Fish Consumption Survey of People Fishing and Harvesting Fish from the Saginaw Bay Watershed

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Table Contents

List of Tables

List of Figures

List of Appendices

INTRODUCTION

The Saginaw Bay Watershed has a diverse set of economic and natural resources including numerous rivers, lakes, and streams. Saginaw Bay along with its many tributaries, which include the Saginaw, Shiawassee and Tittabawassee Rivers, provide residents and visitors numerous opportunities to enjoy local fish and wildlife. The Michigan Department of Natural Resources (DNR) has predicted more harvestable walleye and perch in Saginaw Bay over the next few years, with a harvest objective of 1 million pounds per year (MDNR 2003, Fielder and Baker 2003).

The waters of the Saginaw Bay Watershed are not pristine. In fact, several water bodies continue to be contaminated to varying degrees with an array of persistent, bioaccumulative and toxic (PBT) chemicals. This chemical contamination has resulted in an *Area of Concern* label, as defined by the U.S. Environmental Protection Agency (U.S. EPA), within the Saginaw Bay Watershed. Furthermore, based on the *Lake Huron Initiative Action Plan-2002*, the Saginaw and Tittabawassee Rivers appear to be conduits that are transporting historical industrial contamination into Lake Huron. However, that does not mean that all Saginaw Bay Watershed waters are contaminated or all fish are unsafe for consumption. In fact, many water bodies in the Saginaw Bay Watershed have minimal chemical contamination, and even those water bodies with more severe contamination contain species of fish with minimal chemical contamination that can be consumed on a regular basis.

The existing chemical contamination in several of the water bodies of the Saginaw Bay Watershed have placed the avid fish harvester and fish consumer in a difficult position. The American Heart Association recommends that Americans "eat fish at least twice a week, particularly fatty fish". Fish is a good source of protein that is low in the saturated fats found in other meats (e.g. beef). Consumption of fish high in two kinds of omega-3 fatty acids [eicosapentaenoic (EPA) and docosahexaenoic acid (DHA)], which tend to be fish with a high lipid content, can decrease the risk of arrhythmias, triglyceride levels, and growth rate of atherosclerotic plaque; while also slightly lowering blood pressure. These benefits can significantly reduce one's risk of heart disease and thus the associated societal economic costs. Unfortunately, fish from contaminated waters may also have high concentrations of PBT chemicals. Based on toxicology and epidemiology studies, the long term health risks from these various chemicals may include, reductions in IQ, increased risk of cancer, neurodevelopmental effects, endocrine system disruptions, and reproductive effects.

While many of the long-term solutions to the various local chemical contamination problems have not been determined, the Michigan Department of Community Health (DCH) has been issuing fish consumption advisories to the public on many of these waters since the early 1980s. However, fish consumption advisories can have unintended negative consequence to the local communities. If the public does not fully understand the fish consumption advisories, false assumption can result among the public and incorrect choices can occur resulting in either too little consumption of fish that are minimally contaminated (i.e., "safe to eat) or too much consumption of fish that are

highly contaminated (i.e., "not safe to eat"). The solution to such a problem is multifaceted, however, any such solution must include a good understanding of the knowledge and fish consumption practices of the local community. Thus, the objective of this survey project is to determine fish consumption patterns of people fishing the Saginaw Bay Watershed. This study focuses on the Saginaw Bay, Saginaw River, Shiawasseee/Bad Rivers, and Tittabawassee River because they have robust fisheries allowing frequent access to Saginaw Bay Watershed fishers.

METHODS

Experimental Design

Survey teams approached people fishing the Saginaw Bay, Saginaw River, Shiawasseee River, and Tittabawassee River during high-use fishing times of the year. Survey teams were comprised of two students trained to implement the surveys. Three to four teams of students were working each week during the survey period. The survey period was from March 6 to August 30th, 2005, and January 1st to March 1st, 2006. The survey period was based on local DNR fisheries biologist knowledge and attempted to target the following fisheries: ice fishery, walleye fishery, perch fishery, white bass fishery, sucker fishery, summer fishery. Survey teams approached people along the rivers who were in the process of fishing (starting, ending, or actively fishing). The survey teams provide all participants with a written informed consent notice and verbally described the project. Survey implementation lasted approximately 10 minutes. All surveys were returned to a local survey coordinator, compiled, and delivered to the Michigan Department of Community Health for data entry and analysis.

Survey Design

The survey contained twenty-four questions. Questions covered four topics. Topics and their order in the survey were awareness about Michigan's fish consumption advisory, fish consumption patterns related to the water body the person was fishing on at the time of the interview, fish consumption patterns related to other sources such as purchased fish or fish other local water bodies, and demographics. The survey and the work plan for implementing the survey were submitted to the State of Michigan's Independent Review Board (IRB) for human research. IRB concluded that the survey and its implementation did not pose a risk to participating individuals and the survey was granted an IRB waiver. The survey was piloted on a small group of individuals prior to implementation.

Survey Teams

A total of 12 individuals implemented the surveys. Ten of the surveyors were undergraduate students from a local university and college. The surveyors were trained about the purpose of each survey question, how to ask the questions, and accompanied by the project manager during the initial implementation. The surveyors worked in teams of two. Survey teams tracked their time in the field and record the number of people they encountered on a daily basis. A regional coordinator stationed at a local college collected all tracking forms and surveys, and provided daily oversight. Survey team meetings were

held by the project manager every two weeks during the survey period to review methodology and progress.

Sampling Schedule

The days and times for conducting surveys were determined in advance by one to two months. Survey teams were assigned to three 5-hour intervals per week. Typically, four teams were working each week for a total of 12 5-hour intervals per week. An interval started either in the morning or early afternoon. The earliest recorded interview was 6:10 am and the latest interview was 7:45 pm with 14 surveys not having a time reported on the survey instrument. Most surveys were completed between 9 am and 3 pm (Table 1). Both mornings and afternoons were surveyed on the weekends, leaving eight sampling intervals for Monday through Friday. These eight intervals were scheduled to fit both student class schedules and to allow sampling of each weekday morning or afternoon approximately two times per month. The project manager approved team request for changes in the schedule. Alterations were made such that weekend intervals were rotated with other weekend intervals and weekday intervals for other weekday intervals.

Table 1. Number of interviews (count) conducted during each time interval.

Time Interval	Count	Time Interval	Count	Time Interval	Count
6 am to 7 am	2	11 am to 12 pm	174	4 pm to 5 pm	57
7 am to 8 am	31	12 pm to 1 pm	167	5 pm to 6 pm	44
8 am to 9 am	54	1 pm to 2 pm	139	6 pm to 7 pm	25
9 am to 10 am	120	2 pm to 3 pm	135	7 pm to 8 pm	9
10 am to 11 am	152	3 pm to 4 pm	64		

Description of Fisheries by Water Body

According to conversations with the DNR Fisheries Division, each of the chosen waters have unique aspects about the fishery that attract people to fish there at differing times during the year. This study used this information to target large groups of fishers.

The Saginaw Bay is known for multi-species year-around fishery including walleye, perch, salmon and lake trout. The fishery is mainly a small and large boat fishery during the spring, summer, and fall. In the winter, ice fishing is popular attracting large numbers of fishers.

The Saginaw River is known for a spring and fall walleye fishery, ice fishery (e.g. *Shiver on the River)*, and a year around multi-species fishery. The fishery is both a shoreline and small boat fishery. Fishing pressure increases when the walleye migrate from the Saginaw Bay up the Saginaw River during the spring and fall.

The Shiawassee River has its highest fishing pressure from March 15th to April 30th. This time frame represents when the walleye fishery is closed. During this time frame fishers are primarily targeting suckers. This fishery typically attracts avid fishers eager to catch any fish because they are excited for the spring and summer fishing season to begin. This

primarily is a shoreline fishery; boats are not a good option. The fishery also tends to be family oriented (i.e., mom, dad, grandpa, and the kids).

The Tittabawassee River is known for the spring walleye fishery and walleye festival. The fishery is both a shoreline and small boat fishery. The highest two-day fishing pressure occurs on the opening weekend of walleye season (last weekend in April). The fishing pressure, in general, slowly declines after that weekend. The depth of the Tittabawassee River is the greatest in the spring and declines in the summer and fall. The declining water levels tend to make the River less easy to fish in the summer, fall, and winter. Ice fishing is less popular on the Tittabawassee River compared to the Saginaw River and Bay.

Survey Technique
Individuals were selected using a purposive sampling design based on the Michigan DNR Creel survey methods. All surveys were conducted at the side of the water body. Based on Michigan DNR Fisheries Division recommendations, locations were selected along each river and the Saginaw Bay for survey teams to frequent. Locations were selected because they were known to be regularly used by fishers. A survey team would be assigned a section of a river, which would have approximately 6-8 sites. The survey team would go to each site until they encountered people fishing. They would approach the fishers, explain their purpose, and request an interview. The survey team would stay at a site as long as they had fishers to survey. The survey teams' objective in selecting a site was to encounter as many people fishing as possible to allow a maximum of surveys to be collected.

Data Entry
A total of 1,187 surveys were completed for this study. Each survey was assigned a unique ascending number starting with the number one then the responses were entered into an Access Database. Approximately 90% of the surveys were entered by one MDCH staff person with the remaining 10% being entered by two other staff. Surveys were filed in numerical order by the number assigned at the time of entry into the database.

Data Quality Assurance
Once all surveys were numbered, entered, and filed, 10% of the surveys were reviewed for entry errors into the database. A random number between one and ten was selected. Starting with that random number every tenth survey had every aspect of the survey reviewed. Typical entry errors were noted and all surveys and all questions were reviewed for such entry errors.

Logic errors were also corrected where possible. Logic errors were responses that could not be true based on a series of questions. An example of a logic error would be if a survey had a person eating a meal of fish during the last 7-days, but eating zero fish during the last 30-days. Notes regarding logic errors and responses to those errors are provided in Appendix A. Once a logic error was discovered, all surveys were checked for that logic error.

Fish consumption diaries were given to fishers stating they regularly consumed sport caught fish. A total of 20 fish consumption diaries were returned, with 18 matching field interviews. The number of fish-meals per month reported in the interview was compared to the number of fish meals documented with the diary. Six individuals overestimated their monthly meals of fish in the survey, 10 individuals underestimated their consumption, and 2 individuals reported the same amount of fish consumption in the survey and in the diary (Appendix A). Those completing the diary were primarily eating sport caught fish (20.6 – 239 g/d, mean±sd: 71.2 ± 51.6 g/d) and to a lesser extent purchased fish (0 – 69.3 g/d, mean±sd: 15.8 ± 20.2 g/d).

Data Analysis

Data were queried from the Access database and exported to Excel for summary. Data analysis consisted of descriptive statistics by question. Not all respondents answered all questions. Respondents were placed in three groups. Group 1 respondents reported that they do not eat fish from any Michigan water body. Group 2 respondents reported that they do eat fish from Michigan waters, however, 272 of these respondents reported not eating fish from the water body they were fishing at the time of the interview. Group 3 respondents reported that they do eat fish from Michigan waters including the water body they were fishing at the time of the interview. Group 1 provided responses to question "A". Group 2 was asked to provide responses to questions "A", "B", 1-3, and 15-24. Group 3 was a subset of Group 2 and was asked to provide responses to questions 4-14.

RESULTS

A total of 1,187 surveys were completed for this study during 2005 and 2006 (Table 2), of which 99 were people who were interviewed previously, resulting in a total 1,088 surveys containing data. Survey teams did not start a survey for previously interviewed individuals if they recognized that individual from a distance as someone they had interviewed before.

Table 2. Number of surveys completed for each month and year by water body.

	Saginaw B.	Saginaw R.	Shiawassee R.	Tittabawassee R.
Feb-05	0	1	0	0
Mar-05	93	143	2	0
Apr-05	0	1	132	83
May-05	0	102	0	125
Jun-05	31	115	0	34
Jul-05	25	25	0	26
Aug-05	20	31	0	17
Jan-06	3	92	0	2
Feb-06	10	25	0	0
Mar-06	3	3	0	0
Totals	185	581	134	287

The 1,088 fishers surveyed can be sorted into one of three groups for the purpose of data analysis (Table 3). Group 1 had 181 respondents and they reported not eating fish from any Michigan water body. Group 2 had 907 respondents, which reported that they do eat fish from Michigan waters, however, 272 of these respondents reported not eating fish from the water body they were fishing at the time of the interview. Group 3 had 634 respondents, which were a subset of Group 2 and reported that they do eat fish from Michigan waters including the water body they were fishing at the time of the interview.

Table 3. Grouping for survey respondents.

Number of People Surveyed (N)	Response
181	*Group 1*: Do Not Eat Fish from MI Waters.
907 (272 + 634 + 1NR)	*Group 2*: Do eat fish from MI Waters, however 272 of these respondents did **not** eat from the water body they were fishing at the time of the survey.
634	*Group 3*: Do eat fish from MI waters including fish from the water body they were fishing at the time of the survey.
1088	Total Surveys Completed (907+181)

Pre-Survey Questions

Pre-survey questions were used to identify fishers that eat fish from Michigan waters and had not been previously interviewed for the study.

Question A. Have we interviewed you before with this questionnaire?

- YES 99 (9%)
- NO 1088 (91%)

Question "A" prevented duplication of interviews. Of the 1,187 surveys, 99 individuals reported being interviewed previously. For those 99 individuals, the survey was ended. The 1,088 individuals were asked question "B."

Question B. Do you eat fish from rivers or lakes in the State of Michigan?

- YES 907 (83%)
- NO 181 (17%)

Of the 1,088 fishers, 907 or 83% responded in the affirmative to eating fish from Michigan waters. The remaining 181 individuals were asked question "b1."

Question b1. If you do not eat fish from MI waters, is it due to concerns about chemical pollution?

- YES 86 (48%)
- NO 80 (44%)
- No Response Provided 15 (8%)

Of the 181 individuals who said they do not eat fish from Michigan waters, 86 or 48% responded in the affirmative that it was due to concerns about chemical pollution. Forty-four percent responded that it was not due to chemical pollution, and 8% did not provide a response. The survey was ended for these 181 fishers.

Survey Questions

Section A. Michigan's Fish Consumption Advisory

Section A questions were asked to the 907 Group 2 fishers (i.e., people who eat fish from Michigan's waters). Section A questions address fishers use and awareness of the Michigan Fish Consumption Advisory.

Question 1. Are you aware that the State of Michigan issues fish consumption advisories on some rivers and lakes related to chemical contamination?

- YES 759 (84%)
- NO 147 (16%)

Of the 907 fishers, 84% responded in the affirmative to having heard about the fish advisory; 16% were not aware of the existence of fish consumption advisories. Question 1 does not measure the depth of the person's knowledge regarding the use of the advisory.

Question 1a. If Yes, where did you hear about these advisories?

Table 4. Results to Question 1a.

