		
Chemicals harmful	92.0	---	---	---	20.0
Harmful side effects	---	60.7	33.3	81.0	---
Harm sport fishing	---	11.2	---	---	---
Not effective	---	---	6.2	19.0	40.0
Too costly	---	---	40.6	---	---
Other reasons	8.0	28.1	19.9	---	40.0

Table 25

Reasons Why Control Least Preferred -
Ontario Residents

<u>Reason for Avoidance</u>	<u>Control Measure</u>				
	<u>TFM</u>	<u>No control</u>	<u>Special dams/traps</u>	<u>Reduce reprod.</u>	<u>Sterilization</u>
			in percent		
Chemicals harmful	94.8	---	---	---	10.0
Harmful side effects	---	66.7	32.7	100.0	---
Harm sport fishing	---	15.9	---	---	---
Not effective	---	---	10.2	---	30.0
Too costly	---	---	40.8	---	---
Other reasons	5.2	17.4	16.3	---	60.0

It can be observed, in examining Tables 22 and 23, that the major motivations underlying choice of Sea Lamprey control measures is avoidance of chemicals and harmful side effects in the Lakes. Respondents choosing TFM did so largely because it was a proven method. Cost was a factor, but does not seem to be of primary importance on the basis of our analysis (see also subsequent analysis of Question (15)). These results hold for both Ontario and Michigan.

Table 24 and 25 indicate that avoidance of chemicals and of harmful side effects in the Great Lakes are also the determining considerations in identification of least preferred measures for Sea Lamprey control. Over 90 percent of Michigan and Ontario residents who least preferred TFM cited chemical harm as a reason for avoiding this control procedure. Cost was also identified by both sampled groups as a significant negative element with respect to building special dams or traps as a control measure. Again, responses from Michigan and Ontario are remarkably similar with respect to these issues.

Finally, Question (14) attempted a more structured assessment of the underlying concerns potentially affecting residents' views of Sea Lamprey control measures. Results are reported in Table 26 for Michigan and in Table 27 for Ontario.

Table 26
Considerations Underlying Choice of Control Measures
for Sea Lamprey - Michigan Residents

<u>Consideration</u>	<u>Relative Scale of Importance</u>					<u>Undecided</u>
	<u>Not Important</u>		<u>Critical</u>		<u>0</u>	
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>		
	----- in percent -----					
Public health	2.8	3.5	6.5	9.9	74.7	2.6
Sport fishing in Great Lakes	2.1	5.6	20.7	27.6	43.4	0.7
Sport fishing in streams	2.4	5.4	21.8	27.7	41.5	1.2
Humane treatment of Sea Lamprey	59.2	10.5	10.5	6.3	10.2	3.3
Cost	5.4	6.1	32.1	26.6	27.3	2.6
Effects on natural plants and animals	0.2	1.0	4.0	16.8	75.2	2.8
Commercial fishing	6.4	5.2	23.8	25.9	36.3	2.4

Table 27
Considerations Underlying Choice of Control Measures
for Sea Lamprey - Ontario Residents

<u>Consideration</u>	<u>Relative Scale of Importance</u>					<u>Undecided</u>
	<u>Not Important</u>		<u>3</u>	<u>4</u>	<u>Critical</u>	
	<u>1</u>	<u>2</u>			<u>5</u>	
----- in percent -----						
Public health	4.1	1.5	7.4	10.0	74.0	3.0
Sport fishing in Great Lakes	5.0	10.0	20.4	25.7	37.8	1.1
Sport fishing in streams	3.9	8.2	21.7	28.0	37.3	0.9
Humane treatment of Sea Lamprey	46.8	13.5	12.9	10.5	12.6	3.7
Cost	6.5	5.9	33.3	26.3	23.9	4.1
Effects on natural plants and animals	2.0	0.4	2.6	12.1	79.8	3.0
Commercial fishing	3.2	5.2	13.1	29.1	47.2	2.2

These findings generally confirm results from Tables 18 through 25. Concerns over effects of control measures on natural plants and animals of the Great Lakes and on public health are most predominant. Effects on fishing follow. Cost is a significant concern, but of lesser magnitude.

b) Concern for Natural Plants and Animals of the Great Lakes

As for Question (7), it is possible to examine cross-tabulated output, both to obtain further understanding of respondent preferences respecting Sea Lamprey control, and to test the vulnerability of results obtained to variant sample characteristics. We will first enquire whether respondent knowledge of Sea Lamprey, age, income, or past fishing experience

affected the control preferences most strongly represented in prior reported results. Table 28 identifies the potential effect of these factors on concern for Great Lakes natural plants and animals expressed in Question (14). Again, direction of significant linkages are not specified by the non-parametric chi-squared analysis, but are inferred from visual inspection of cross-tab frequencies.

Table 28

Potential Factors Affecting Respondent Concern for
Natural Plants and Animals of the
Great Lakes (Question 14)

<u>Respondent</u> <u>Char.</u>	<u>Linkage to Question 14 Responses</u>							
	<u>Michigan</u>				<u>Ontario</u>			
	<u>Chi-sq.</u> <u>Value</u>	<u>Signif.</u> <u>Value</u>	<u>Linkage</u> <u>Signif.</u>	<u>Linkage</u> <u>Dir.</u>	<u>Chi-sq.</u> <u>Value</u>	<u>Signif.</u> <u>Value</u>	<u>Linkage</u> <u>Signif.</u>	<u>Linkage</u> <u>Dir.</u>
Knowledge of Sea Lamprey	3.5	.6288	No		3.2	.6615	No	
Age	76.5	.0000	Yes	-	33.5	.3014	No	
Income	26.5	.6507	No		24.2	.7626	No	
Fished in past year	1.9	.8605	No		3.3	.6523	No	
Fished ever	2.7	.6030	No		11.7	.0398	Yes	?

In general, we can conclude from Table 28 that underlying characteristics of sampled residents have little effect on the strong concern they exhibited for natural plants and animals of the Great Lakes. Only age of respondent in the Michigan sample, and prior fishing experience in the Ontario sample display statistically significant linkage, and the direction of linkage in the latter is unclear.

Finally, as in our prior analysis of Question (7), we examined the age vector showing least concern for Great Lakes plants and animals from our Michigan sample (for sub-unit sizes > 10). This turned out to be the 70 years and older age group. Even for this group, 59.2 percent of respondents considered effect on natural plants and animals of the Great Lakes "critical", 19.7 percent considered them "very important", and 7.9 percent considered them "fairly important". We consequently conclude that the strong concern of Ontario and Michigan residents with respect to natural plants and animals of the Great Lakes is validated, regardless of potential shifts in underlying sample characteristics.

c) Concern for Public Health in the Great Lakes

In Table 29, we consider data with respect to concern for public health expressed in Question (14).

Table 29

Potential Factors Affecting Respondent Concern for
Public Health in the Great Lakes (Question 14)

Respondent Char.	Linkage to Question 14 Responses							
	Michigan				Ontario			
	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.
Knowledge of Sea Lamprey	5.9	.3192	No		4.3	.5004	No	
Age	62.3	.0005	Yes	-	49.7	.0134	Yes	-
Income	31.2	.4045	No		37.4	.1663	No	
Fished in past year	5.7	.3390	No		6.0	.3077	No	
Fished ever	6.1	.2988	No		9.0	.1073	No	

Table 29 indicates that only age has a significant effect on respondents' concern for public health. Age vectors indicating the least public health concern for Michigan and Ontario respectively are displayed in Table 30.