Response	Count	Response	Count
Radio	**43**	**Other (continued)**	
T.V.	**163**	*Magazines*	*8*
Local Newspapers	**160**	*Word of Mouth*	*6*
Medical Doctor	**5**	*Store where they bought license*	*5*
Friend/Neighbor	**30**	*Family*	*4*
Church	**0**	*Work*	*4*
DNR Fishing Guide/ MDCH	**445**	*Bait Shop*	*3*
Local Organization	**5**	*Friend*	*2*
American Fisherman Club	*1*	*MUCC*	*2*
Bass Pro Club	*1*	*TV*	*2*
Chesaning Conservation Club	*1*	*Boat Launches*	*1*
Sigma Pi	*1*	*Classes*	*1*
Walleye Club	*1*	*Fishing License*	*1*
Other	**100**	*Posted Flyer*	*1*

Posted Signs	*13*	*Handout*	*1*
Internet	*13*	*WIC Office*	*1*
DNR	*10*	*Marina*	*1*
Outdoor Sport Magazines	*9*	*Miscellaneous*	*23*

Multiple responses were allowed for this question. The most frequent response was the DNR and/or DCH as being the source of their awareness. Television, local newspapers, and radio were also commonly mentioned. Fish consumption advisory signs posted along the rivers and on the internet were mentioned by 13 individuals under other sources of information.

Question 2. Do you use the State of Michigan's Family Fish Consumption Guide?

- YES 379 (42%)
- NO 515 (57%)
- No Response Provided 13 (1%)

Question 2a. If Yes to Question 2, How do you use the Family Fish Consumption Guide?

- How often to eat fish 291 (77%)
- Select fish species 250 (66%)
- Select a water body to fish 199 (53%)
- All of the above 171 (45%)
- No 18 (5%)
- No Response Provided 17 (4%)
- Other use
  - Select fish by length 2
  - Cleaning methods 8
  - Learn name of chemicals 1

Question 2b. [If No to Question 1] Would you use the Family Fish Consumption Guide?

- YES 33 (56%)
- NO 18 (31%)
- Undecided 8 (14%)

Question 2b. [If Yes to question 1 but No to Question 2] Would you use the Family Fish Consumption Guide?

- YES 50 (17%)
- NO 184 (62%)
- Undecided 61 (21%)

Question 3. What are names of the media outlets you regularly get news from?
Respondents listed television stations and newspapers as their most common source of news (Table 5). Commonly mentioned television stations were WNEM channel 5 and WJRT channel 12. Commonly mentioned newspapers were the Saginaw News, Bay City Times, Flint Journal, Detroit Free Press, Midland Daily News, and Detroit News. Radio, magazines, and internet were cited to a lesser extent as sources of information (Table 5).

Table 5. List of television, radio, newspaper, magazines, and internet information sources used by survey participants.

TV	Count	Radio	Count	Newspaper	Count	Magazines	Count	Internet	Count
NBC WNEM 5	236	WSGW 790	10	Saginaw News	203	Michigan Out-of-Doors	5 to 25	Internet	19 to 20
ABC WJRT 12	88	WKQZ 93.3	4	Bay City Times	141	Michigan Outdoor News	4 to 24	DNR Website	8
CNN	14	WCEN 94.5	4	Flint Journal	36	Woods-N-Water News	3 to 5	MLIVE	2
Channel 25 WEYI	12	NPR	3 to 4	Detroit Free Press	31	Fishing Magazine	2 to 4	Sports Net	1
Fox Channel 66	6 to 13	WWJ 950	1 to 2	Midland Daily News	19 to 20	Field & Stream	2	TNN.com	1
Channel 7	4 to 6	WKCQ 98.1	3	Detroit News	12	Bass Fisherman	1	Walleyecentral.com	1
Fishing Channel	2 to 4	WIOG 102.5	3	Grand Rapids Press	8	Crappie News	1	AOL	1
Channel 6 UPN	2 to 3	WCMU 89.5	2	Oakland Press	7 TO 9	Fishing Report	1	Walleyefirst.com	1
Channel 10	4	WHNN 96.1	2	Morning Sun	3 to 5	Hook & Hunting Report	1		
PBS	4	WUGN 99.7	1	Traverse City Record Eagle	1 to 4	Michigan Sportsman	1		
Channel 12	3	WKZO 590	1	Lansing State Journal	3				
Channel 9	3	WNEM 1250	1	Argus Press	2				
MSNBC	2	WTCF 100.5	1	Jackson Citizen Patriot	2				
WZZM 13	2	WEEG 97.3	1	USA Today	2				
Channel 11	1	WJZJ 95.5	1	Ann Arbor News	1				
Channel 19	1	94.9	1	Cadillac News	1				
Channel 8	1	93.7	1	Chicago News	1				
Delta Public TV	1	91.8	1	Fort Wayne Gazette	1				
WKAR 23	1			Greenville Daily News	1				
Muskegon Channel	1	*Radio Programs*		Herald News	1				
OLN Station	1	Mike Avery- PBS	2	Lapeer County Press	1				
		Great Lakes News	1	Livingston County Press	1				
TV Programs		Rush Limbaugh	1	Macomb Daily	1				
Fred Troust	3			Muskegon Chronical	1				
In Fisherman (Cable)	1			Owosso Press	1				
				Pontiac Newspaper	1				
				Times Herald	1				
				Tri-County Citizen	1				
				Tuscola County Advertiser	1				

Section B. Water body specific fish consumption

Questions 4 – 14 were specific to the water body the individual was fishing at the time of the interview. Respondents who stated they had previously eaten fish from the water body they were fishing at the time of the interview were asked questions 5 – 14. The results of these questions are provided for each water body, although, the sample results may be more robust and representative when analyzed for all water bodies combined.

Question 4. Do you eat fish from this water body?

The number of individuals eating fish from the water body they were fishing at the time of the interview varied between water bodies. Saginaw Bay fishers were the most likely to eat their catch. Of the 182 Saginaw Bay fishers surveyed, 163 (90%) reported eating the fish from the Saginaw Bay. Of the total number of fishers surveyed on the Saginaw River (N=519), Shiawassee/Bad Rivers (N=132), and Tittabawassee River (N=255), 57%, 35%, and 51% reported eating the catch, respectively (Table 6).

The percentage of fishers eating their catch from a given water body increases when individuals that do not eat fish from Michigan waters are removed from the estimate. The range of percentages for fishers that eat fish from Michigan waters and eat fish from the water body they were fishing at the time of the survey are 46-96%.

Table 6. Sample size by water body and percentage of people consuming fish based on the total number of surveys or the number of Group 2 surveys.

Water Body	**Sample Size**				
	Total Surveys (T) N	**Group 2 (G2) N**	**Group 3 (G3) N**	**Group 3**	
				% of T	**% of G2**
Saginaw Bay	182	170	163	90%	96%
Saginaw River	520	423	297	57%	70%
Shiawassee/Bad River	132	101	46	35%	46%
Tittabawassee River	254	213	128	50%	60%
Totals	1088	907	634	58%	70%

Question 5. Which months of the year do you fish this water body?

The months of the year that respondents fish these waters varied by water body (Figure 1). Saginaw River and Bay had similar percentages of respondents fishing these waters each month. The Tittabawassee River and Shiawassee/Bad Rivers had higher percentages of people fishing during April and May, and the lowest percentages during winter.

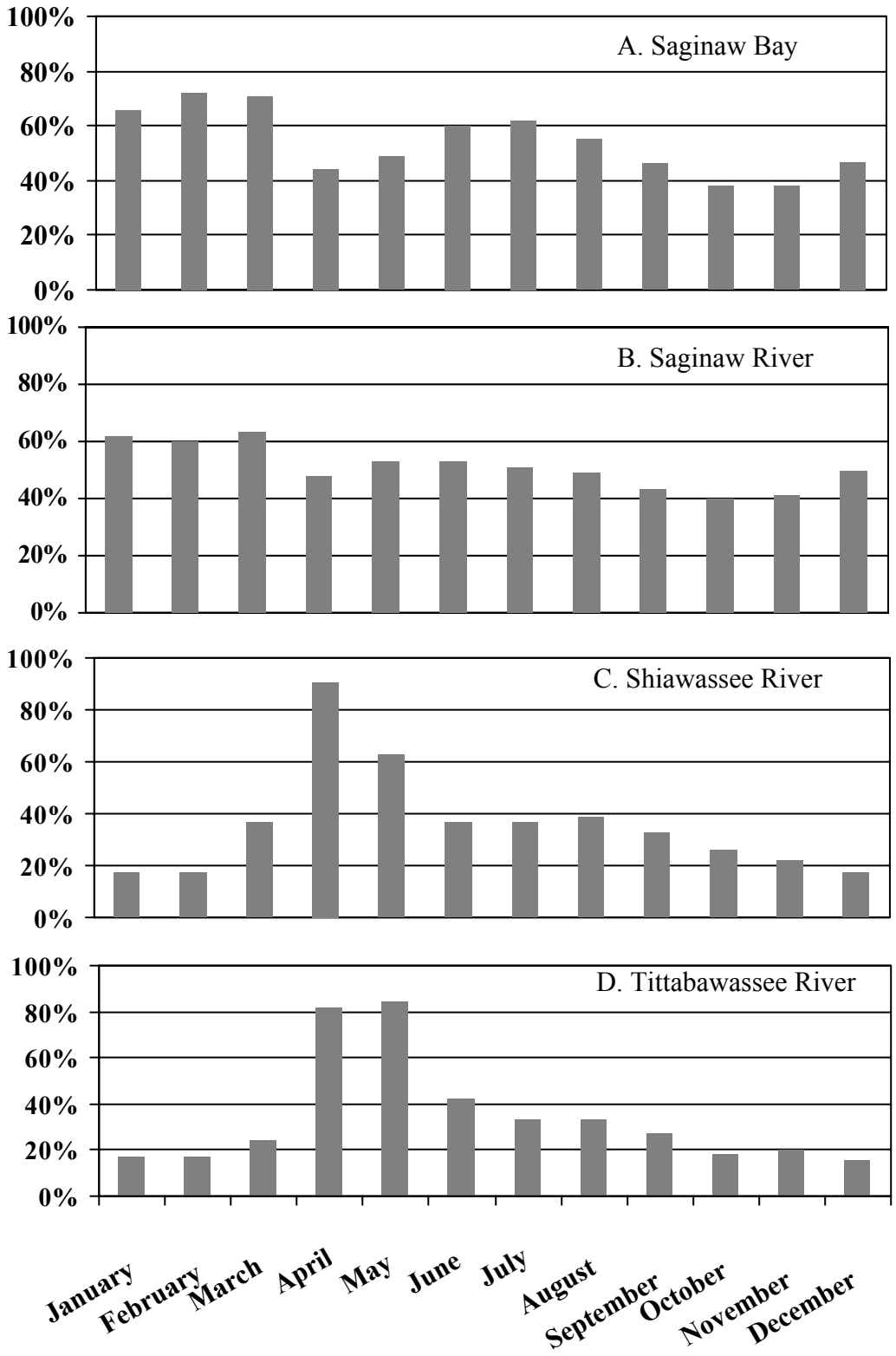


Figure 1. Percentage of fishers responding in the affirmative to fishing the A.) Saginaw Bay, B.) Saginaw River, C.) Shiawassee/Bad River, or D.) Tittabawassee River during each month of the year.

Question 6. Have you ever noticed any odd smells or tastes in fish harvested from this water body?

During the 1970s and 1980s, reports of "tainted" fish from the Saginaw and Tittabawassee Rivers and Saginaw Bay were common. Historical complaints of tainted fish were about odd tastes or odors. The Shiawassee/Bad River was not thought to have this problem. Ten to 15% of respondents reported that they had noticed odd smells or tastes, with 85-90% of respondents reporting never noticing odd smells or tastes (Figure 2).

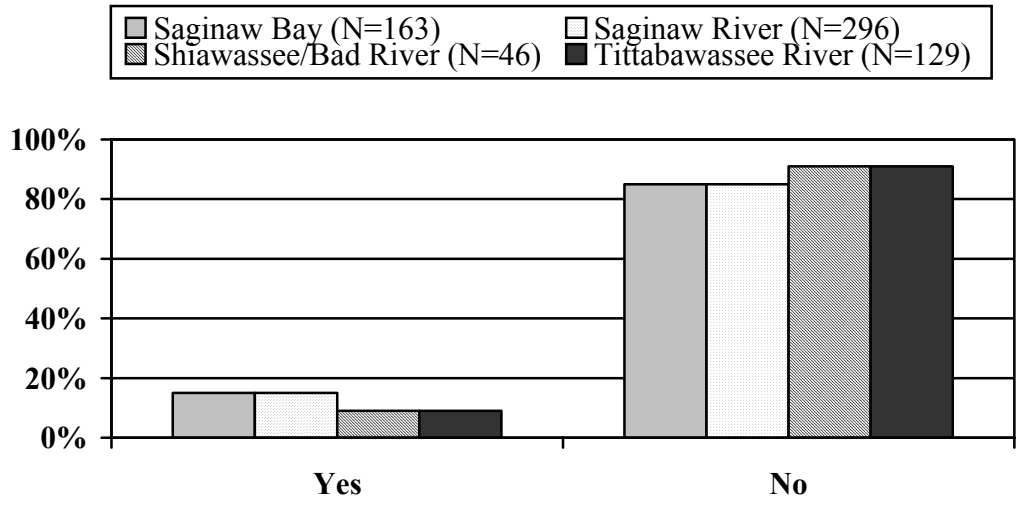


Figure 2. Percentage of respondents by water body reporting "yes" or "no" to ever noticing odd smells or tastes in fish they had eaten from the water body they were fishing at the time of the survey.

Question 6a. If yes, how long ago was it that you noticed these odd odors or tastes: Within the Last Year (<1 yr), Within the Last 5 years (1-5 yrs), Between 5 and 10 years ago (5-10 yrs), Greater than 10 years ago (>10 yrs).

Of the respondents answering in the affirmative to question 6, the time frame when they encountered the meal of fish from a given water body ranged from within the last year to more than 10 years ago (Table 7).

Table 7. Number of respondents by time frame and water body reporting odd smells or tastes in their fish.

	<1 yr	1-5 yrs	5-10 yrs	>10 yrs	Totals
Saginaw Bay	8	9	0	4	21
Saginaw River	21	8	5	10	44
Shiawassee River/ Bad River	3	0	1	0	4
Tittabawassee River	4	2	2	2	10
Totals	36	19	8	16	79

Question 6b. If yes, please describe the smell or taste.

Self-defined responses for those answering in the affirmative to question 6 were within 12 topics (Table 8). The most common responses were nonspecific such as "bad", "odd", or "different." The second most common response was that of a chemical taste or odor followed by a "fishy" taste or odor.

Table 8. Summary of taste and smell responses to question 6b.

Topics	Smell	Taste	Taste or Smell	Totals
Bad/Odd/Different	10	12	3	25
Chemical	8	4	3	15
Diesel Fuel	0	0	2	2
Fishy	5	2	3	10
Metallic/Foundry	2	0	0	2
Mucky/Muddy	1	0	5	6
Oily	1	0	2	3
Paint Thinner	0	0	1	1
Sulfur	1	0	1	2
Sweet	0	1	0	1
Tar-like	0	0	1	1
Weedy	0	1	0	1
Non-applicable Response	na	na	na	5

Question 7: How many fish (any species) from this water body have you caught in the past 7 days?

Question seven documented the total number of fish of any species caught in the 7 days prior to the interview. The interviewer instructed that respondent to only include fish that were kept and not returned to the water body. The range of fish caught within a seven-day period varied by water body (Saginaw Bay: 0 to 300, Saginaw River: 0 to 200, Shiawassee/Bad: 0 to 150, Tittabawassee River: 0 to 19) (Table 9).

The Tittabawassee River surveys began on the opening day of walleye season (April 30th), and as such, the people interviewed during the first few days did not have a full seven days to fish the river. For example, 83 individuals were interviewed on opening day and their responses would only reflect a single days catch. The other three water bodies did not have this same degree of overlap with fishing openers.

Table 9. Number of respondents reporting the number of fish caught 7 days prior to the interview from the river they were fishing at the time of the interview.

Number of Fish Caught	Number of Responses			
	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee
No Response	1	2	0	2
0	62	142	23	53
1	11	18	3	15
2	14	9	4	12
3	10	15	1	7
4	6	10	0	7
5	11	10	1	11
6	2	7	0	3
7	1	6	0	1
8	4	13	1	1
10	7	14	1	4
11	0	0	0	1
12	0	2	2	4
13	1	1	0	3
14	1	0	1	0
15	6	8	0	3
16	2	0	0	0
18	0	2	0	0
19	1	0	0	1
20	4	13	1	0
22	1	1	0	0
24	0	1	0	0
25	3	3	2	0
30	3	2	1	0
35	1	2	0	0
40	0	3	0	0
50	2	4	0	0
55	0	0	1	0
60	1	2	1	0
61	0	1	0	0
70	0	3	0	0
72	1	0	0	0
75	1	0	0	0
80	1	0	0	0
100	3	2	2	0
150	0	0	1	0
200	0	1	0	0
250	1	0	0	0
300	1	0	0	0

Question 8. How many meals of fish from this water body have you eaten in the past 7 days?

The question focuses on the number of meals of fish eaten from the river they were fishing at the time of the interview during the 7 days prior to the interview. The number of fish meals consumed ranged from 0 to 15 meals from the water body they were fishing (Table 10).

Table 10. Number of respondents reporting the number of meals eaten during the 7 days prior to the interview from the river they were fishing at the time of the interview.

	Number of Responses			
Meals - last 7 days	**Saginaw B.**	**Saginaw R.**	**Shiawassee/Bad**	**Tittabawassee***
No Response	1	4	0	2
0	100	234	41	116
1	37	39	2	9
2	12	10	3	1
3	5	5	0	0
4	5	2	0	0
5	1	1	0	0
6	2	0	0	0
10	0	1	0	0
15	0	1	0	0

* Tittabawassee River surveys were begun on the opening day of walleye season (April 30th), and as such, the people interviewed during the first few days would have had minimal opportunity to consume the fish they caught before the time of the interview. For example, 83 individuals were interviewed on opening day and are included in the table. However, none of those individuals had time to eat the fish they caught by the time of the interview.

Question 8a. Does the number of meals eaten also apply to people living in your household?

Participants reported that their responses to question 8 also applied to family members 82-85% of the time, with 2-9% responding in the negative, and 7 to 16% not providing a response (Table 11).

Table 11. Number of responses (percentage of total by water body) to question 8a reported by answer and water body.

	Saginaw B.	**Saginaw R.**	**Shiawassee/Bad**	**Tittabawassee**
Yes	133 (82%)	249 (84%)	39 (85%)	105 (82%)
No	9 (6%)	23 (8%)	4 (9%)	3 (2%)
No Response	21 (13%)	25 (8%)	3 (7%)	20 (16%)

Question 9. How many fish (any species) from this water body have you caught in the past 30 days?

Question nine documented the total number of fish of any species caught in the 30 days prior to the interview. The interviewer instructed the respondent to only include fish that were kept and not returned to the water body. The range of fish caught within a 30-day period varied by water body (Saginaw Bay: 0-300, Saginaw River: 0-450, Shiawassee/Bad: 0-150, Tittabawassee River: 0-300) (Table 12).

The Tittabawassee River surveys began on the opening day of walleye season (April 30th), and as such, the people interviewed during the first few days did not have a full 30 days to fish the river for walleye (most common fish species targeted). For example, 83 individuals were interviewed on opening day and their responses would only reflect a single days' catch. The other three water bodies did not have this same degree of overlap with fishing openers.

Table 12. The number of responses by participants of fish caught from a water body in past 30 days.

Number of Fish Caught	**Number of Responses**			
	Saginaw B.	**Saginaw R.**	**Shiawassee/Bad**	**Tittabawassee**
No Response	1	4	0	3
0	29	110	25	52
1	9	17	2	14
2	14	6	4	13
3	12	9	1	6
4	5	9	0	7
5	7	10	0	12
6	7	5	0	2
7	3	5	0	1
8	3	8	1	1
10	5	13	0	5
11	0	1	0	1
12	2	7	2	2
13	2	2	0	3
14	1	2	1	0
15	7	13	1	4
16	1	1	0	0
17	2	1	0	0
18	0	2	0	0
19	1	1	0	1
20	9	17	0	0
21	0	0	1	0
22	0	1	0	0
23	1	0	0	0
24	0	1	0	0

Table 12. Con't

Number of Fish Meals Eaten	Number of Responses			
	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee
25	7	4	1	0
27	1	0	0	0
28	0	1	0	0
30	1	9	1	0
35	3	5	0	0
40	1	4	0	0
42	0	1	0	0
43	1	0	0	0
45	1	0	0	0
49	0	1	0	0
50	7	9	1	0
51	1	0	0	0
55	2	0	1	0
60	3	1	1	0
70	0	2	0	0
72	1	0	0	0
80	1	0	0	0
90	0	1	0	0
100	3	4	1	0
135	0	1	0	0
140	1	0	0	0
150	2	5	2	0
200	2	3	0	0
250	1	0	0	0
300	3	0	0	1
450	0	1	0	0

Question 10. How many meals of fish (any species) from this water body have you eaten in the past 30 days?

Question 10 documents the number of meals of fish eaten from the river they were fishing at the time of the interview during the 30 days prior to the interview. The range of fish meals consumed was 0-90 and varied by water body (Table 13).

Table 13. The number of responses by participants reporting the number of meals eaten in the last 30 days from a specific water body.

Number of Fish Meals Eaten	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee
No Response	2	2	0	3
0	58	179	37	109
1	32	39	4	7
2	27	30	2	4
3	10	22	2	1
4	12	7	0	1
5	8	5	0	1
6	6	6	1	1
7	0	1	0	0
8	1	0	0	0
10	1	4	0	1
12	2	1	0	0
15	2	1	0	0
20	1	0	0	0
90	1	0	0	0

Question 11. Is this (response from question 10) a typical number of fish meals you eat per month from this water body?

Greater than half the respondents (51-63%) stated that their fish consumption during the last 30 days was not their typical amount of fish consumption (Table 14).

Table 14. Number of responses (percentage of total by water body) to question 11 reported by answer and water body.

	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee
Yes	58 (36%)	111(37%)	16 (35%)	55 (43%)
No	95 (58%)	176 (59%)	29 (63%)	65 (51%)
No Response	10 (6%)	10 (3%)	1 (2%)	8 (6%)

Question 11a. IF NO (to question 11), What is a typical (average) number per month?

The typical fish consumption was calculated by combining the "Yes" responses in question 10 with the estimates provided by participants in question 11a. Self-reported typical number of meals of fish eaten per month from the specific water body ranged from 0 – 90 meals and varied by water body (Saginaw Bay: 0-90; Saginaw River: 0-20; Shiawassee/Bad: 0-20; Tittabawassee River: 0-10) (Table 15).

Table 15. The number of responses by participants reporting the typical number of meals eaten each month from a specific water body.

Number Meals per Month Eaten	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Sum
NR	1	2	0	3	6
0	27	104	25	54	210
0.5	7	8	1	17	33
1	33	67	7	27	134
2	34	42	2	13	91
3	9	23	3	2	37
4	15	13	2	1	31
5	9	6	1	1	17
6	5	5	0	1	11
7	0	2	0	0	2
8	3	1	0	1	5
10	0	2	1	1	4
12	0	1	1	0	2
15	2	1	0	0	3
20	0	3	1	0	4
90	1	0	0	0	1

Question 12. In recent years, (past 5 years), what is the most number of fish meals in any single month you have eaten from this water body?

The range of self-reported single month maximum number of meals eaten was 0–100 meals and varied by water body (Saginaw Bay: 0-90; Saginaw River: 0-100; Shiawassee/Bad: 0-25; Tittabawassee River: 0-100) (Table 16).

Table 16. The number of responses by participants reporting the maximum number of meals eaten in a month from a specific water body.

Number of Fish Meals Eaten	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Sum
No Response	26	34	8	7	75
0	2	12	3	4	21
0.5	0	5	0	8	13
1	17	51	10	34	112
2	22	44	8	34	108
3	21	36	4	8	69
4	20	23	3	10	56
5	16	31	3	10	60
6	9	17	1	1	28
7	3	3	0	2	8
8	6	7	0	2	15
9	1	0	0	0	1
10	9	20	3	5	37
12	5	3	0	0	8
13	0	1	0	0	1
15	1	2	0	1	4
17	0	1	0	0	1
20	2	2	0	1	5
22	0	0	1	0	1
24	0	1	1	0	2
25	0	0	1	0	1
30	2	0	0	0	2
36	0	1	0	0	1
40	0	1	0	0	1
90	1	0	0	0	1
100	0	1	0	1	2

Question 13. In recent years (past 5 years), which species have you eaten from this water body and what amount (e.g. 5%, 25%, 50%, 100%) of your consumption do the *Sport Fish* versus *Bottom Feeding* fish make up in your fish diet (e.g. 75% sport fish and 25% bottom feeding)?

Totals of 12, 14, 12, and 15 different types of fish were identified as being eaten within recent years from the Saginaw Bay, Saginaw River, Shiawassee/Bad River, and Tittabawassee River, respectively (Table 17). Respondents were allowed to report multiple fish species. The most commonly consumed species varied by water body (Saginaw Bay: walleye 92%, perch 70%; Saginaw River: walleye 79%, perch 47%,

catfish 21%, smallmouth bass 9%, crappie 8%; Shiawassee/Bad Rivers: suckers 84%, walleye 51%, smallmouth bass 21%; Tittabawassee River: walleye 96%, smallmouth bass 15%, catfish 8%, perch 7%) (Table 17). According to local DNR fisheries biologist, high water conditions on the Tittabawassee River during the spring of 2005 reduced the opportunity for white bass fishing, which may have resulted in an underestimation of the number of people consuming white bass from the Tittabawassee River (personal communication James Baker, DNR)

Table 17. Percentage of respondents reporting recent (past 5 years) fish consumption by fish species and water body.

	Number of Responses			
Species	**Saginaw B.**	**Saginaw R.**	**Shiawassee/Bad**	**Tittabawassee**
Pelagic				
Bluegill	2%	7%	9%	5%
Crappie	3%	8%	0%	3%
Largemouth Bass	2%	4%	7%	5%
Muskellunge	0%	0%	0%	0%
Northern Pike	5%	3%	14%	5%
Perch	70%	47%	7%	7%
Rock Bass	0%	0%	7%	2%
Salmon	4%	1%	0%	1%
Smallmouth Bass	3%	9%	21%	15%
Smelt	2%	0%	0%	0%
Trout	3%	3%	2%	2%
Walleye	92%	79%	51%	96%
White Bass	1%	7%	5%	5%
Benthic				
Catfish	3%	21%	12%	8%
Carp	0%	2%	5%	4%
Freshwater Drum	0%	6%	0%	2%
Sucker	0%	1%	84%	2%
Bullhead	0%	0%	0%	0%

As a further analysis, reported species of fish consumption were grouped into four categories:

1. Walleye Only [Walleye]: People that reported only eating walleye.
2. Walleye and Perch or Perch Only [WP/P]: People that reported eating walleye and perch or perch only.

3. Other Pelagic: People that reported eating other fish species that feed in the water column and not directly from the sediment (All species listed in Table 16 under pelagic species) and can include walleye and perch consumption.
4. Benthic: People that reported consumption of fish that feed from the sediments at the bottom of the water body (i.e., catfish, carp, freshwater drum, suckers, bullheads). Individuals may also have reported consumption of pelagic species.

These grouping are broadly based on the levels of chemical contamination in the various fish species for the Saginaw Bay, Saginaw River, and Tittabawassee River. The sections of the Shiawassee and Bad Rivers in this study have fish with minimal chemical, with the exception of Bad River catfish that does have significant restrictions on its consumption by women and children. In the context of this study, the sections of the Shiawassee and Bad Rivers surveyed in this study represent water bodies from which it is much safer to eat the fish. In general, the walleye and perch are the least contaminated fish species in the Saginaw Bay, Saginaw River, and Tittabawassee River and are not restricted for consumption by the general public and have minimal restrictions for the sensitive population. Other Pelagic species from the Saginaw Bay, Saginaw River, and Tittabawassee River tend to vary widely in chemical contamination but this group contains several species that are known to have substantially more contamination than the walleye and perch. Benthic species from the Saginaw Bay, Saginaw River, and Tittabawassee River tend to be the most contaminated with the carp and catfish having the most restrictive fish consumption advisories.

The most predominant fish species consumed from the Saginaw Bay was walleye and perch. Combining the *walleye only* and *walleye and perch or perch only* groups results in 83% of the Saginaw Bay fishers reporting only eating these least contaminated fish species. Minimal numbers of Saginaw Bay fishers reported consumption of *benthic* species (Table 18). Sixty percent of Saginaw River fish consumers eat only walleye and/or perch, with 17% reporting consumption of *other pelagic* species and 23% reporting consumption of *benthic* species (Table 18). A small percentage (7%) of Shiawassee/Bad Rivers fishers reported consuming only walleye and/or perch, with 7% reporting consumption of *other pelagic* species and 88% reporting recent consumption of *benthic* species (Table 18). Sampling on the Shiawassee/Bad Rivers was restricted to April during the sucker fishing season, which may contributed to the high reporting rate of benthic consumption. For the Tittabawassee River, 70% of the fishers reported eating only walleye and/or perch, with 20% reporting consumption of *other pelagic* species and 10% reporting consumption of *benthic* species (Table 18).

Table 18. Percentage of respondents reporting recent (past 5 years) fish consumption by fish group and water body.