Table 30

Boundary Sub-Groups Who Consider Public Health Issues
Least Important in the Great Lakes

<u>Degree of Importance</u>	<u>Michigan</u>		<u>Ontario</u>	
	<u>Full Sample</u>	<u>70 + Age Group</u>	<u>Full Sample</u>	<u>70 + Age Group</u>
Undecided	2.6	12.5	3.0	10.8
Not Important	2.8	5.6	4.1	13.5
Somewhat Important	3.5	6.9	1.5	---
Fairly Important	6.5	8.3	7.4	2.7
Very Important	9.9	4.2	10.0	8.1
Critical	74.7	62.5	74.0	64.9

On the basis of these data, we can also confirm the importance that residents of Ontario and Michigan place on public health issues, irrespective of variation in sample characteristics.

d) Use of TFM in the Great Lakes

Our third cross-tabular analysis of linkages between key issues and underlying respondent concerns considers aversion to TFM (Question 9), largely on the basis of concern over chemicals (Question 13). This analysis uses data on acceptability of the TFM process from Question 9 (Table 31), and from Question 12 (Table 32).

Table 31

Potential Factors Affecting the Acceptability of
TFM as a Control Procedure for
Sea Lamprey (Question 9)

Respondent Char.	Michigan				Ontario			
	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.
Knowledge of Sea Lamprey	39.0	.0000	Yes	+	12.7	.0128	Yes	+
Age	81.5	.0000	Yes	+	66.3	.0000	Yes	+
Income	38.2	.0332	Yes	-	21.4	.6164	No	
Fished in past year	21.5	.0003	Yes	+	7.5	.1105	No	
Fished ever	5.5	.2420	No		11.9	.0181	Yes	+

Table 32

Potential Factors Affecting Resistance to Using
TFM as a Control Procedure for
Sea Lamprey (Question 12)

Respondent Char.	Michigan				Ontario			
	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.
Knowledge of Sea Lamprey	14.5	.0059	Yes	-	10.5	.0332	Yes	-
Age	60.4	.0001	Yes	-	30.2	.1778	No	
Income	27.9	.2638	No		21.6	.6022	No	
Fished in past year	25.2	.0000	Yes	-	10.6	.0310	Yes	-
Fished ever	9.2	.0569	No		6.8	.1463	No	

Data from Tables 31 and 32 generally corroborate each other. Respondents with prior knowledge of Sea Lamprey, who are older and who are from households with prior fishing experience in the Great Lakes area may find TFM more acceptable as a control device. Linkages with respect to income are more uncertain. Again using results from Question (12), boundary conditions with respect to avoidance of TFM are outlined in Table 33 for Michigan and Table 34 for Ontario.

Table 33

Boundary Sub-Groups - TFM Should Not be Used
in the Great Lakes - Michigan Residents

<u>Method of Control</u>	<u>Michigan Sub-Groups</u>			
	<u>Full Sample</u>	<u>Prior Sea Lamprey Knowledge</u>	<u>Age Group 60-69</u>	<u>Fished in Past Year</u>
	----- in percent -----			
TFM	48.4	43.5	27.5	40.7
No control	22.9	25.9	26.1	30.7
Special dams/traps	21.0	22.4	33.3	20.7
Reduce reproductive senses	4.9	5.1	4.3	6.6
Sterilization	2.7	3.2	8.7	1.2

Table 34

Boundary Sub-Groups - TFM Should Not be Used
in the Great Lakes - Ontario Residents

<u>Method of Control</u>	<u>Ontario Sub-Groups</u>		
	<u>Full Sample</u>	<u>Prior Sea Lamprey Knowledge</u>	<u>Fished in Past Year</u>
	----- in percent -----		
TFM	58.7	54.8	50.4
No control	19.0	19.5	25.9
Special dams/traps	12.5	15.7	14.4
Reduce reproductive senses	6.3	6.1	5.8
Sterilization	3.6	3.8	3.6

Examination of boundary preferences respecting TFM from Michigan and Ontario sub-groups does not change control preference conclusions. In the Michigan sample, the actual percentage of respondents preferring TFM least is reduced considerably for the 60-69 age group, from 48.4 percent for the full sample, to 27.5 percent. However, the percentages of other over 40 age groups in the Michigan sample range between 38.9 percent and 51.7 percent, and the magnitude of decrease for the 60-69 age group may display a degree of anomaly. In reviewing all the data on TFM and other potential controls identified in Tables 18 through 34, there appears to be a strong view among residents of Ontario and Michigan that alternative procedures to TFM should be developed to control the Sea Lamprey in the Great Lakes.

e) Alternative Methods for Controlling Sea Lamprey

No consistent measures of significance are observable to further relate the descriptive findings of Tables 18 through 25 to underlying sample characteristics. Some data with respect to control alternatives is incorporated in discussion of preceding Section 5d. Further, cross-tab analysis of Question (9) suggests the significance of prior knowledge of Sea Lamprey and of age as potential predictors of preferred control procedure for Michigan, but not necessarily for Ontario. Other results are even more mixed. In sum, we do not feel comfortable extending discussion of significance to these areas, and recommend that readers retain primary focus on the descriptive data concerning alternative control options (Table 18-25).

f) Concern Over Cost to Taxpayers

This section further examines the potential importance residents give to cost, in considering Sea Lamprey control in the Great Lakes. It will be recalled from cross-tabular results for Question (14) that cost was identified as a significant but not overriding concern for Michigan residents in Table 26, and for Ontario residents in Table 27. Cross-tabular analysis identifies no significant linkage between prior knowledge of Sea Lamprey and judgments respecting control costs. The Michigan sample did show significant linkage between concern over control costs and age, income and fishing experience in the past 12 months. The Ontario sample showed statistical linkage for income and past year fishing experience. Examination of underlying computer output suggests that boundary condition analysis (see previous)

would not substantially change the conclusions respecting cost identified with Tables 26 and 27, save for households earning less than \$5,000 per year. For these poorest households, our data shows cost to be a much more important control consideration. Basic cross-tabulation values with respect to cost of Sea Lamprey control are provided for Michigan and Ontario samples in Table 35.

Table 35

Potential Factors Affecting Respondent Concern Over
Cost of Sea Lamprey Control Measures

<u>Respondent Char.</u>	<u>Linkage to Question 14 Responses</u>							
	<u>Michigan</u>				<u>Ontario</u>			
	<u>Chi-sq. Value</u>	<u>Signif. Value</u>	<u>Linkage Signif.</u>	<u>Linkage Dir.</u>	<u>Chi-sq. Value</u>	<u>Signif. Value</u>	<u>Linkage Signif.</u>	<u>Linkage Dir.</u>
Knowledge of Sea Lamprey	8.6	.1241	No		9.2	.1022	No	
Age	62.4	.0005	Yes	+	28.9	.5248	No	
Income	90.0	.0000	Yes	-	63.0	.0004	Yes	-
Fished in past year	11.4	.0447	Yes	-	21.0	.0008	Yes	-
Fished ever	9.9	.0768	No		5.8	.3293	No	

6. The Willingness of Residents to Pay Increased Taxes to Support Sea Lamprey Control in the Great Lakes

Question (15) directly asked respondents whether they would be willing to pay increased taxes per household per year to support Sea Lamprey control efforts by GLFC. Options from "no tax increase" to a "1 dollar" increase were provided. Equivalent GLFC annual budget calculations were based on estimated Canada and U.S. households in the Great Lakes area (2). Resulting data, for Ontario and Michigan are reported in Table 36.