Species Category	**Percentage of Respondents Consuming Fish**							
	Saginaw B		**Saginaw R**		**Shiawassee/Bad**		**Tittabawassee**	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Walleye Only	42	26%	82	28%	2	5%	86	68%

WP/P	91	57%	93	32%	0	0%	2	2%
Other Pelagic	23	14%	48	17%	3	7%	26	20%
Benthic	5	3%	65	23%	38	88%	13	10%

Question 13 asked respondents to provide an estimate of the percentage of their fish consumption that came from benthic fish (i.e., catfish, carp, freshwater drum, bullhead, suckers) versus sport fish (i.e., all fish species other than benthic feeders). Responses ranged from 100% sport fish consumption to 100% benthic fish consumption. Twelve other percentage ratios were reported by fish consumers. A total of 498 individuals reported 100% sport fish consumption, 43 individuals reported 100% benthic fish consumption, and 59 individuals reported a mixed percentage of both sport fish and benthic fish consumption (Table 19).

Table 19. Number of respondents reporting a specific ratio as a percentage of sport fish to benthic fish eaten from a given water body.

Sport Fish	**Benthic Fish**	**Number of Respondents**			
Percentage	**Percentage**	**Saginaw B.**	**Saginaw R.**	**Shiawassee/Bad**	**Tittabawassee**
No Response	No Response	6	20	7	1
0	100	0	28	15	0
5	95	0	1	0	0
20	80	0	2	0	0
25	75	0	1	1	0
30	70	0	1	0	0
33	67	0	0	0	1
50	50	0	8	3	3
60	40	0	1	1	0
66	34	1	3	0	0
75	25	1	4	12	2
80	20	1	3	1	2
90	10	0	4	0	1
95	5	0	0	0	1
100	0	154	221	6	117

Question 14. List the top three fish species you eat the most from this water body, from greatest to least?

This question investigates the favorite species to eat by water body. The total number of responses for each fish species by water body was summed, then the species were ranked

from greatest to least based on number of responses. Walleye was the most commonly mentioned fish species eaten for all water bodies except the Shiawassee and Bad Rivers (Table 20). For Saginaw Bay, walleye (51%), perch (38%), pike (2%), trout (2%), salmon (2%), and various bass species (i.e., smallmouth bass, largemouth bass, white bass were added to the response "bass") (2%) each make up greater than one percent of the species reported. For the Saginaw River, walleye (44%), perch (27%), catfish (10%), bass species (9%), crappie (3%), and bluegill (3%) each made up greater than one percent of responses. For the Shiawassee and Bad Rivers, suckers (42%) and walleye (26%) were the most commonly reported species. The remaining species from the Shiawassee and Bad Rivers each contributed 3-5% of the total responses, with the exception of largemouth bass, which contributed 1%. For the Tittabawassee River, walleye (79%), smallmouth bass (7%), white bass (4%), pike (3%), and sunfish (2%) each contributed greater than 1% to the total number of responses.

Table 20. Total number of times a fish species was listed in response to questions 14 reported by water body.

Saginaw B.		**Saginaw R.**		**Shiawassee/Bad**		**Tittabawassee**	
Walleye	144	Walleye	223	Suckers	32	Walleye	124
Perch	108	Perch	135	Walleye	20	Smallmouth Bass	11
Pike	7	Catfish	53	Bluegill	4	White Bass	6
Trout	5	Bass	22	Bass	3	Pike	4
Salmon	5	Crappie	14	Catfish	3	Sunfish	3
Smallmouth Bass	3	Bluegill	13	Pike	3	Rock Bass	2
Catfish	3	White Bass	11	Rock Bass	3	Steelhead	2
Steelhead	2	Freshwater Drum	7	Smallmouth Bass	3	Salmon	1
Smelt	2	Carp	5	Perch	2	Freshwater Drum	1
Crappie	2	Pike	5	White Bass	2	Suckers	1
Whitefish	1	Trout	5	Largemouth Bass	1	Trout	1
Largemouth Bass	1	Steelhead	4				
Bluegill	1	Salmon	2				
Bass	1	Smallmouth Bass	2				
		Suckers	2				
		Largemouth Bass	1				
		Smelt	1				

Section C. Questions about fish consumption from sources other than the water body being fished at the time of the interview.

Question 15. Have you eaten any other meals of fish not from this water body, but from another source including grocery stores or restaurants, in the past 7 days?

	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Sum	%
No	102	268	66	127	563	62%
Yes	66	154	35	86	341	38%
No Response	2	1	0	0	3	0%

Question 15a. If "Yes" to question 15, how many fish meals not from this water body have you eaten in the past 7 days?

Number of Fish Meals Eaten	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Sum
1	45	112	27	57	241
2	13	28	4	20	65
3	5	7	4	8	24
4	2	1	0	0	3
5	0	1	0	0	1
6	0	0	0	1	1
7	1	2	0	0	3
10	0	1	0	0	1

Question 15b. Does this (question 15a) also apply to people living in your household?

	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Sum	%
No	15	44	9	20	88	10%
Yes	139	352	84	187	762	84%
No Response	16	27	8	6	57	6%

Question 16. Have you eaten any other meals of fish not from this water body, but from another source including grocery stores or restaurants, in the past 30 days.

	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Sum	%
No	58	138	24	56	276	30%
Yes	108	279	77	153	617	68%
No Response	4	6	0	4	14	2%

Question 16a. If "yes" to question 16, how many fish meals not from this water body have you eaten in the past 30 days?

Number of Meals Eaten	Number of Responses				Sum
	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	
1	40	107	24	54	225
2	26	77	17	46	166
3	18	25	8	20	71
4	8	24	14	14	60
5	6	15	2	4	27
6	4	3	3	2	12
7	1	6	2	1	10
8	2	5	0	2	9
9	1	0	1	1	3
10	1	7	4	3	15
12	0	4	1	1	6
14	0	0	1	0	1
15	0	2	0	2	4
16	1	0	0	0	1
18	0	0	0	2	2
20	0	2	0	1	3
30	0	1	0	0	1
40	0	1	0	0	1

Question 16b. Does your response to question 16a also apply to people living in your household?

Number of Meals Eaten	Number of Responses				Sum	%
	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee		
No	24	49	15	39	127	14%
Yes	127	347	78	166	718	79%
No Response	19	27	8	8	62	7%

Question 17. Does your response to question 16a represent a typical number of fish meals you eat per month not from this water body?

	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Sum	%
No	25	91	34	63	213	23%
Yes	134	316	65	145	660	73%
No Response	11	16	2	5	34	4%

Question 17a. If "no" to question 17, what is a typical (average) number of fish meals per month?

The responses to question 17, both those who indicated "yes" (i.e., Yes their typical fish consumption was their response in question 16a) and who responded "no", resulted in the distribution of the typical number of fish meals per month from sources other than the water body being fished at the time of the interview. The meals of fish per month ranged from 0-40 and included all the participants in Group 2 (N=907) (Table 21).

Table 21. The number of responses by water body and across all water bodies for the typical number of fish meals per month from sources other than the water body the respondent was fishing at the time of the interview.

Meals per	**Number of Responses**				
Month	**Saginaw B.**	**Saginaw R.**	**Shiawassee/Bad**	**Tittabawasse**	**Sum**
NR	10	17	3	5	35
0	48	113	17	39	217
0.5	4	10	6	12	32
1	41	95	21	50	207
2	25	81	23	46	175
3	17	30	7	26	80
4	10	33	9	17	69
5	6	13	4	2	25
6	4	3	2	1	10
7	0	6	1	3	10
8	3	6	0	2	11
9	0	0	1	1	2
10	1	6	4	3	14
12	0	4	1	1	6
15	0	3	1	1	5
16	1	0	0	1	2
17	0	0	0	1	1
19	0	0	0	1	1
20	0	2	1	1	4
30	0	1	0	0	1
40	0	1	0	0	1

Question 18. What rivers, lakes, or bays in the Saginaw Bay Watershed do you regularly like to fish?

The most common responses were the Saginaw Bay (373), Saginaw River (238), and Tittabawassee River (124) (Table 22). A total of 111 water bodies were mentioned and not all were within the Saginaw Bay Watershed.

Table 22. Alphabetical list of water body names provided by survey participants in response to question 18.

Number Responses	Water Body Name	Number Responses	Water Body Name
165	No response	1	Farm Ponds
1	Albright Shores	1	Five Lakes
7	Au Gres River	11	Flint River
20	AuSable River	1	Frankenmuth Dam
2	Bad Axe River	1	Grand Lake
17	Bad River	5	Grand River
2	Bay Port	1	Harbor Beach
1	Bear Lake	2	Harrison
1	Beaver Lake	1	Heron Lake
1	BeBe Lake	25	Higgins Lake
2	Betsy River	2	Holloway Reservoir
2	Black River	39	Houghton Lake
1	Brown Lake	1	Howell Lake
1	Bud Lake	1	Hubbard lake
1	Carp River	2	Indian Lake
1	Caseville	7	Kawkawlin River
14	Cass River	1	Kersley Lake
1	Chippewa Lake	1	Lake Chemung
2	Chippewa River	9	Lake Erie
1	Corunna	1	Lake Fenton
1	Crawford Lake	1	Lake George
5	Crystal Lake	33	Lake Huron
14	Detroit River	2	Lake Lancer
1	Devil's Lake	1	Lake Lansing
2	Duck Lake	28	Lake Michgan
1	Edenville	2	Lake Orion
1	Everett	3	Lake Ovid

Table 22. Con't.

Number Responses	Water Body Name	Number Responses	Water Body Name
1	Lake St. Clair	1	Rose Lake
2	Linwood River/Bay Area	1	Sabo River
1	Little Bear Lake	373	Saginaw Bay
2	Local Ponds	238	Saginaw River
2	Looking Glass River	25	Sanford Lake
2	Loon Lake	2	Sebewing River
1	Manistee Lake	49	Shiawassee River
14	Manistee River	2	Sleepy Hollow
2	Maple River	1	Smith Park
1	Missaukee County	1	Southern Inland Lakes
2	Mott Lake	2	St. Clair River
1	Murphy Lake	1	St. Helen
1	Muskegon Lake	4	St. Marys River
3	Muskegon River	1	Sturgeon Bay
1	North Lake	1	Tawas Bay
1	Oganaw Lake	2	Tawas Lake
2	Oscoda River	1	Tawas River
1	Otsego Lake	1	Thunder Bay River
1	Otter Lake	124	Tittabawassee River
1	Park Lake	1	Tobacco River
3	Peer Marquette River	1	Trenton Channel
4	Pine River	1	Water Treatment Plant
2	Pontiac Lake	1	Weiss
2	Port Huron	1	West Branch
16	Quanicassee River/Bay Area	1	White Lake
1	Radley Lake	1	White River
3	Rainbow Lake	2	Williamsville
12	Rifle Lake	19	Wixom Lake

Section D. Demographics of participants that eat fish from Michigan waters.

Question 19. What is your age?

A broad range of ages (17-79 years old) participated in this survey. The age distributions for the Saginaw Bay (58%) and River (56%) were shifted to greater than half the respondents being over 40 years old compared to the Shiawassee/Bad Rivers (40%) and Tittabawasse River (45%) (Table 23). The distribution of individuals by age for each water body is provided in Table 24.

Table 23. The percentage of the total respondents by water body grouped by age range.

Age Ranges	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee
No Response	1.0%	1.0%	2.0%	< 0.5%
17 to 30	18%	21%	27%	27%
31 to 40	22%	23%	32%	27%
41 to 50	22%	24%	19%	20%
51 to 60	22%	17%	15%	14%
61 to 70	12%	10%	3%	7%
71 to 79	2%	5%	3%	4%

Table 24. Number of respondents by age and water body.

Age	Number of Responses			
Years	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee
No Response	2	4	2	1
17	1	1	0	2
18	1	4	1	3
19	1	2	1	4
20	1	6	4	2
21	3	3	3	1
22	2	5	4	3
23	3	4	2	1
24	2	7	3	3
25	0	13	1	4
26	3	6	1	4
27	2	10	3	2
28	4	7	1	11
29	4	6	0	11
30	4	13	3	6
31	3	6	2	0

Table 24. Con't.

Age	Number of Responses			
Years	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee
32	4	13	0	6
33	2	13	4	5
34	5	9	2	3
35	7	7	7	9
36	5	8	5	6
37	2	6	3	5
38	5	10	4	10
39	1	8	1	3
40	4	19	4	11
41	1	11	3	2
42	4	11	3	8
43	6	9	2	6
44	2	7	2	7
45	10	17	1	4
46	1	8	4	3
47	8	11	1	4
48	4	9	2	2
49	0	12	0	5
50	2	7	1	2
51	3	9	1	3
52	5	10	2	4
53	4	7	1	1
54	5	6	1	4
55	1	5	0	5
56	3	5	1	2
57	4	6	1	3
58	5	5	1	4
59	2	5	5	1
60	5	12	2	3
61	2	2	1	4
62	5	7	2	1
63	5	5	0	2
64	1	8	0	2
65	0	3	0	1
66	2	3	0	1
67	3	9	0	0

Table 24. Con't.

Age Years	Number of Responses			
	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee
68	1	1	0	2
69	0	1	0	2
70	1	2	0	0
71	0	5	1	5
72	2	3	0	0
73	0	2	1	1
74	0	0	0	2
75	2	2	0	0
76	0	3	0	0
77	0	1	0	0
78	0	2	0	1
79	0	2	1	0

Question 20. What is your gender?

	Number of Responses					
	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Sum	%
Female	7	33	9	11	60	7%
Male	162	387	92	202	843	93%
NR	1	3	0	0	4	0.4%

Questions 21 & 22. What is your Race? and Are you Spanish/ Hispanic/Latino?

Questions 21 and 22 are reported together by water body and across all water bodies for both Group 2 (Table 25) and Group 3 (Table 26) respondents. Responses reported under "Other" are totaled above the individual quotes from the respondent and those quotes represent self-given descriptions (e.g., one person fishing the Tittabawassee River stated they were [from] "Belize" and that person is counted in the sum of the six individuals reporting "Other" race/ethnic background.) (Table 25).

Table 25. Group 2 responses for face/ethnicity by water body and across all water bodies.

	Number of Responses				
	Saginaw B	**Saginaw R**	**Shiawassee/Bad**	**Tittabawassee**	**Sum**
No Response	2	7	2	0	11
American Indian, Native Alaskan	0	0	1	1	2
Asian Indian	0	1	0	0	1
Black African-Am	4	76	2	13	95
Mexican, Mexican-American, Chicano	1	2	0	2	5
Puerto Rican	0	0	0	1	1
White	163	332	96	195	786
Other	0	5	0	1	6
"Asian"		*1*			
"Black/White"		*1*			
"Hispanic"		*1*			
"Italian"		*1*			
"Mexican American"		*1*			
"Belize"				*1*	

Table 26. Group 3 responses for race/ethnicity by water body and across all water bodies.

	Number of Responses				
	Saginaw B.	**Saginaw R.**	**Shiawassee/Bad**	**Tittabawassee**	**Sum**
No Response	2	6	1	0	9
American Indian Native Alaskan	0	0	0	1	1
Asian Indian	0	1	0	0	1
Black African-Am	4	56	2	5	67
Japanese	0	0	0	0	0
Mexican, Mexican-American, Chicano	1	1	0	0	2
Puerto Rican	0	0	0	0	0
White	156	230	43	122	551
Other	0	3	0	0	3
"Asian"		*1*			
"Black/White"		*1*			
"Italian"		*1*			

Question 23. Is your permanent, primary residence in Michigan?

Greater than 97% of the respondents reported having their primary residence in Michigan (Table 27). Six counties accounted for 82% of the respondents (Saginaw 37%, Bay 25%, Genesee 7%, Shiawassee 5%, Midland 5%, and Tuscola 3%) (Table 28). These counties either contained portions of the water bodies in this study or were adjacent to counties that contained portions of the water body.

Table 27. Responses to Question 23.

	Number of Responses				
	Saginaw B.	**Saginaw R.**	**Shiawassee/Bad**	**Tittabawassee**	**Sum**
No	2	4	0	2	8
Yes	165	414	98	208	885
No Response	3	5	3	3	14

Table 28. Number of responses for each Michigan County reported by water body and summed across all water bodies.

	Number of Responses				
County*	**Saginaw B**	**Saginaw R**	**Shiawassee/Bad**	**Tittabawassee**	**Sum**
No Response	3	8	3	1	15
Alcona		3			3
Bay	76	136		9	221
Branch		2		1	3
Charlevoix			1		1
Clave				1	1
Clinton			3	1	4
Eaton	2	2			4
Genesee	5	47	9	4	65
Gladwin	4	3		2	9
Grand Traverse		1		2	3
Gratiot		2		3	5
Huron	2	2			4

Table 28. Con't.

	Number of Responses				
County*	**Saginaw B**	**Saginaw R**	**Shiawassee/Bad**	**Tittabawassee**	**Sum**
Ingham		4		4	8
Ionia		4		3	7
Iosco	1	3		1	5
Isabella	1			8	9
Kalamazoo				2	2
Jackson					0
Kent	1	6		2	9
Lapeer		2		1	3
Livingston	2	4		2	8
Macomb	2	4		1	7
Mecosta	1				1
Midland	9	9		23	41
Missaukee	2				2
Montcalm		3			3
Muskegon	1			2	3
Newaygo		1		1	2
Ottawa				1	1
Oakland	4	16			20
Otsego		1			1
Presque Isle	1				1
Roscommon	1				1
Saginaw	36	122	45	125	328
Shiawassee		4	37	2	43
St. Clair	1				1
Tuscola	9	16		3	28
Washtenaw				3	3
Wayne		9			9
Wexford	1				1

*Bolded county names are counties that in part or whole are within the Saginaw Bay Watershed.

Question 24. Number of people living in you home (Fill in numbers): Males (15 years or older); Females (15 years or older); Children (under 15 years old).

Group 2 respondents reported 1,175 males (≥15 years old), 902 females (≥15 years old), and 645 children (<15 years old) living in their homes. Group 3 respondents reported 824 males (≥15 years old), 643 females (≥15 years old), and 422 children (<15 years old) living in their homes (Table 29). For respondents reporting greater than zero for each of the categories, the majority of the respondents reported 1 or 2 additional individuals (Table 30).

Table 29. Total number of reported individuals for Group 2 and Group 3 by category (i.e., Males ≥15 years old, Females ≥15 years old, Children <15 years old).

Total number of Reported Individuals					
Group 2			Group 3		
Males ≥15 yr	Females ≥15 yr	Children <15 yr	Males ≥15 yr	Females ≥15 yr	Children <15 yr
1175	902	645	824	643	422

Table 30. Number of Group 2 and Group 3 responses by category (i.e., Males ≥15 years old, Females ≥15 years old, Children <15 years old) and number of individuals.

	Number of Responses					
	Group 2			Group 3		
Number of Individuals	Males ≥15 yr	Females ≥15 yr	Children <15 yr	Males ≥15 yr	Females ≥15 yr	Children < 15 yr
No Response	3	3	3	3	3	3
0	37	161	569	28	101	412
1	661	612	135	462	437	87
2	154	107	133	105	77	84
3	38	21	48	26	13	39
4	8	2	9	5	2	4
5	1	1	4	1	1	1
6	1		4			3
7						
8						
9			1			
10						
11	1		1	1		1
12	1			1		
13	2			2		

Question 25. What is your highest level of education completed? (Less than high school; High school; Some college, no degree currently; 2-yr college degree; 4-yr college degree or more)

Responses were grouped by highest degree completed up to a 4-year college degree. A similar percentage of respondents reported having either a high school or 2-year college degree across water bodies. A larger percentage of respondents fishing the Tittabawassee River (17%) and Saginaw Bay (15%) reported having a 4-year college degree compared to respondents fishing the Saginaw River (11%) and Shiawassee/Bad Rivers (8%). A larger percentage of respondents fishing Shiawassee/Bad Rivers (13%) and Saginaw River (12%) reported having no educational degree compared to respondents fishing the Saginaw Bay (6%) and Tittabawassee River (8%) (Table 31).

Table 31. The percentage of the total responses reported by water body and across all water bodies for each of four educational categories.

Type of Degree	Percentage of Respondents				
	Saginaw B.	Saginaw R.	Shiawassee/Bad	Tittabawassee	Overall
4 Year	15%	11%	8%	17%	13%
2 Year	16%	13%	14%	14%	14%
High School*	60%	62%	60%	61%	61%
None	6%	12%	13%	8%	10%

* Responses of 'high school" and "some college, no degree currently" were combined and reported as "High School".

Question 26. What is your current employment status? (Full-time employment; Part-time employment; Self-employed; Stay at home parent; Student; Retired; Unemployed)

Participants were given seven categories of employment status from which to select an answer. The categories other than full-time employment and unemployed were grouped into a single category of "less than full-time employment". As a group, people fishing the Tittabawassee River (63%) reported the highest percentage of full-employment, followed by people fishing the Shiawassee/Bad Rivers (61%), Saginaw Bay (51%), and Saginaw River (50%). As a group, people fishing the Saginaw River (13%) had the highest percentage of unemployment compared to the other three water bodies (6–8%) (Table 32).

Reporting employment status by level of educational degree attained demonstrates that those reporting a 2-year or 4-year college degree have the highest levels of full-employment (66%) and the lowest levels of unemployment (5-6%) (Table 33). Those reporting no educational degree had the lowest levels of full-time employment (24%) and the highest levels of unemployment (24%) (Table 33).

The percentage of people reporting being "Retired" increased from 14% for those with a 4-year college degree to 36% for those individuals that reported being unemployed. The percentage that reported being "Retired" increased with each decreasing educational status category (Figure 3).

Table 32. The percentage of the total responses reported by water body for each of three employment categories.

Employment Category	Percentage of Respondents			
	Saginaw B	Saginaw R	Shiawassee/Bad	Tittabawassee
Full-Time	51%	50%	61%	63%
Less than Full-Time	43%	36%	31%	30%
Unemployed	6%	13%	8%	7%

Table 33. The percentage of the total responses reported by water body for each of seven employment categories.

Employment Status	Type of Education Degree			
	4-Year College	2-Year College	High School	No Degree
Full-time Employment	66%	66%	55%	24%
Part-time Employment	4%	4%	6%	4%
Retired	14%	17%	20%	36%
Self-employed	7%	6%	7%	9%
Stay at Home Parent	1%	1%	1%	0%
Student	3%	0%	2%	3%
Unemployed	5%	6%	9%	24%

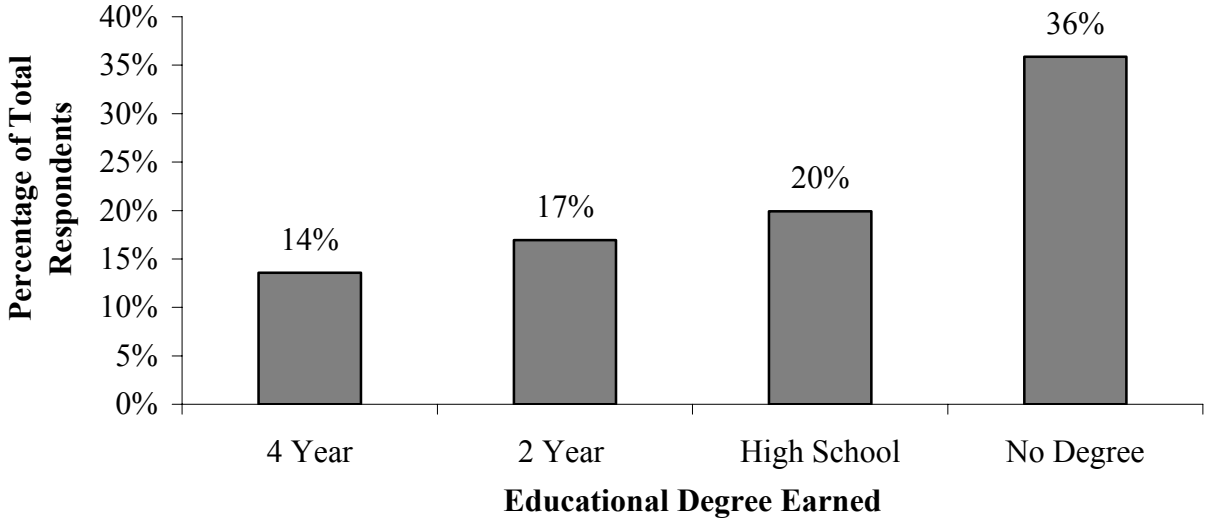


Figure 3. Percentage of participants that reported being "Retired" plotted against the level of self-reported educational degree earned.

Comparative Data Analyses

Subsets of the survey questions were analyzed using race, gender, fishing technique (i.e., boat fishing, ice fishing, shore-line fishing), or fish species eaten as an independent variable. The questions evaluated differ for each variable. To summarize, question 1-3 evaluate awareness and use of the Michigan Fish Consumption Advisory. Question 4-14 evaluated the fishing and fishing consumption patterns specific to the water body the respondent was fishing at the time of the interview. Question 15-18 evaluated fish consumption patterns not associated with the water body the respondent was fishing at the time of the interview. Questions 19-26 document the demographics of the respondent.

Gender

Questions 1, 2, 2a, 2b, 4, 13, 14, 25, and 26 were evaluated with gender as an independent variable. As reported above, Group 2 has 60 females, 843 males and 4 not providing a gender response. Responses to these questions will be reported as percentages.

Awareness and use of the Michigan Fish Consumption Advisory

Results from question 1 show that female fishers were less aware of the existence of the Michigan Fish Consumption Advisory than male fishers, with 37% of females not knowing that a fish consumption advisory existed in Michigan compared to 15% for

males. Of those that were aware of the existence of the fish consumption advisory, 68% of women reported not using the fish consumption advisory compared to 50% for males (question 2). The type of use of the fish advisory was similar between males and females (question 2a). When asked if they would use the advisory if they had a copy of it (question 2b), 39% of women said "yes" or "uncertain", 15% said "no", and 41% did not give a response, whereas, 29% men said "yes" or "uncertain", 41% said "no", and 30% did not give a response.

Fish consumption patterns from the water body being fished at the time of the interview

Fifty-four percent (54%) of females reported having eaten fish from the water body they were fishing at the time of the interview, as compared to 71% of males. Female responses to question 14 (favorite fish species to eat from the water body) resulted in walleye (24%), bass (small- or large-mouth) (21%), perch (17%), and catfish (15%) being selected most often with a total of 10 different fish species being reported as their favorite fish to eat from the given water body. Male responses to question 14 resulted in walleye (49%), perch (24%), catfish (6%), and bass (small- or large-mouth) (6%), being selected most often with a total of 20 different fish species being their favorite fish to eat from the given water body.

Demographics

In Group 2, 30% of the females were minority compared to 11% of the males. Within the minority category, 17% of fishers were female and 83% were male compared to the white category that was 5% female and 95% male.

A higher percentage of Group 2 females (63%) had completed high school degrees than males (61%), however, a lower percentage of females completed 4-year college degrees (8%) or 2-year college degrees (10%) compared to males (4-yr college: 13%; 2-yr college: 14%). Fifteen percent of female fishers reported not having an education degree compared with 10% of males (Table 34).

Table 34. Number and percentage of females and males that reported a given educational status.

Educational Degree	**Females**		**Males**	
	Count	**%**	**Count**	**%**
4-yr college	5	8%	113	13%
2-yr college	6	10%	118	14%
High School	38	63%	615	61%
No Degree	9	15%	83	10%
Refused	2	3%	14	2%

A lower percentage of Group 2 female fishers (33%) reported having full-time employment, compared to 55% of male fishers. The percentage of female fishers (23%) reporting being unemployed was 2.5 times greater than males fishers (9%) (Table 35).

Species of fish consumed were categorized into four groups and described on page 24 and 25 of this report. For males, 35% were *Walleye Only* consumers, 31% were *Walleye and Perch or Perch Only* consumers, 16% were *Other Pelagic* consumers, and 18% were *Benthic* consumers. For females, 9% were *Walleye Only* consumers, 15% were *Walleye and Perch or Perch Only* consumers, 30% were *Other Pelagic* consumers, and 45% were *Benthic* consumers (Table 36).

Table 35. Number and percentage of females and males reporting employment status.

Employment Status	**Female**		**Male**	
	Count	**%**	**Count**	**%**
Full-time	20	33%	467	55%
Part-time	8	13%	38	5%
Self-employed	3	5%	60	7%
Stay at Home Parent	4	7%	2	0%
Student	1	2%	18	2%
Retired	9	15%	172	20%
Unemployed	14	23%	74	9%
Refused	1	2%	12	1%

Table 36. Number and percentage of females and males reported by fish species category consumption.

Fish Species	**Male**		**Female**	
Category Consumed	**Count**	**%**	**Count**	**%**
Walleye Only	206	35%	3	9%
WP/P	179	31%	5	15%
Other Pelagic	92	16%	10	30%
Benthic	106	18%	15	45%

Race

Questions 1, 2, 2a, 2b, 4, 5, 11, 11a, 13, 25, and 26 were evaluated with race as an independent variable. Race was split into two categories. One category was “White”, which included all individuals that selected that response in question 21 and did not select or provide any other responses to question 21 or 22. All other participants were grouped into the second category entitled “Minority”. The “Minority” category included people who selected responses other than white from questions 21 or 22. As reported above in Question 21/22, Group 2 had 110 in the Minority category and 786 in the White category

with 11 individuals who did not provide a response. Group 3 had 74 in the Minority category and 551 in the White category with nine individuals who did not provide a response with regards to race.