Table 36

Great Lakes Residents' Support for Tax Increase to Fund Sea Lamprey Control

<u>Tax Increase per Household</u> \$	<u>GLFC Budget</u> \$'millions	<u>Michigan</u>			<u>Ontario</u>		
		<u>Freq.</u> #	<u>Per.</u> %	<u>Cum.</u> Per.	<u>Freq.</u> #	<u>Per.</u> %	<u>Cum.</u> Per.
1.00	22.5	145	25.4	25.4	130	28.6	28.6
0.75	18.8	17	3.0	28.4	21	4.6	33.2
0.50	15.0	130	22.8	51.2	111	24.4	57.6
0.25	11.2	69	12.1	63.3	56	12.3	69.9
0.10	9.0	95	16.6	79.9	54	11.9	81.8
No increase	7.5	115	20.1	100.0	83	18.2	100.0

It can be observed from these data that significant support exists for increased funding of Sea Lamprey control work. Our survey data suggests that a majority of sampled residents in both Michigan and Ontario would support increased household tax per year of 50 cents - equivalent to doubling the GLFC budget to

\$15 million - to enhance Sea Lamprey control. The data further suggest that two-thirds of Ontario respondents would support an annual tax increment of 25 cents per household - equivalent to a GLFC budget of \$11.2 million. Two-thirds of Michigan residents would support a tax increase of 10 cents per household - equivalent to a GLFC budget of \$9 million.

Examination of cross-tabular data provided the following insights with respect to linkages between perspective on tax increases and underlying sample characteristics (Table 37).

Table 37

Potential Factors Affecting Willingness to be Taxed
for Improved Sea Lamprey Control

Respondent Char.	Linkage to Question 14 Responses							
	Michigan				Ontario			
	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.	Chi-sq. Value	Signif. Value	Linkage Signif.	Linkage Dir.
Knowledge of Sea Lamprey	6.9	.2282	No		14.2	.0144	Yes	+
Age	18.5	.9496	No		37.4	.1656	No	
Income	39.8	.1085	No		57.3	.0020	Yes	+
Fished in past year	26.5	.0001	Yes	+	18.2	.0027	Yes	+
Fished ever	24.6	.0002	Yes	+	28.7	.0000	Yes	+

These data suggest that prior fishing experience is a clear predictor of willingness to pay for Sea Lamprey control. Age is not. Boundary conditions associated with these variables are displayed for Michigan in Table 38, and for Ontario in Table 39.

Table 38

Boundary Sub-Groups' Willingness to be Taxed to Improve
Sea Lamprey Control - Michigan Residents

<u>Tax Increase Per Household</u> \$	<u>Michigan Sub-Groups</u>		
	<u>Full Sample</u>	<u>Did Not Fish in Past Year</u> in percent	<u>Never Fished</u>
1.00	25.4	19.2	9.5
0.75	3.0	3.5	4.1
0.50	22.8	18.8	16.2
0.25	12.1	13.5	12.2
0.10	16.6	18.1	14.9
No increase	20.1	26.9	43.2

Table 39

Boundary Sub-Groups' Willingness to Be Taxed to Improve
Sea Lamprey Control - Ontario Residents

<u>Tax Increase Per Household</u> \$	<u>Ontario Sub-Groups</u>				
	<u>Full Sample</u>	<u>No Knowledge of Sea Lamprey</u>	<u>Income Group 10,000 - 14,999 *</u> in percent	<u>Did Not Fish in Past Year</u>	<u>Never Fished</u>
1.00	28.6	19.7	21.7	22.7	15.6
0.75	4.6	5.6	13.0	4.8	5.4
0.50	24.4	20.4	34.8	25.3	21.1
0.25	12.3	16.2	13.0	14.3	17.7
0.10	11.9	14.1	---	10.6	12.2
No increase	18.2	23.9	17.4	22.3	27.9

* This vector does not report 7 observations from household income vector "less than 5,000", nor 13 observations from income vector "5,000-9,999". Taken together, 50 percent of responses in these two low income vectors indicated "no tax increase".

Data in Tables 38 and 39 have the potential to modify statistical conclusions previously observed in this section - particularly if persons with a fishing history are over-represented in our sample. A Department of Fisheries and Oceans survey (3) suggests that approximately 1.1 million Ontario households sport fished in 1985, out of approximately 3.2 million households estimated in the province(4). This suggests household percentage participation of about 34 percent, compared to our Ontario sample participation of 36 percent, for "fishing in the past 12 months". Of course, our sample referred to fishing only in the Great Lakes area. However, in viewing these data, we see no strong evidence that the results presented in Table 36 are not generally indicative of sentiment in the province.

In Michigan, 1985 data from the Sport Fishing Institute (5) suggest that 1.9 million persons over the age of 15 years fished out of a total population for that age group of 6.7 million - a fishing rate of approximately 28.5 percent. In our sample, 50.5 percent of Michigan respondents reported that someone in their household fished in the past 12 months. Consequently, unlike our Ontario responses, some correction for over-reporting by fishermen may be useful in Michigan. To adjust for this potential bias, we reconstructed frequency distributions for responses to Question (15) for those respondents who reported fishing and no fishing in their households, respectively, over the previous 12 month period, weighted by population estimates of fishing/non-fishing from the Sport Fishing Institute. We then

merged these two reconstructed Michigan data subsets, to obtain a reconstructed Michigan total. Results are presented in Table 40.

Table 40

Reconstructed Estimates of Michigan Residents'
Support for Tax Increase to Fund Sea Lamprey
Control - Adjusted for Over-representation of
Fishermen in the Sample

<u>Tax Increase</u> <u>per Household</u>	<u>GLFC</u> <u>Budget</u>	<u>Adjusted Michigan</u>	
		<u>Percent</u>	<u>Cum. Percent</u>
\$ 1.00	\$'millions 22.5	22.8	22.8
0.75	18.8	3.0	25.8
0.50	15.0	21.3	47.1
0.25	11.2	12.9	60.0
0.10	9.0	17.2	77.2
No increase	7.5	22.8	100.0

Comparing these values to those of Michigan residents reported in Table 36, we identify that revised calculations to correct for over-representation of sport fishers in our sample down-scale willingness to be taxed somewhat - but do not alter the substantive policy conclusion that residents of both Ontario and Michigan would be prepared to see a tax-supported increase in GLFC's budget to support Sea Lamprey control.

The above considerations, and our revised calculations, suggest that a majority of residents of Michigan and Ontario would likely support increased taxation in the order of 25 cents per household to improve Sea Lamprey control - a GLFC budgetary equivalent of \$11.2 million. Similarly, observation of these

data lead us to conclude that a two-thirds majority of residents of the two jurisdictions would likely support a tax increase of 10 cents per household per year - and a GLFC budgetary increase to \$9 million - under any reasonably conceivable sampling distribution.