Awareness and use of the Michigan Fish Consumption Advisory

Results from question 1 show that 88% of the White category reported being aware of the existence of the Michigan Fish Consumption Advisory compared with 52% of the Minority category (Table 37). Of those that were aware of the existence of the fish consumption advisory, 48% of the White category reported not using the fish consumption advisory compared to 58% for Minority category (question 2) (Table 38). The way the fish advisory was used was relatively similar between the race categories (question 2a:1-3) (Tables 39-41). When asked if they would use the advisory if they had a copy of it (question 2b), 47% of the Minority category said "yes" or "uncertain", 22% said "no", and 31% did not give a response, whereas, 29% of the White category said "yes" or "uncertain", 53% said "no", and 18% did not give a response (Table 42).

Table 37. Responses reported by race for question 1.

	Race				
Response	**White**		**Minority**		**No Race Provided**
	Count	**%**	**Count**	**%**	**Count**
Yes	693	88%	57	52%	9
No	92	12%	53	48%	2
No Response	1	0%	0	0%	0

Table 38. Responses reported by race for question 2.

	Race				
Response	**White**		**Minority**		**No Race Provided**
	Count	**%**	**Count**	**%**	**Count**
Yes	352	51%	22	39%	5
No	332	48%	33	58%	4
No Response	9	1%	2	4%	0

Table 39. Responses reported by race for question 2a-1.

Response	Race				
	White		Minority		No Race Provided
	Count	%	Count	%	Count
Yes	185	78%	12	64%	2
No	146	17%	8	27%	2
No Response	21	5%	2	9%	1

Table 40. Responses reported by race for question 2a-2.

Response	Race				
	White		Minority		No Race Provided
	Count	%	Count	%	Count
Yes	232	66%	15	68%	3
No	101	29%	5	23%	1
No Response	19	5%	2	9%	1

Table 41. Responses reported by race for question 2a-3.

Response	Race				
	White		Minority		No Race Provided
	Count	%	Count	%	Count
Yes	185	53%	12	55%	2
No	146	41%	8	36%	2
No Response	21	6%	2	9%	1

Table 42. Responses reported by race for question 2b.

Response	Race				
	White		Minority		No Race Provided
	Count	%	Count	%	Count
Yes	42	13%	8	25%	0
No	175	53%	7	22%	2
Undecided	54	16%	7	22%	0
No Response	61	18%	10	31%	2

Fish consumption patterns from the water body being fished at the time of the interview

The percentage of individuals reporting previous fish consumption from the water body being fished at the time of the interview (question 4) was 70% for the White category and 66% for the Minority category (Table 43). Greater than half the respondents in the White category reported fishing the given river during January through May, where as less than half the respondents reported fishing the given river from June through December. For the given river, April through September were the months most commonly reported as being fished by the Minority category (Figure 4). Typical meal consumption ranged from <1 to 20 meals per month for both the White and Minority categories (Figure 5). In the White category, 33% of respondents reported no typical fish consumption amount; although they did report previously eating fish from the given water body in question 4 (Figure 5). In the Minority category, 50% of respondents reported no typical fish consumption amount; although they did report previously eating fish from the given water body in question 4 (Figure 5).

As described previously in question 1, species of fish consumption was grouped into four categories:

1. Walleye Only [Walleye]: People that reported only eating walleye.
2. Walleye and Perch or Perch Only [WP/P]: People that reported eating walleye and perch or perch only.
3. Other Pelagic: People that reported eating other fish species that feed in the water column and not directly from the sediment (All species listed in Table 16 under pelagic species) and can include walleye and perch consumption.
4. Benthic: People that reported eating fish that feed from the sediments at the bottom of the water body (i.e., catfish, carp, freshwater drum, suckers, bullheads) and can include consumption of pelagic species.

Combining the *walleye only* group with the *walleye and perch or perch only* group resulted in 72% of the White category fishers reporting only eating these fish species. Fifteen percent of White category fishers reported including *other pelagic* species but not benthic species, with 14% of the White category reporting eating benthic species (Table 43). Ten pelagic species in addition to walleye and perch were reported by the White category (Figure 6). Catfish (7%) and suckers (7%) were the primary benthic fish consumed by the White category (Figure 7). In the Minority category, combining the *walleye only* and *walleye and perch or perch only* groups results in 12% of the fishers reporting only eating these fish species. Twenty-four percent of Minority category fishers reported including *other pelagic* species but not benthic species, with 64% of the Minority category reporting eating benthic species (Table 44). Nine pelagic species in addition to walleye and perch were reported by the Minority category (Figure 6). Catfish (62%), freshwater drum (10%), and carp (7%) were the primary benthic fish consumed by the Minority category (Figure 7).

Table 43. Responses reported by race for question 4.

	White		Minority		No Race Provided	
	Count	**%**	**Count**	**%**	**Count**	**%**
Yes	551	70%	71	66%	12	86%
No	235	30%	35	33%	2	14%
No Response	0	0%	1	1%	0	0%

Table 44. Responses reported by race for fish species category consumed.

Species Category	**Responses**					
	White		**Minority**		**No Race Provided**	
	Count	**%**	**Count**	**%**	**Count**	**%**
Walleye Only	204	38%	6	9%	2	29%
WP/P	182	34%	2	3%	2	29%
Other Pelagic	82	15%	17	24%	1	14%
Benthic	74	14%	45	64%	2	29%

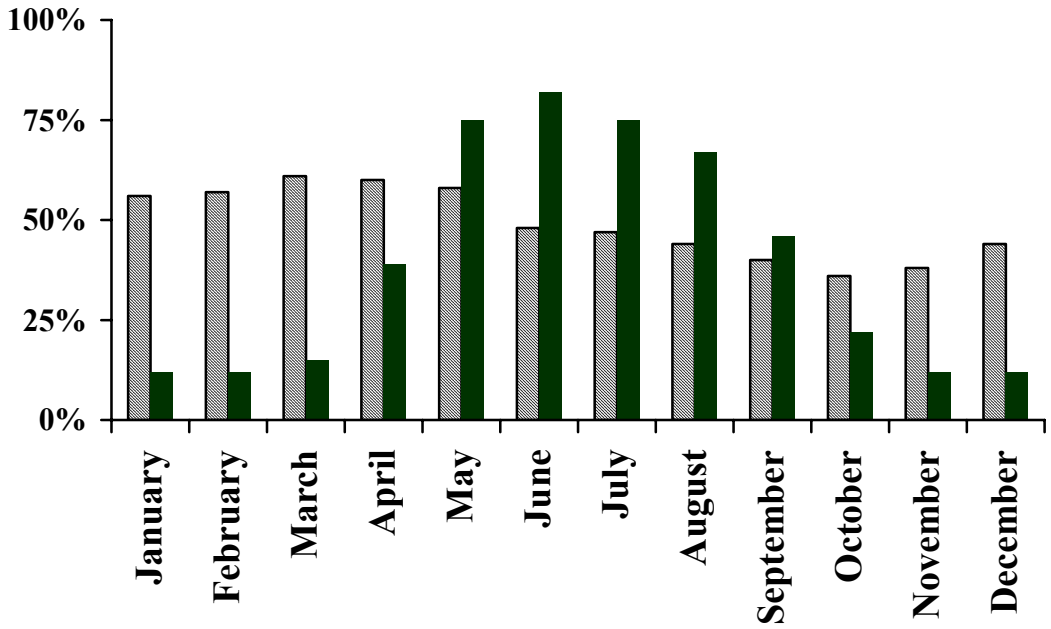


Figure 4. Percentage of white (striped bars) or minority (solid bars) respondents reporting the months they fish the water body about which they were interviewed.

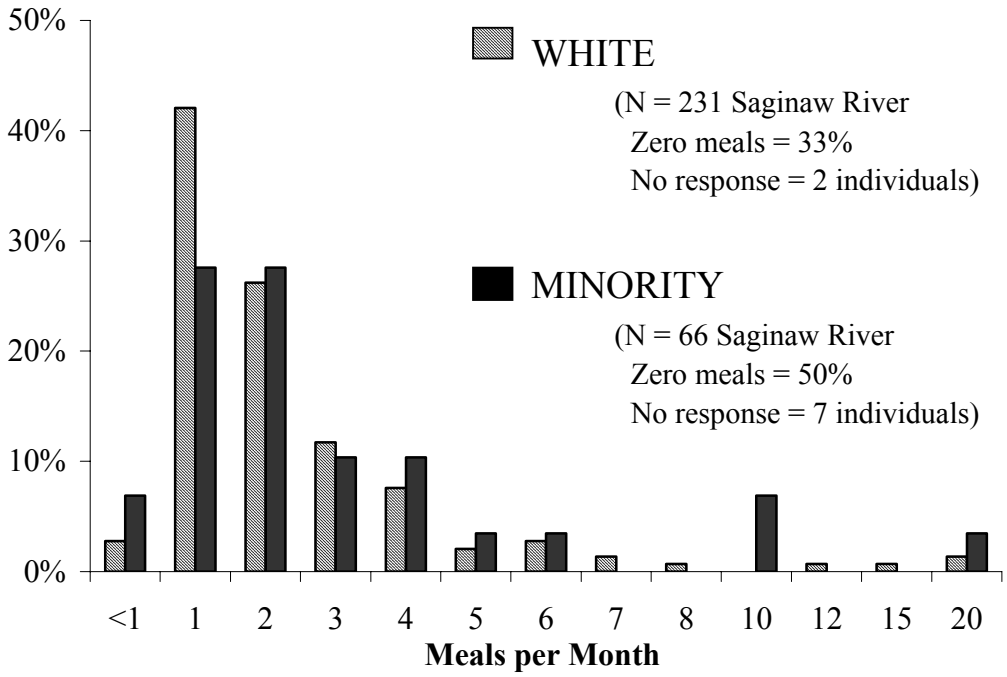


Figure 5. Percentage of white or minority respondents reporting their typical number of fish meals eaten per month from the water body they were fishing at time of the interview.

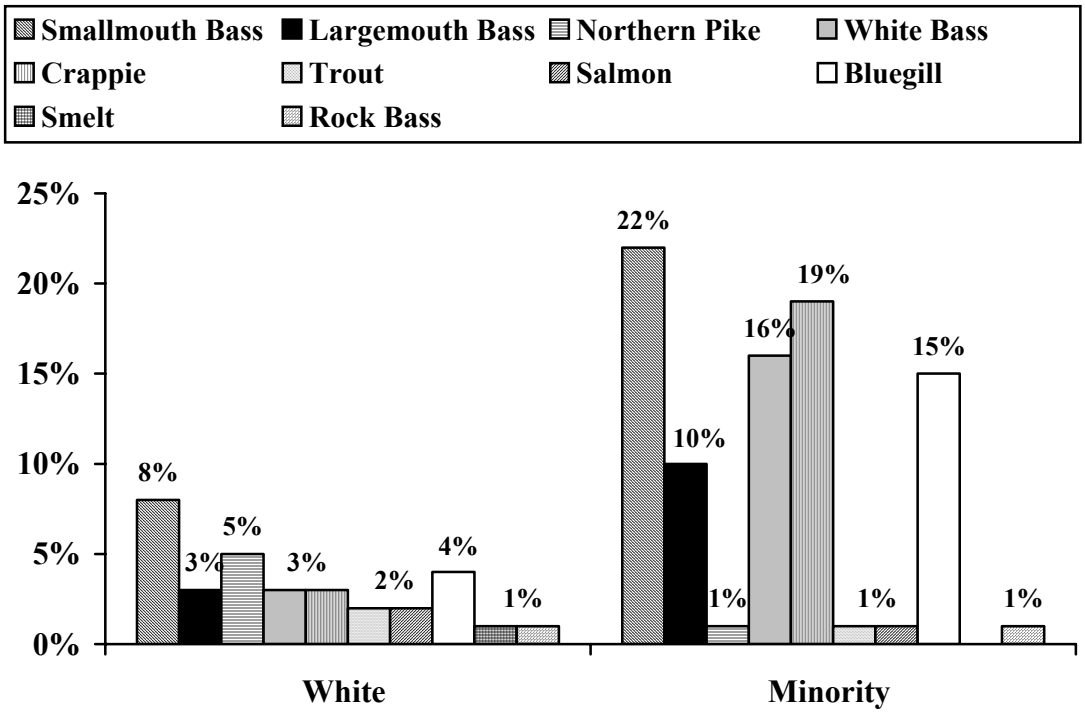


Figure 6. Percentage of white or minority respondents that have eaten a specific pelagic fish species from the water body being fished at time of the interview.

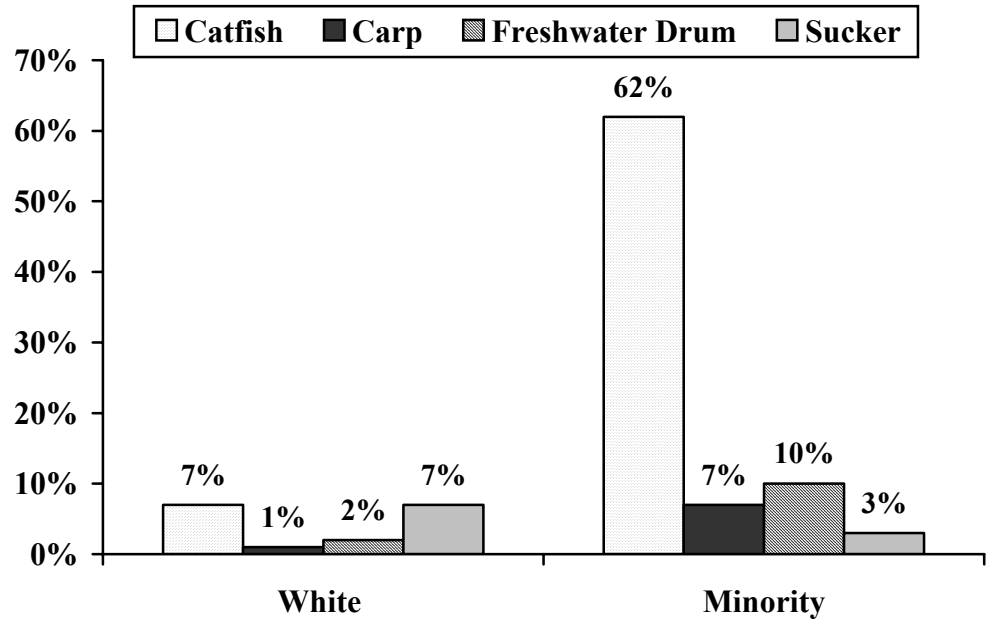


Figure 7. Percentage of white or minority respondents that have eaten a specific benthic fish species from the water body being fished at time of the interview.

Demographics

For highest educational degree acquired, White category fishers reported 14% with a 4-year college degree, 14% with a 2-yr college degree, 63% with a high school degree, and 9% with no degree. Minority category fishers reported 6% with a 4-year college degree, 16% with a 2-yr college degree, 60% with a high school degree, and 18% with no degree (Table 45).

The employment status reported by White category fishers was 57% full-time employment, 35% less than full-time employment, and 8% unemployment. Minority category fishers reported 38% full-time employment, 42% less than full-time employment, and 20% unemployment (Table 46).

Table 45. Highest educational degree acquired reported by race.

Educational Degree	White	Minority
College 4-year	14%	6%
College 2-year	14%	16%
High School	63%	60%
No Degree	9%	18%

Table 46. Employment status reported by race.

Employment Status	White	Minority
Full-Time	57%	38%
Less than Full-Time	35%	42%
Unemployed	8%	20%

Fishing Technique

For this study, "fishing technique" was defined as fishing from a boat, fishing while sitting on the frozen water body (i.e. ice fishing), and fishing from land (e.g. river bank). Questions 1, 2, 4, 14, 25, and 26 were evaluated with fishing technique as an independent variable.

Awareness and use of the Michigan Fish Consumption Advisory

Results from question 1 show that 92% of boat fishers, 90% of ice fishers, and 76% of land fishers as being aware of the existence of the Michigan Fish Consumption Advisory (Table 47). Of those that were aware of the existence of the fish consumption advisory, 46% of boat fishers, 55% of ice fishers, and 49% of land fishers reported not using the fish consumption advisory (question 2) (Table 48).

Table 47. Responses to question 1 reported by fishing technique.

	Boat		Ice		Land	
	Count	**%**	**Count**	**%**	**Count**	**%**
No	29	8%	13	10%	98	23%
Yes	319	92%	113	90%	320	76%
No Response	0	0%	0	0%	1	0%

Table 48. Responses to question 2 reported by fishing technique.

	Boat		Ice		Land	
	Count	**%**	**Count**	**%**	**Count**	**%**
No	146	46%	62	55%	158	49%
Yes	168	53%	49	43%	158	49%
No Response	5	2%	2	2%	4	1%

Fish consumption patterns from the water body being fished at the time of the interview

The percentage of individuals reporting previous fish consumption from the water body being fished at the time of the interview (question 4) was 84% for boat fishers, 94% for ice fishers, and 51% for land fishers (Table 49). Favorite species of fish eaten by boat fishers were walleye (62%) and perch (24%); by ice fishers were walleye (49%), perch (38%), and trout/salmon (7%); and by land fishers were walleye (32%), catfish (16%), perch (15%), suckers (9%), bass (8%) and white bass (4%) (Table 50).

Table 49. Responses to question 4 reported by fishing technique.

	Boat		Ice		Land	
	Count	**%**	**Count**	**%**	**Count**	**%**
No	56	16%	7	6%	203	48%
Yes	292	84%	119	94%	215	51%
No Response	0	0%	0	0%	1	0%

Table 50. Responses to question 14 reported by fishing technique.

Boat		Ice		Land	
Count	**Species**	**Count**	**Species**	**Count**	**Species**
278	Walleye	112	Walleye	117	Walleye
106	Perch	87	Perch	58	Catfish
10	Northern Pike	16	Trout/Salmon	57	Perch
10	Smallmouth Bass	5	Crappie	32	Suckers
8	Bluegill	2	Northern Pike	28	Bass
7	Bass	2	Smelt	16	White bass
7	Catfish	1	Whitefish	12	Bluegill
7	Trout/Salmon	1	Bluegill	10	Crappie
4	Crappie	1	Smallmouth Bass	8	Northern Pike
3	Largemouth Bass			7	Smallmouth Bass
3	Suckers			6	Sheephead
3	White Bass			5	Rock Bass
1	Sheephead			4	Carp
1	Carp			4	Sunfish
1	Smelt			2	Largemouth Bass
				2	Trout/Salmon
				1	Steelhead

Demographics

For highest educational degree acquired, boat fishers reported 20% with a 4-year college degree, 13% with a 2-yr college degree, 61% with a high school degree, and 5% with no degree. Ice fishers reported 9% with a 4-year college degree, 15% with a 2-yr college degree, 66% with a high school degree, and 7% with no degree. Land fishers reported 9% with a 4-year college degree, 14% with a 2-yr college degree, 60% with a high school degree, and 15% with no degree (Table 51).

The employment status reported by boat fishers was 61% full-time employment, 32% less than full-time employment, and 6% unemployment. Employment status for ice fishers was 56% full-time employment, 33% less than full-time employment, and 10% unemployment. Employment status for land fishers was 47% full-time employment, 37% less than full-time employment, and 13% unemployment (Table 52).

Table 51. Responses to question 25 reported by fishing technique.

Educational	Boat		Ice		Land	
Degree	Count	%	Count	%	Count	%
4-Year College	68	20%	11	9%	37	9%
2-Year College	44	13%	19	15%	59	14%
High School	212	61%	83	66%	250	60%
No Degree	18	5%	9	7%	63	15%
No Response	6	2%	4	3%	10	2%

Table 52. Responses to question 26 reported by fishing technique.

Employment	Boat		Ice		Land	
Status	Count	%	Count	%	Count	%
Full-Time	212	61%	70	56%	199	47%
Less than Full-Time	110	32%	41	33%	156	37%
Unemployed	20	6%	12	10%	56	13%
No Response	6	2%	3	2%	8	2%

Fish Species Category

For this study, "fish species category" was defined based on the type(s) of fish consumed by respondents from the given water body they were fishing at the time of the interview (Group 3, N=634). The fish species categories were:

1. Walleye Only [Walleye]: Fishers that reported only eating walleye.
2. Walleye and Perch or Perch Only [WP/P]: Fishers that reported eating walleye and perch or perch only.
3. Other Pelagic: Fishers that reported eating other fish species that feed in the water column and not directly from the sediment (All species listed in Table 16 under pelagic species) and can include walleye and perch consumption.
4. Benthic: Fishers that reported eating fish that feed from the sediments at the bottom of the water body (i.e, catfish, carp, freshwater drum, suckers, bullheads) and can include consumption of pelagic species.

Questions 1, 2, 2b, 21, 22, 25, and 26 were evaluated with fishing technique as an independent variable.

Awareness and use of the Michigan Fish Consumption Advisory

Results from question 1 show 91% of *Walleye Only* consumers, 89% of *Walleye and Perch or Perch Only* consumers, 85% of *Other Pelagic* consumers, and 75% of *Benthic* consumers as being aware of the existence of the Michigan Fish Consumption Advisory (Table 53). Of those that were aware of the existence of the fish consumption advisory, 47% of *Walleye Only* consumers, 55% of *Walleye and Perch or Perch Only* consumers, 47% of *Other Pelagic* consumers, and 41% of *Benthic* consumers reported not using the fish consumption advisory (question 2) (Table 54). Of those are not currently using the fish consumption advisory, 52% of *Walleye Only* consumers, 55% of *Walleye and Perch or Perch Only* consumers, 32% of *Other Pelagic* consumers, and 22% of *Benthic* consumers reported that it would not be likely they would use the fish consumption advisory if it were readily available to them (question 2b) (Table 55).

Table 53. Responses to question 1 reported by fish species category consumed.

	Walleye		**WP/P**		**Other Pelagic**		**Benthic**	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
No	18	8%	20	11%	15	15%	29	24%
Yes	193	91%	165	89%	86	85%	92	75%
No Response	1	0%	0	0%	0	0%	1	1%

Table 54. Responses to question 2 reported by fish species category consumed.

	Walleye		**WP/P**		**Other Pelagic**		**Benthic**	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
No	90	47%	47	55%	75	47%	38	41%
Yes	101	52%	38	44%	85	53%	49	53%
No Response	2	1%	1	1%	0	0%	5	5%

Table 55. Responses to question 2b reported by fish species category consumed.

	Walleye		**WP/P**		**Other Pelagic**		**Benthic**	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
No	56	52%	55	55%	20	32%	15	22%
Yes/Undecided	25	23%	25	25%	20	32%	20	30%
No Response	27	25%	20	20%	22	35%	32	48%

Demographics

For highest educational degree acquired, *Walleye Only* consumers reported 18% with a 4-year college degree, 16% with a 2-yr college degree, 58% with a high school degree, and 6% with no degree. *Walleye and Perch or Perch Only* consumers reported 12% with a 4-year college degree, 14% with a 2-yr college degree, 65% with a high school degree, and

9% with no degree. *Other Pelagic* consumers reported 11% with a 4-year college degree, 13% with a 2-yr college degree, 65% with a high school degree, and 10% with no degree. *Benthic* consumers reported 7% with a 4-year college degree, 11% with a 2-yr college degree, 60% with a high school degree, and 18% with no degree (Figure 8).

The employment status reported by *Walleye Only* consumers was 66% full-time employment, 14% partial employment, 14% retired, and 4% unemployment. Employment status for *Walleye and Perch or Perch Only* consumers was 51% full-time employment, 14% partial employment, 25% retired, and 10% unemployment. Employment status for *Other Pelagic* consumers was 47% full-time employment, 17% partial employment, 28% retired, and 7% unemployment. Employment status for *Benthic* consumers was 45% full-time employment, 13% partial employment, 24% retired, and 17% unemployment (Figure 9).

Racial category differences existed within each fish species consumption category. *Walleye Only* consumers were 97% in the White category and 3% in the Minority category. *Walleye and Perch or Perch Only* consumers were 99% in the White category and 1% in the Minority category. *Other Pelagic* consumers were 83% in the White category and 17% in the Minority category. *Benthic* consumers were 62% in the White category and 38% in the Minority category (Table 56).

Gender differences existed within each fish species consumption category. *Walleye Only* consumers were 99% male and 1% female. *Walleye and Perch or Perch Only* consumers were 97% male and 3% female. Other Pelagic consumers were 90% male and 10% female. *Benthic* consumers were 88% male and 12% female (Table 57).

Table 56. Responses to questions 21&22 reported by fish species category consumed.

	Walleye Only		**WP/P**		**Other Pelagic**		**Benthic**	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
White	204	97%	182	99%	82	83%	74	62%
Minority	6	3%	2	1%	17	17%	45	38%

Table 57. Responses to questions 20 reported by fish species category consumed.

	Walleye Only		**WP/P**		**Other Pelagic**		**Benthic**	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Male	206	99%	179	97%	92	90%	106	88%
Female	3	1%	5	3%	10	10%	15	12%

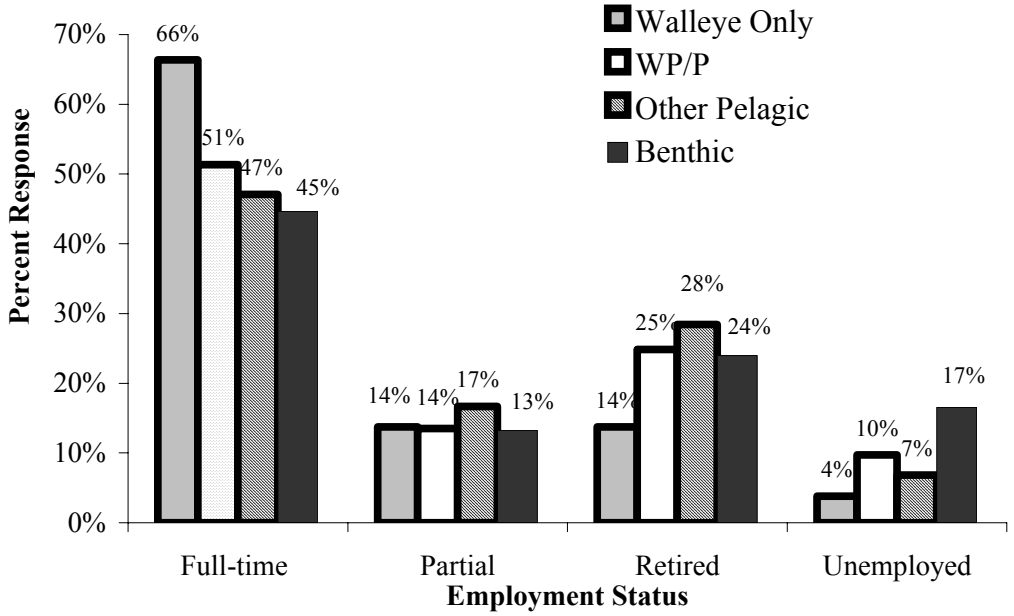


Figure 8. Employment status percentage for each fish species consumption category.

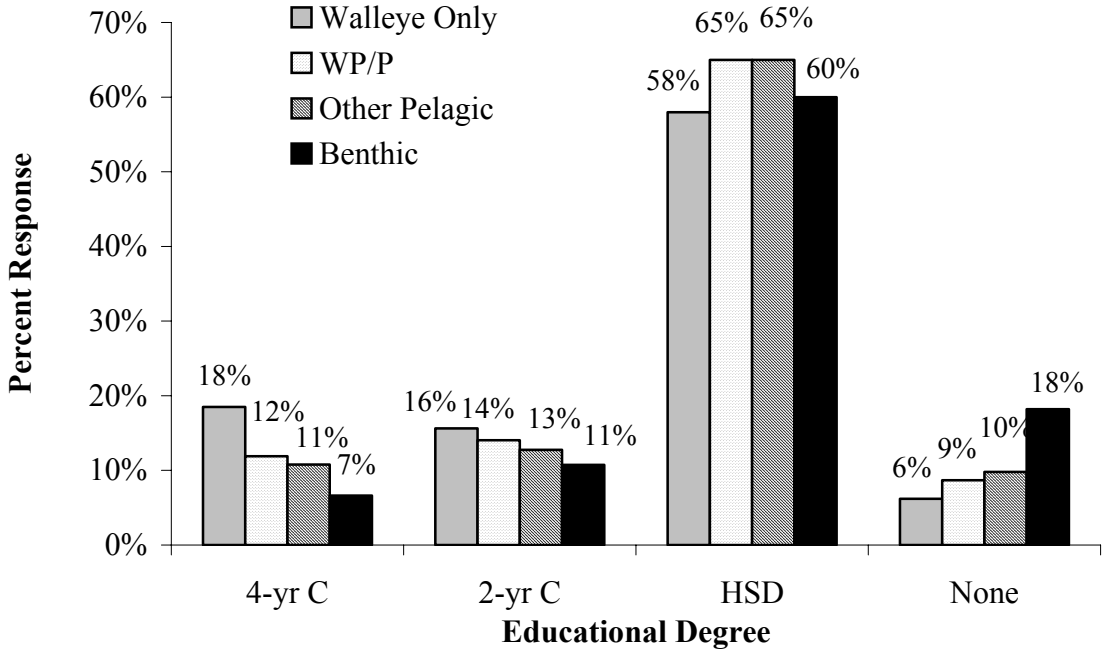


Figure 9. Percentage of respondents within each fish species consumption category reporting a given educational degree attained.

DISCUSSION

This study surveyed fishers from the Saginaw Bay Watershed (SBW) to determine their awareness and use of the Michigan Fish Consumption Advisory and their fish consumption patterns for the purpose of improving the delivery of the fish consumption message.