8. Future Issues for Planning and Applied Research

Results of this study describe general respondent preference concerning methods to control Sea Lamprey and suggest some key bases for these opinions. Public and environmental health are clearly high priorities to be used in evaluating any proposed control technology. A general public dislike for putting chemicals into the environment is a similar important component of the process of evaluating control procedures. It is also clear that respondent knowledge with respect to alternative Sea Lamprey control measures, and linkages between Great Lakes ecosystems and particular species (eg. salmon and trout), may be limited and uneven. As knowledge is a predictor for public response, GLFC may wish to conduct further more focused public enquiry as it develops its control programs. Such an initiative could usefully have both educational and research components.

A particularly intriguing dimension emerging from our data is the apparently strong endorsement given the ecologically-based management philosophy of GLFC. Generally, it has been observed that anglers provide strong support for species specific management efforts by agencies (eg. salmon programs). Our data suggest that at least equally strong public support exists for

managing the Great Lakes towards an ecologically healthy and stable condition. This issue may be worthy of further enquiry.

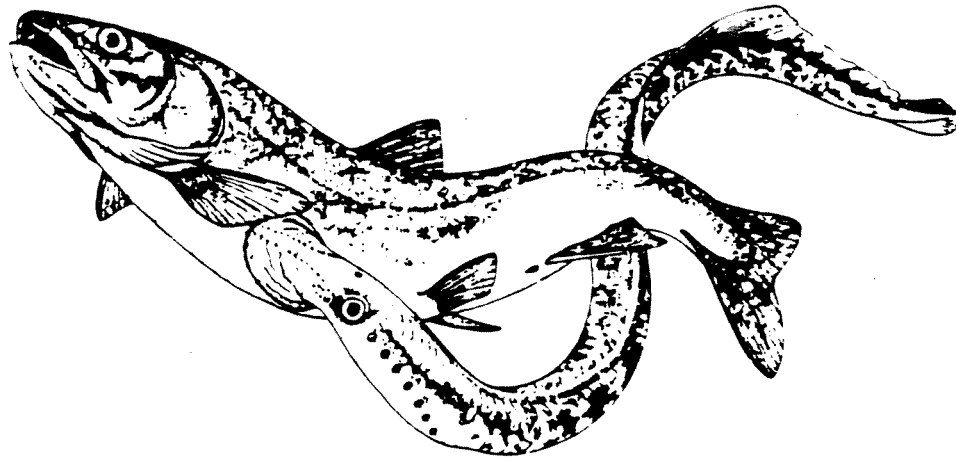
Finally, examination of data in Tables 38 and 39 suggest a further point requiring emphasis. A 1978 study of recreation in urban British Columbia, identified that persons who fished as a child were 2.8 times more likely to fish as an adult (6). Data from our present Great Lakes study suggest that persons who have fished are far more likely to support and fund fishery-related measures as well - and that this propensity is related to temporal proximity of past fishing experiences. Such data clearly identify the value of fishing opportunities and programs for children as vital in long range fishery planning.

8. Reference Notes

1. See, Norusis Marija J. 1988. SPSS-X Introductory Statistics Guide. SPSS Inc. Chicago: and Norusis, M.J. 1988. SPSS-X Advanced Statistics Guide. SPSS Inc. Chicago.
2. Developed in consultation with GLFC staff.
3. Department of Fisheries and Oceans, 1988. 1985 Survey of Sport Fishing in Canada. Ottawa.
4. Brickley, Keith. 1989. Personal Communication. Department of Fisheries and Oceans, March 14.
5. Rockland, David B. 1989. Personal Communication. The Sport Fishing Institute, April 3.
6. See, Meyer, Philip A. and C.J.H. Dodd, 1978. Recreation: A Study of Satisfaction and Substitutability in Recreation Available to Residents of Urban British Columbia. Department of Fisheries and the Environment and Ministry of Recreation and Conservation, Vancouver. p. 39.

Appendix A
The Survey Questionnaire

Public Opinion on:
Sea Lamprey
in the Great Lakes

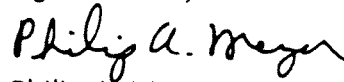


**A Project of the
Great Lakes Fishery Commission**

Thank you for helping us by answering these questions. This is our most effective way of getting public input for our programs.

Please follow the directions presented below. These questions are designed to take only about 10 minutes of your time.

Again, thank you,



Philip A. Meyer
Project Director

Directions

- Anyone 15 years of age or older living in your household may answer these questions.
- Answers should reflect the feelings, opinions and knowledge of the person answering the questions.
- Your answers will be combined with those of other persons to protect your privacy.
- We will use the serial number on the last page of your completed questionnaire to enter you in a drawing for a 21" color T.V. set.
- Please return the questionnaire using the addressed, pre-paid return envelope provided.

WHAT DO YOU KNOW ABOUT THE SEA LAMPREY?

- 1. Please check **only one** of the choices provided below.
 - I HAVE HEARD OF THE SEA LAMPREY.
 - I HAVE NOT HEARD OF THE SEA LAMPREY.

If you “have heard of the Sea Lamprey,” answer QUESTION 2 next.

If you “have not heard of the Sea Lamprey,” skip to QUESTION 7.

- 2. If you have heard of the Sea Lamprey in the Great Lake, please jot down brief phrases which describe what types of things you know about it.

- 3. Please describe briefly any measures you are aware of to control the Sea Lamprey.

- 4. How many times have you heard about the Sea Lamprey on T.V., radio, in newspapers, magazines or other media in the past 12 months, if any? _____ (Number of times)

5. Below are eight "opposite" pairs of adjectives which might be used to describe the Sea Lamprey. Please circle the number between each pair which best describes your opinions about Sea Lamprey. If you do not have an opinion on an item, circle the "0". Please do this for **each** of the eight rows below.

						No Opinion	
Unfamiliar	1	2	3	4	5	Familiar 0
Beneficial	1	2	3	4	5	Harmful 0
Boring	1	2	3	4	5	Interesting 0
Foreign	1	2	3	4	5	Native 0
Important	1	2	3	4	5	Not important 0
Resource	1	2	3	4	5	Pest 0
Uncontrolled	1	2	3	4	5	Controlled 0
Good	1	2	3	4	5	Bad 0

6. Did you know anything about **the Great Lakes Fishery Commission** before receiving our letter? (Please check one)
 No Yes

THE PRESENT STATUS OF SEA LAMPREY IN THE GREAT LAKES

7. The Sea Lamprey is an eighteen inch eel-like fish that has found its way into the Great Lakes. Today, they kill significant numbers of lake trout, salmon and whitefish. In some areas, Sea Lamprey kill as many lake trout as are caught by fishermen.

How important do you think it is to control Sea Lamprey in the Great Lakes? Please circle the **one** most appropriate number.

No Opinion	Not Important	Somewhat Important	Fairly Important	Very Important
0	1	2	3	4

8. Please show how important it is to solve each of the following Great Lakes problems by **circling** the one most appropriate number for each row. The higher the number you circle, the more importance you attach to solving the problem.

	Level of Importance					
	<i>Not Important</i>				<i>Critical</i>	<i>Undecided</i>
A. Reduce acid rain.	1	2	3	4	5	0
B. Control Sea Lamprey in Great Lakes.	1	2	3	4	5	0
C. Increase salmon size and numbers.	1	2	3	4	5	0
D. Establish natural populations of lake trout.	1	2	3	4	5	0
E. Reduce levels of toxic contaminants in the Great Lakes.	1	2	3	4	5	0
F. Rehabilitate the Great Lakes to their natural ecological state.	1	2	3	4	5	0

FUTURE MANAGEMENT OF SEA LAMPREY PROBLEMS IN THE GREAT LAKES

9. Five alternatives (listed (a) through (e)) are presented below for the future control of Sea Lamprey in the Great Lakes. PLEASE CIRCLE ONE NUMBER **IN EACH ROW** TO SHOW YOUR PREFERENCE BETWEEN THESE ALTERNATIVES.

(Circle **one** number in **each** row)

Method to Control Sea Lamprey	Not Acceptable	Not Very Acceptable	No Opinion	Somewhat Acceptable	Completely Acceptable
A. Currently, a chemical called TFM is applied to young Sea Lamprey in streams, to eliminate them before they mature and go to the Great Lakes.	1	2	3	4	5
B. Materials could be placed in streams to reduce the Sea Lamprey's senses that lead to reproduction.	1	2	3	4	5
C. Methods could be used to sterilize Sea Lamprey so they could not reproduce at high levels in the Great Lakes.	1	2	3	4	5
D. Special dams or traps could be built on streams to prevent Sea Lamprey from swimming up the streams to reproduce.	1	2	3	4	5
E. Sea Lamprey should not be controlled.	1	2	3	4	5

10. Which control alternative listed in Question 9 do you most prefer?

11. Why do you prefer it?

12. Which control alternative listed in Question 9 do you feel most strongly should **not** be used?

13. Why do you feel that way?

14. As the Great Lakes Fisheries Commission looks for ways to control the Sea Lamprey, the relative costs, risks, and benefits of control methods must be evaluated. PLEASE INDICATE HOW IMPORTANT YOU BELIEVE IT IS TO CONSIDER **EACH** OF THE FOLLOWING WHEN DECIDING WHETHER TO USE ANY SEA LAMPREY CONTROL METHOD. The higher the number you circle in each row, the more importance you attach to that particular concern.

	Level of Importance					
	<i>Not Important</i>				<i>Critical</i>	<i>Undecided</i>
	1	2	3	4	5	0
A. Effects on Public Health	1	2	3	4	5	0
B. Effects on Sport Fishing in the Great Lakes	1	2	3	4	5	0
C. Effects on Sport Fishing in Streams Flowing into the Great Lakes	1	2	3	4	5	0
D. Humane Treatment of the Sea Lamprey	1	2	3	4	5	0
E. Cost to Taxpayers	1	2	3	4	5	0
F. Effects on the Natural Plants and Animals in the Great Lakes and Associated Streams	1	2	3	4	5	0
G. Effects on Commercial Fishing	1	2	3	4	5	0
H. Please describe any other concerns which you believe should be considered.						

15. The Great Lakes Fishery Commission presently spends approximately \$7.5 million per year to control Sea Lamprey—about 50 cents per Great Lakes area household.

What level of tax increase, if any, would you support to reduce losses of lake trout, salmon and other Great Lakes fish due to Sea Lamprey?

Check only one	Level of Yearly Tax Increase per Household	Great Lakes Fishery Commission Yearly Budget (in millions)
<input type="checkbox"/>	No tax increase	7.5
<input type="checkbox"/>	10 cents	9.0
<input type="checkbox"/>	25 cents	11.2
<input type="checkbox"/>	50 cents	15.0
<input type="checkbox"/>	75 cents	18.8
<input type="checkbox"/>	1 dollar	22.5

A GENERAL PROFILE OF CITIZENS IN OUR SAMPLE

This section is included solely to allow us to compare the citizens who respond to our questions to citizens in general in your area—so we will know whether our sample is representative. Again, YOUR ANSWERS WILL BE ADDED UP, and not associated with your name and address TO PROTECT YOUR PRIVACY.

16. What age category are you in? (Please check one)

- 15-19
 20-29
 30-39
 40-49
 50-59
 60-69
 70 and over

17. Yearly household income? (Please check one)

Less than \$4,999

5,000 - 9,999

10,000 - 14,999

15,000 - 24,999

25,000 - 49,999

50,000 - 74,999

Over \$75,000

18. Has someone in your household fished in the Great Lakes area?

In the past 12 months Yes No

Ever Yes No

19. Did you fish as a child? Yes No

Appendix B
Detailed Tabulation of Michigan and
Ontario Questionnaires Returned,
by ZIP Code

<u>Michigan (Number Returned by Zip Code)</u>			
48001- 1	48091- 4	48212- 1	48624- 1
48009- 2	48092- 2	48214- 2	48625- 1
48010- 3	48093- 4	48219- 1	48626- 1
48013- 2	48095- 1	48223- 2	48629- 1
48016- 2	48096- 1	48224- 2	48631- 1
48017- 1	48097- 1	48228- 1	48640- 8
48018- 2	48098- 4	48229- 1	48647- 1
48020- 1	48101- 1	48230- 1	48651- 1
48021- 1	48103- 5	48234- 1	48653- 1
48022- 1	48104- 5	48235- 1	48657- 1
48024- 2	48105- 3	48236- 2	48658- 1
48025- 1	48111- 2	48237- 1	48659- 1
48026- 1	48116- 1	48238- 1	48701- 1
48028- 1	48118- 1	48239- 6	48703- 1
48030- 2	48120- 1	48240- 2	48706- 4
48033- 2	48122- 1	48309- 2	48708- 1
48034- 2	48124- 2	48310- 2	48723- 1
48035- 1	48125- 2	48322- 3	48725- 1
48040- 1	48126- 3	48331- 2	48727- 1
48042- 2	48127- 3	48412- 1	48731- 1
48043- 4	48128- 2	48413- 1	48732- 2
48044- 3	48133- 1	48422- 1	48739- 1
48045- 3	48134- 1	48423- 2	48750- 1
48047- 1	48135- 2	48429- 2	48763- 1
48050- 2	48141- 1	48430- 2	48766- 1
48051- 1	48146- 2	48433- 1	48768- 1
48053- 1	48150- 3	48435- 1	48801- 1
48055- 1	48154- 4	48439- 4	48813- 2
48057- 2	48161- 7	48442- 1	48820- 2
48058- 2	48166- 1	48444- 1	48821- 1
48060- 5	48167- 4	48446- 1	48822- 1
48062- 2	48169- 1	48450- 1	48823- 3
48064- 1	48170- 2	48451- 1	48827- 2
48065- 2	48174- 2	48453- 1	48829- 1
48066- 2	48176- 1	48458- 1	48837- 2
48067- 4	48178- 1	48462- 1	48838- 2
48069- 1	48180- 2	48467- 1	48840- 2
48070- 1	48183- 5	48473- 2	48842- 1
48072- 3	48185- 8	48503- 1	48843- 3
48073- 4	48187- 4	48504- 2	48847- 2
48076- 2	48188- 1	48505- 1	48849- 1
48077- 2	48189- 1	48506- 3	48850- 1
48078- 2	48192- 3	48507- 1	48854- 2
48080- 1	48195- 1	48532- 1	48857- 1
48081- 2	48197- 2	48601- 1	48858- 3
48082- 1	48202- 1	48602- 4	48864- 3
48083- 1	48203- 3	48603- 4	48867- 1
48084- 1	48204- 2	48610- 1	48875- 2
48085- 2	48205- 3	48612- 1	48877- 1
48087- 2	48206- 1	48616- 1	48879- 2
48088- 1	48207- 1	48617- 2	48880- 1
48089- 1	48211- 1	48618- 1	48891- 1
48893- 1	49250- 1	49629- 1	

48895- 1	49252- 1	49635- 1
48906- 1	49255- 1	49640- 1
48910- 1	49267- 1	49646- 1
48911- 3	49269- 1	49651- 1
48912- 2	49270- 1	49657- 1
48915- 1	49274- 1	49660- 3
48917- 2	49286- 2	49664- 1
49001- 3	49287- 1	49684- 3
49002- 4	49307- 2	49690- 1
49004- 1	49316- 2	49707- 3
49007- 3	49319- 2	49712- 1
49010- 1	49321- 1	49713- 1
49015- 1	49325- 1	49720- 2
49017- 8	49328- 1	40721- 1
49022- 3	49331- 1	49725- 1
49028- 1	49333- 1	49729- 1
49030- 1	49336- 1	49738- 1
49032- 1	49341- 1	49745- 1
49036- 3	49347- 1	49749- 2
49038- 1	49349- 1	49770- 1
49042- 1	49406- 1	49779- 1
49047- 2	49411- 1	49783- 3
49058- 2	49412- 1	49795- 1
49060- 1	49417- 3	49801- 2
49067- 1	49418- 1	49829- 3
49068- 1	49421- 1	49837- 1
49071- 1	49423- 4	49841- 1
49072- 1	49424- 2	49843- 1
49079- 1	49425- 1	49849- 1
49080- 2	49426- 1	49854- 1
49082- 1	49428- 1	49855- 2
49085- 4	49431- 1	49858- 2
49089- 1	49437- 1	49866- 2
49090- 1	49441- 4	49881- 1
49091- 1	49442- 6	49908- 1
49093- 2	49445- 1	49912- 1
49097- 1	49451- 1	49913- 1
49099- 1	49453- 1	49935- 1
49107- 1	49454- 1	49938- 2
49111- 1	49455- 1	49968- 1
49112- 1	49456- 1	
49117- 2	49461- 2	
49120- 3	49464- 1	
49129- 1	49503- 3	
49201- 1	49504- 6	
49202- 2	49505- 6	
49203- 4	49506- 5	
49221- 3	49508- 7	
49224- 1	49509- 5	
49237- 1	49601- 1	
49242- 1	49613- 1	
49245- 1	49615- 1	

Ontario (Number Returned by Zip Code)

LOB1N0- 1	L4C5J3- 1	L8H7H5- 1	M1M2Z5- 1
L0K2B0 -1	L4M1Y6- 1	L7N1G4- 1	M1N2T6- 1
L1H1L6- 1	L4N4G2- 1	L7S1R5- 1	M1R4C2- 1
LOG1M0- 1	L3V3S1- 1	L6Z3J4- 1	M1T1S8- 1
L0M1J0- 1	L4C2T4- 1	L7L1L8- 1	M1J2S1- 1
LOR1P0- 1	L4C5Z8- 1	L7L4P6- 1	M1K3B3- 1
L1A2E1- 1	L4W4C1- 1	L8K1P7- 1	M1L1H4- 1
L1H2S3- 1	L5C3Z6- 1	L7E3G3- 1	M1P3G4- 1
L1H6P5- 1	L5G2N9- 1	L7L5P4- 1	M1R2C3- 1
L1J1Z3- 1	L5H3G3- 1	L7P3K8- 1	M1R5A9- 1
LOC1K0- 1	L5J3N8- 1	L7R2Y1- 1	M1L2E5- 1
L0M1T0- 1	L5L1L4- 1	L8H6E8- 1	M1N1M7- 1
L1G3S3- 1	L5M3R1- 1	L8K2K6- 1	M1R2V3- 1
L1J2Z3- 1	L4Y3N3- 1	L8M3J5- 1	M1S1V7- 1
L0S1C0- 1	L5A3C2- 1	L8K3N6- 1	M1T2P8- 1
L1J4S2- 1	L5N1S9- 1	L8V2T9- 1	M1J1P2- 1
L1S2N8- 1	L4W2C1- 1	L8P4N3- 1	M1K1W6- 1
L1T1B9- 1	L5E2N5- 1	L8S1A1- 1	M1L3C1- 1
L1J5H5- 1	L5G4H3- 1	L8S4H2- 1	M1M2MB- 1
L1S3A8- 1	L5K1E9- 1	L9A1R7- 1	M1P4J3- 1
L1V4A3- 1	L5N2B5- 1	L8K4K9- 1	M1R3N3- 1
L2A1W8- 1	L4T2K8- 1	L8L1E8- 1	M1S2L8- 1
L2G5P7- 1	L5C3M5- 1	L8M2C7- 1	M1W2E6- 1
L2J1P3- 1	L5G1M1- 1	L8S1N5- 1	M2N4P6- 1
L2M5K9- 1	L5J2L8- 1	L8V1C4- 1	M1V4H1- 1
L1J5Y9- 1	L5K2B2- 1	L8K5J1- 1	M2J2Y5- 1
L1V2P8- 1	L6S1S2- 1	L8L2S2- 1	M2R2J6- 1
L1W1S9- 1	L6S3K3- 1	L8L6L1- 1	M1W3H5- 1
L2E2W1- 1	L6T1Y7- 1	L8P2S9- 1	M2H2G2- 1
L1V2W2- 1	L5N4K9- 1	L8V2H2- 1	M2K1X3- 1
L1W2P8- 1	L6H2V8- 1	L9A3E3- 1	M2M1N4- 1
L2G7M5- 1	L6S3W2- 1	L9A4B4- 1	M3A2X9- 1
L2N5S6- 1	L6T2M5- 1	L9C6L6- 1	M3B3E5- 1
L2T1M4- 1	L6X1M5- 1	L9W2H1- 1	M3L2K4- 1
L3M3A5- 1	L6Y2B7- 1	M1B2S7- 1	M4C4A6- 1
L3K4S6- 1	L6H4H1- 1	M1C1Y2- 1	M3A3N1- 1
L3C3R2- 1	L6K1N2- 1	M1C4C5- 1	M3C2A4- 1
L3K2B9- 1	L6L2J9- 1	M1E3M5- 1	M3H2L6- 1
L3T2S7- 1	L6M1J3- 1	L9C6Y6- 1	M3N1N6- 1
L3T5M8- 1	L6T3H8- 1	M1E4A5- 1	M4A1P4- 1
L3R3Y5- 1	L6W1J5- 1	M1G2N5- 1	M3A1X5- 1
L3Y4V8- 1	L6Y2L9- 1	L9C1H7- 1	M3H3H2- 1
L3Z1S5- 1	L6K2T5- 1	L9H5N5- 1	M3J1H6- 1
L4G1Z4- 1	L6L3L4- 1	M1B1W7- 1	M3N1Z4- 1
L4L3C1- 1	L6S1B8- 1	M1E2A4- 1	M4A2K2- 1
L3V1W3- 1	L6X2V7- 1	L9C2H2- 1	M4C2W9- 1
L3Y2J4- 1	L6Z1M1- 1	L9Y4E5- 1	M4C5A5- 1
L3Z2A6- 1	L7E5R7- 1	M1C3M9- 1	M3N2G4- 1
L4C4K7- 1	L7G4NT- 1	M1H1P3- 1	M4E3H6- 1
L4J3L5- 1	L7P4A1- 1	M1J2B7- 1	M4G2M5- 1
L4L436- 1	L8G1J5- 1	M1K2J1- 1	M4K2Z9- 1

M4K1X7- 1	M6S1B2- 1	N2C2L1- 1	N6H2M5- 1
M4M2H5- 1	M8V1T3- 1	N2G3S4- 1	N6E2P9- 1
M4N1K7- 1	M8Y1Z3- 1	N2H3Y2- 1	N6H1B7- 1
M4E2S1- 1	M9B2H4- 1	N2B1J9- 1	N6H3K1- 1
M4N1Y3- 1	M8W1X4- 1	N2B3M2- 1	N6H4T3- 1
M4G1P4- 1	M8Y2W9- 1	N2G1M2- 1	N6K1L4- 1
M4J4O4- 1	M8Z3V6- 1	N2H4H5- 1	N6K2Y6- 1
M4S1S1- 1	M9A3K8- 1	N2H5O7- 1	N7AEY1- 1
M4V1H4- 1	M9B3C8- 1	N2M3S9- 1	N7M1Z6- 1
M5A2X5- 1	M9M2R6- 1	N3B2T3- 1	N7M5J4- 1
M5M3B9- 1	M9R1Z2- 1	N2M4G4- 1	N7T4C7- 1
M4W2E6- 1	M9V4Y3- 1	N3C1L5- 1	N6K1P9- 1
M5P1L9- 1	NOG1M0- 1	N3L1B3- 1	N6K3N2- 1
M4P2S8- 1	M9V2X6- 1	N2L1B5- 1	N7S3R8- 1
M5N1N1- 1	M9W1V2- 1	N2M4Y1- 1	N7V4E2- 1
M5P2G1- 1	NOB2J0- 1	N2V1E5- 1	N6K2J2- 1
M4V1A9- 1	NOG1Z0- 1	N2L1W4- 1	N7A1S7- 1
M5M1H5- 1	NOG2V0- 1	N2L6C1- 1	N7S1C7- 1
M5R2P5- 1	M9V3N5- 1	N2P1A3- 1	N7V2A8- 1
M5S1W8- 1	M9W2E5- 1	N3C3C6- 1	N8A1W3- 1
M5T1Z7- 1	NOG2G0- 1	N3S4B6- 1	N6J4G6- 1
M6C2S2- 1	M9N3A3- 1	N4K5N4- 1	N6K2T6- 1
M6C3Y9- 1	M9V1N1- 1	N3R1E5- 1	N7L2P7- 1
M6G2N5- 1	NOA1E0- 1	N3R7G7- 1	N7S1X7- 1
M6H1V6- 1	NOB1J0- 1	N3Y4J9- 1	N8A3A7- 1
M5R2Z1- 1	NOB2T0- 1	N4B2N2- 1	N8A4K7- 1
M6C3A6- 1	NOE1G0- 1	N3G4L2- 1	N8T1A3- 1
M6H2H7- 1	NOG2L0- 1	N4K5N8- 1	N8W4B8- 1
M5T1J4- 1	NOK1L0- 1	N4G1H8- 1	N8Y2L1- 1
M6E2S5- 1	NOL1W0- 1	N4N2B5- 1	N8Y4V2- 1
M6G2Y7- 1	NOM1V0- 1	N4S7V8- 1	N8R1W5- 1
M6H2P3- 1	NON1M0- 1	N5A7B7- 1	N8S3B4- 1
M6J1K9- 1	N1A1V2- 1	N5W4M5- 1	N8T1Y3- 1
M6N1G4- 1	NOH2C0- 1	N5A2B2- 1	N8K4E6- 1
M6P2T3- 1	NOP1W0- 1	N5Y1E1- 1	N8X1M7- 1
M6R1H1- 1	NOR1A0- 1	N572M8- 1	N8X4S3- 1
M6H2Y3- 1	N1E6N3- 1	N4W1E2- 1	N8H2S1- 1
M6L2M2- 1	NOM2K0- 1	N5C2P2- 1	N9A6E2- 1
M6N1Z3- 1	N1E4CB- 1	N5Z3C9- 1	N9A6W8- 1
M6H3B4- 1	NOM1L0- 1	N5V1X9- 1	N9B2V6- 1
M6H3Y2- 1	NOP1J0- 1	N5W1H5- 1	N9E3A8- 1
M6J3H1- 1	NOP2K0- 1	N5W3P1- 1	POR1H0- 1
M6N2K6- 1	N2A2A8- 1	N5X2A3- 1	N9F2W3- 1
M6P2B7- 1	N2B1Y8- 1	N5Y2A3- 1	N9Y2E1- 1
M6P3H2- 1	N2E1V2- 1	N5Y3Z3- 1	POH1W0- 1
M6H3H5- 1	N2G2C2- 1	N5Z4H1- 1	POH2M0- 1
M6H4C3- 1	N2H2H6- 1	N6A4C2- 1	N9B1Z7- 1
M6S2K9- 1	N1H7L7- 1	N6C4S6- 1	N9C1J5- 1
M6S4C1- 1	N1R4S3- 1	N6H4B1- 1	N9E1Z9- 1
M8W2W6- 1	N1S3Y1- 1	N6C2Y6- 1	N9G1W5- 1
M9L1J2- 1	N2E2H3- 1	N6G3H1- 1	POH1B0- 1
M8V3H1- 1	N1R2H1- 1	N6J1V4- 1	P1A1Y4- 1
M9B4V3- 1	N1S4M5- 1	N6C1L8- 1	N9B2L3- 1
M9C3M3- 1	N2A2V5- 1	N6C5H6- 1	N9E2M4- 1

POH1K0-	1	P5A1S1-	1
POR1C0-	1	P5N2J5-	1
POT1X0-	1	P5A1B9-	1
P1A1G1-	1	P5A1W3-	1
P1B5S6-	1	P5N2N1-	1
P1B8M6-	1	P6A4B7-	1
P1C1B9-	1	P6A5J6-	1
P1A2K5-	1	P6A6M6-	1
P1B1G9-	1	P6B2S8-	1
P1A2N9-	1		
P1B4C1-	1		
P1B7J4-	1		
P1B8E7-	1		
P1A2T7-	1		
P1B4P9-	1		
P3A3Y3-	1		
P2N1Y3-	1		
P3A1E1-	1		
P3A2W4-	1		
P3A4R5-	1		
P3A5A8-	1		
P3A5C5-	1		
P2A2R4-	1		
P2N1G1-	1		
P2N2J8-	1		
P3A2N2-	1		
P3A3C9-	1		
P3A5L6-	1		
P383M6-	1		
P3C1Y8-	1		
P3C1Y8-	1		
P3C2V2-	1		
PEC3H7-	1		
PEC5H5-	1		
P3E1L1-	1		
P383R6-	1		
P3C1K4-	1		
P3C2X3-	1		
P3E2E7-	1		
P3B3X3-	1		
P3E1W7-	1		
P3B307-	1		
P3E2B7-	1		
P3E2M2-	1		
P2E4C1-	1		
P5A2P7-	1		
P5N2T2-	1		
P3E3P8-	1		
P5A1L5-	1		
P5A2G3-	1		
P5A3A2-	1		
P5N2Z8-	1		

Ontario (Number Returned by 1st 3 Symbols of Zip Code)

LOB- 1	L6H- 2	M3L- 1	NOK- 1
LOK- 1	L6X- 2	M3C- 1	NOL- 1
LOG- 1	L6Y- 2	M3J- 1	NOM- 3
LOM- 2	L6K- 2	M3H- 2	NON- 1
LOR- 1	L6L- 2	M3N- 3	NOH- 1
LOC- 1	L6M- 1	M4C- 3	NOP- 3
LOS- 1	L6W- 1	M4A- 2	NOR- 1
L1H- 3	L6Z- 2	M4E- 2	N1A- 1
L1A- 1	L7E- 2	M4G- 2	N1E- 2
L1J- 5	L7G- 1	M4K- 2	N1H- 1
L1G- 1	L7P- 2	M4M- 1	N1R- 2
L1S- 2	L7N- 1	M4N- 2	N1S- 2
L1T- 1	L7S- 1	M4J- 1	N2A- 2
L1V- 3	L7L- 3	M4S- 1	N2B- 3
L1W- 2	L7R- 1	M4V- 2	N2E- 2
L2A- 1	L8G- 1	M4W- 1	N2G- 3
L2G- 2	L8H- 2	M4P- 1	N2H- 4
L2J- 1	L8K- 5	M5A- 1	N2C- 1
L2M- 1	L8M- 2	M5M- 2	N2M- 3
L2E- 1	L8V- 3	M5N- 1	N2V- 1
L2N- 1	L8P- 2	M5P- 2	N2L- 3
L2T- 1	L8S- 3	M5R- 2	N2P- 1
L3M- 1	L8L- 3	M5S- 1	N3C- 2
L3K- 2	L9A- 3	M5T- 2	N3L- 1
L3C- 1	L9C- 4	M6C- 3	N3S- 1
L3T- 2	L9W- 1	M6G- 2	N2R- 2
L3R- 1	L9Y- 1	M6H- 8	N3Y- 1
L3Y- 2	L9H- 1	M6E- 1	N3G- 1
L3Z- 2	M1B- 2	M6J- 2	N3B- 1
L3V- 2	M1C- 3	M6N- 3	N4K- 2
L4G- 1	M1E- 3	M6P- 3	N4B- 1
L4L- 2	M1G- 1	M6R- 1	N4G- 1
L4C- 4	M1H- 1	M6L- 1	N4N- 1
L4J- 1	M1J- 3	M6S- 3	N4S- 1
L4M- 1	M1K- 3	M8W- 2	N4W- 1
L4N- 1	M1M- 2	M8V- 2	N5A- 2
L4W- 2	M1N- 2	M8Y- 2	N5W- 3
L4T- 1	M1R- 5	M8Z- 1	N5Y- 4
L4Y- 1	M1T- 2	M9L- 1	N5C- 1
L5C- 2	M1L- 3	M9B- 3	N5Z- 2
L5G- 3	M1P- 2	M9C- 1	N5V- 1
L5H- 1	M1S- 2	M9A- 1	N5X- 1
L5J- 2	M1W- 2	M9M- 1	N6A- 1
L5L- 1	M1V- 1	M9R- 1	N6C- 4
L5M- 1	M2J- 1	M9V- 4	N6H- 5
L5A- 1	M2R- 1	M9W- 2	N6G- 1
L5N- 3	M2H- 1	M9N- 1	N6J- 2
L5E- 1	M2K- 1	NOG- 5	N6E- 1
L5K- 2	M2M- 1	NOB- 3	N6K- 6
L6S- 4	M3A- 3	NOA- 1	N7A- 2
L6T- 3	M3B- 1	NOE- 1	N7M- 2

N7T- 1
N7S- 3
N7V- 2
N7L- 1
L8A- 3
N8T- 2
N8W- 1
N8Y- 2
N8R- 1
N8S- 1
N8K- 1
N8X- 2
N8H- 1
N9A- 2
N9B- 3
N9E- 3
N9F- 1
N9Y- 1
N9C- 1
N9G- 1
POH- 4
POR- 1
POT- 1
P1A- 5
P1B- 7
P1C- 1
P2N- 3
P2A- 1
P2E- 1
P3A- 9
P3B- 4
P3C- 7
P3E- 7
P5A- 10
P5N- 4
P5B- 1

Appendix C

Sample Respondent Characteristics

Table C-1
Comparison of Age Distributions of the
Michigan and Ontario Samples with Overall Populations

<u>Age Interval</u>	<u>Michigan</u>		<u>Ontario</u>	
	<u>Population</u>	<u>Sample</u>	<u>Population</u>	<u>Sample</u>
	----- in percent -----			
15-19	12.8	1.0	9.3	1.9
20-29	24.1	10.6	22.3	11.8
30-39	18.1	23.3	20.7	24.6
40-49	12.9	18.3	15.4	18.2
50-59	13.6	17.5	12.5	14.1
60-69	10.1	15.9	10.6	21.0
70 +	8.4	13.4	9.2	8.4

Notes:

1. Percentages are calculated to exclude persons under age 15.
2. Ontario sample did not consider the whole province. The only population area excluded was Greater Ottawa, however, and comparison with province-wide Ontario data is considered indicative.

Sources:

1. U.S. Bureau of Census, 1982. General Population Characteristics, 1980 Census of Population, Vol. I, Chapter B, part 24, Michigan.
2. Statistics Canada, 1987. Postcensal Annual Estimates of Population by Marital Status, Age, Sex and Components of Growth for Canada, Provinces and Territories. Ministry of Supply and Services, June 1.

Table C-2Comparison of Household Income Distributions of the Michigan and Ontario Samples with Overall Populations

<u>Income Distributions</u>	<u>Michigan</u>		<u>Ontario</u>	
	<u>Population</u>	<u>Sample</u>	<u>Population</u>	<u>Sample</u>
	----- in percent -----			
Less than \$10,000	25.6	11.1	4.2	5.2
\$10,000 - \$14,999	13.1	10.9	6.7	5.8
\$15,000 - \$24,999	26.5	20.7	16.0	22.0
\$25,000 +	34.3	57.4	73.1	67.1

Note:

1. Ontario sample did not include the whole province. The only population area excluded was Greater Ottawa, however, and comparison with province-wide data is considered indicative. Ontario data is for 1985.

Sources:

1. U.S. Bureau of Census, 1982. (See Table C-1).
2. Canada Year Book, 1988.

Table C-3Michigan and Ontario Respondents Who Previously Fished

<u>Fishing Experience</u>	<u>Michigan</u> ----- in percent -----	<u>Ontario</u> -----
Fished in the Great Lakes in the Past 12 Months	50.5	36.2
Fished in the Great Lakes Previously	79.2	55.9
Fished as a Child	80.9	76.0