Awareness and use of the Michigan fish consumption advisory

The vast majority of fishers interviewed were white (87%) and/or male (93%). The highest level of awareness regarding the existence of the Michigan fish consumption advisory was among individuals categorized as males, white, walleye only fish eaters, or boat-based fishers. Individuals who were categorized as either female, minority, benthic fish eaters, or land-based fishers were more likely to not be aware of the existence of the Michigan fish consumption advisory. Additionally, individuals under the age of 30 years old were less aware about Michigan fish consumption advisory. For those who were aware of the fish consumption advisory, approximately half of those individuals attempted to use the fish consumption advisory; and half-again of those may have been close to using it to the fullest possible extent. Those categorized as either female, minority, benthic fish eaters, or land-based fishers were slightly more open to the idea of using the fish consumption advisory compared to males, white, walleye only fish eaters, or boat-based fishers, respectively. The most common informational sources cited for their awareness about the fish consumption advisory were the Michigan DNR fishing guide, local television, and local newspapers.

Fishing and fish consumption patterns in the Saginaw Bay Watershed

Seasonal Fishing

Fishing activity on the Saginaw Bay and River occurred equally all year long, whereas, fishing activity on the Tittabawassee and Shiawassee/Bad Rivers was greatest in the spring and summer. Fishing activity on the Tittabawassee River was dominated by walleye fishing in May. The Saginaw Bay and River had significant walleye and perch fishing activity, however, a broad range of fish species were caught and eaten from these waters. Shiawassee/Bad Rivers fishing activity were dominated by sucker fishing in April, but also included a broad range of species being caught and eaten. As a group, the White category reported equal fishing activity for the entire year. The Minority category reported highest fishing activity between April and September.

Home Residence of Fishers

Most fishers lived within the counties closest to the water bodies in this study. Based on this study, 82% of participants resided in one of six counties in the SBW, with Saginaw and Bay counties contributing 62% of the total participants. Approximately 90% of participants were from counties that are either completely or partially within the SBW. When participants were asked what water bodies they fish in the SBW, the Saginaw Bay, Saginaw River, and Tittabawassee River comprised 60% of the responses. Based on these results, one can conclude that almost everyone fishing and eating fish from these local

water bodies live within the SBW. Most minority fishers were interviewed while they were fishing the Saginaw River or the confluence of the Tittabawassee, Shiawassee, and Saginaw Rivers.

Species Consumption

To understand the potential health implication of species consumption in relation to the Michigan fish consumption advisory, it is necessary to have a general understanding of the differences in chemical contamination between species and water bodies. At a minimum, chemical contamination varies between fish species and water bodies in the SBW. Of the water bodies included in this study, the Saginaw River, Saginaw Bay, and Tittabawassee River had the greatest number of fish consumption advisories. The segment of the Shiawassee River in this study has a minimal number of fish consumption advisories, however, the Bad River does have some significant restrictions on the consumption of catfish by women and children. Based on chemical analyses of carp and catfish tissue, benthic fish were most likely to have the highest concentrations of unwanted chemicals. Pelagic species vary widely in chemical tissue concentrations in these waters, with walleye and perch on average having lower tissue concentrations and white bass and smallmouth bass on average having higher concentrations. Several other pelagic species either have never been analyzed for chemical contamination or have not been analyzed within the past decade.

Individuals most likely to eat the fish they caught from the water body they were fishing at the time of the interview were people fishing the Saginaw Bay or fishing from boats or on ice. Males were more likely to report eating the fish they caught compared to females. Race did not appear to make a difference in the likelihood of eating the harvested fish.

The most consumed fish reported in this study from the Saginaw Bay, Saginaw River, and Tittabawassee River were walleye. Walleye are generally low in chemical contamination and can be consumed in accordance to the recommendations found in Michigan's fish consumption advisory. Besides walleye, perch were the second most commonly consumed fish from the Saginaw Bay and River, whereas, smallmouth bass were the second most commonly consumed fish from the Tittabawassee River. Between 14 to 21% of fishers included pelagic fish species beyond walleye and perch in their diets. An additional 3 to 23% of fishers included benthic fish consumption from these water bodies (Saginaw Bay, Saginaw River, and Tittabawassee River) in their diets. Based on the combined percentage of fishers consuming species other than walleye and perch, the Saginaw River (40% of fishers) had the greatest percentage of fishers eating a mixed diet of fish species. The Tittabawassee River (30% of fishers) was second followed by the Saginaw Bay (17%).

The segment of the Shiawassee River in this study, along with its confluence with the Bad River, has a fishing population that is mainly selecting species other than walleye and perch. Fishers form these rivers were primarily selecting benthic fish (88%), specifically suckers. The high percentage of sucker consumption in this study likely was in part due to the narrow time frame the survey was conducted on the Shiawassee/Bad Rivers. The survey of these rivers occurred during the peak sucker fishing season.

Frequency of Fish Meals
Two estimates of average monthly fish consumption and one estimate of maximum monthly fish consumption were reported in this study. The first average monthly fish consumption estimate was for consumption from the river respondents were fishing at the time of the interview. The second average monthly fish consumption estimate was for consumption from other sources (i.e., other local water bodies or purchased fish) not including the river they were fishing at the time of the interview. For the average monthly fish consumption from the water body being fished at the time of the interview, 87% of the responses were within 0.5 - 4 meals per month. For 0.5 - 8 meals per month and 0.5 - 12 meals per month the percentages increased to 96% and 98%, respectively. For the average monthly fish consumption from other sources, 86% of responses were within 0.5 - 4 meals per month. For 0.5 - 8 meals per month and 0.5 - 12 meals per month the percentages increased to 94% and 98%, respectively. For the reported maximum meal consumption within one month, 67% of responses were from 0.5 - 4 meals per month. For 0.5 - 8 meals per month and 0.5 - 12 meals per month the percentages increased to 87% and 96%, respectively.

Frequency of consumption was similar between the White and Minority categories (Figure 5). The range of average fish meals per month from the given water being fished at the time of the interview was <1 to 20 meals per month for both categories.

Across all water bodies, a large percentage (79-85%) of fish consumers in this study reported that their fish consumption was the same as their families' fish consumption. In this study, Group 3 fish consumers reported 824 adult males, 643 adult females, and 422 children under the age of 15 having the same consumption to the individuals interviewed.

Reports of Tainting
During the 1970s and 1980s, reports of "tainted" fish from the Saginaw and Tittabawassee Rivers and Saginaw Bay were common. Historical complaints of tainted fish were about odd tastes or odors. The Shiawassee/Bad River was not thought to have this problem. This study asked Group 3 respondents if they had ever noticed odd tastes or odors when eating the fish. Over 85% or Group 3 respondents reported never experiencing odd tastes or odors when eating the fish from the given river. Responses were similar between all four rivers, demonstrating that the odd odors and/or tastes related to chemical contamination is far less currently than three decades ago. In addition, these results are suggestive that the issue of odd tastes and odors from chemical contamination no longer exist.

Health Education Needs

The purpose of this study was to identify variables within the Saginaw Bay Watershed sport fish-consuming population that would allow for the delivery of fish consumption advisory information to those with the least knowledge and the greatest consumption of fish species that exceed the advisory limits. Variables identified in this study related to

less knowledge or consumption that likely exceeds the advisory limits were gender, race, fishing technique, fish species consumed, age, educational background, and employment status. Based on these variables the following populations should be considered for targeted fish consumption advisory educational activities:

1. Minorities that have a person in their family that fishes the SBW.
2. Females that have a person in their family that fishes the SBW.
3. SBW fishers under the age of 30 years.
4. Land-based fishers of the SBW.
5. SBW fishers that included benthic fish species in their diets.
6. SBW fishers that included pelagic fish beyond walleye and perch in their diet.
7. SBW fishers that have lesser educational backgrounds or that are not employed at a full time status.

CONCLUSIONS

Fish consumption from local water bodies in the Saginaw Bay Watershed is very common. Certain individuals consuming locally caught fish are clearly eating fish species from contaminated water bodies that the Michigan Department of Community Health (MDCH) advises that no person should consume. Furthermore, the results of this study are suggestive that the frequency of consumption by some groups of individuals consuming local caught fish of a mixture of fish species from contaminated waters is greater than MDCH would advise. MDCH concludes from this study that the chemical exposure pathway from contaminated water bodies to the fish consuming population via local fish consumption still exists. MDCH further concludes that some individuals consuming locally caught fish are likely receiving chemical doses that cannot be categorized as representing minimal risk. Further health education and evaluation of this population are necessary.

ADDITIONAL INFORMATION NEEDS

Determination of Chemical Exposures

1. Generate estimates of dioxin-like chemical exposure and measurements of dioxin-like chemical concentrations in the blood of people frequently consuming fish from the Tittabawassee River, Saginaw River, and Saginaw Bay in relation to the quantities and species of fish they consume, with particular attention to people consuming highly contaminated species such as catfish, carp, and white bass.

2. Evaluate locally used fish trimming and cooking methods and the extent that those methods remove chemical contaminants from the edible fish tissue and prevent exposure.

Communication with sub-populations of local fish consumers

1. Develop a better understanding of the fish consumption patterns and fish preparation practices of the minority communities (e.g., Hispanic-American, African-American, Native American, Asian-American) within the Saginaw Bay Watershed.

2. Continue to develop local networks of people and organizations that are known in the community and are interested in collaboration on promoting a better understanding of the public health measures that can be undertaken by community members to limit their chemical exposure when consuming locally caught fish.

3. Once a better understanding of minority community fish consumption practices are obtained, materials should be created and distributed and community activities undertaken that communicate how to limit exposure to the chemicals in local fish that does not conflict with current local ethnic and cultural practices.

Appendix A: Quality Assurance

Notes on Logic/ Entry Error Handling

1. If a numerical answer was provided for a question that is a sub-part to a trigger question and a logic error exists, preference will be given to the sub-part numerical answer that was written in such a manner, where possible, to preserve data for analysis.

2. If subsequent questions are completed, but the trigger question is left blank, the trigger question is assumed to be completed in such a manner that it logically follows that the subsequent questions would be answered.

3. Question 13, interviewers were instructed to use the value 100% if the person only listed one group of fish (bottom feeders vs predators). On surveys where only fish from one group is checked, 100% is entered as the response.

4. Numerical responses that provide ranges or approximations will be reported as the midpoint value of the range or approximation.

5. For response logic errors that are accurately entered into the database (i.e., no data entry errors, database is the same as survey markings), and the illogical result can be appropriately identified and addressed at the point of analysis, no changes were made to either the database or the survey.

6. All surveys to which were answered "previously interviewed", any subsequent information provided was not entered, with the exception of survey 613 to which a diary was given and explanation provided on survey by interviewer. Note this applies to a total of 3 surveys.

7. All surveys to which "no" was answered to question "B", all subsequent information, except demographics, was not entered into the database. Note this applied to about 8 surveys.

8. Survey 807 was a test survey and should not have been entered into database, to leave in the number 807, such that a number is not missing, the survey was marked as "previously interviewed".

9. Questions 17 and 17a. Double-checked 18 surveys that had blank results for 17a. Checked and corrected entry errors.

10. Time of surveys: 14 surveys were without times. Survey times were re-checked by comparing the original survey to the database entered value for surveys outside the daylight sampling hours. Thus, any data entries prior to 7 am or after 7 pm were rechecked. If the time was listed but "am" or "pm" was not, surveys times were compared between surveys of the team for the same day to confirm the appropriate "am" or "pm" designation. The determined designation was entered into the database.

Appendix A: Quality Control data from fish diaries and surveys.

Age	Sex	Race	MI Resident	County	Fish Consumption Diary			Survey			Difference
					Total Meals	Total Days	Total (A) Meals/Month	WB Interview Meals/Month	Other Sources Meals/Month	Total (B) Meals/Month	(B-A)
52	Male	White	YES	BAY	10	36	8	2	16	18	10
59	Male	Black	YES	Saginaw	8	67	4	3	0	3	-1
53	Male	White	YES	Bay	16	62	8	2	1	3	-5
64	Female	White	YES	Saginaw	17	62	8	6	4	10	2
35	Male	White	YES	Saginaw	8	73	3	1.5	10	12	8
25	Male	White, Black	YES	Saginaw	8	38	6	2	1	3	-3
32	Male	Black	YES	Saginaw	4	44	3	3.5	0	4	1
46	Male	Black	YES	Saginaw	15	66	7	0	0	0	-7
57	Male	White	YES	Midland	6	27	7	3	0	3	-4
62	Male	White	YES	Bay	9	64	4	4	1	5	1
45	Male	White	YES	BAY	6	54	3	1	4	5	2
66	Male	White	YES	BAY	11	29	11	2	4	6	-5
52	Male	White	YES	Bay	7	65	3	3	0	3	0
Blank	Blank	Blank	Blank	Blank	5	47	3	1	0	1	-2
Blank	Male	Black	YES	Oakland	4	66	2	0	2	2	0
62	Male	White	YES	Blank	15	76	6	0	2	2	-4
60	Male	White	YES	Bay	23	56	12	0	5	5	-7
34	Male	White	YES	Tuscola	5	35	4	2	0	2	-2

Appendix B: Survey Instrument and Consent Form

Saginaw, Shiawassee, and Tittabawassee River FISH Consumption Questionnaire

*Interviewers Name(s):*_____ *Fish Diary No:*_____

Date:_____ **Time:**_____

Name of Water: Saginaw River Shiawassee R. Tittabawassee R. Saginaw Bay

Location Along River:_____

OBSERVATIONS:

Was the person: a) ice fishing _____
b) shore line fishing _____
c) boat fishing _____

Length of boat:_____

Style of boat: Flat or V bottom: _____
Bass boat: _____
GL fishing boat _____
Cruiser: _____

BEGIN INTERVIEW

A. Have we interviewed you before with this questionnaire?

YES --------→ END INTERVIEW

NO --------→ CONTINUE TO QUESTION B

B. Do you eat fish from rivers or lakes in the State of Michigan? (Circle)

NO --------→ GO TO b1:

b1. Do you not eat fish from Michigan rivers and lakes due to concerns about chemical pollution?

YES --------→ GO TO SECTION C - DEMOGRAPHICS

NO --------→ GO TO SECTION C - DEMOGRAPHICS

YES --------→ CONTINUE TO QUESTION 1

Section A. Determine Awareness and Use of MI Fish Consumption Advisory

1. Are you aware that the State of Michigan issues fish consumption advisories on some rivers and lakes related to chemical contamination?

NO --------→ GO TO QUESTION 3, GIVE COPY OF FISH ADVISORY

YES --------→ CONTINUE TO QUESTION 1a

1a. If Yes. Where did you hear about these advisories? (check all that apply):

_____Radio
_____Television
_____Local Newspapers
_____Medical doctor
_____Church
_____Friend or Neighbor
_____DNR/ DCH Fishing Guides
_____Local Organization _____
_____Other_____

2. Do you use it? (State of Michigan's fish consumption guide) YES NO

2a. IF YES --------→ How?

a. How often to eat fish. YES NO
b. Selecting species to eat or catch. YES NO
c. Which rivers, lakes or streams to go fishing on. YES NO
d. Other_____

2b. IF NO --------→ Would you use it, if you had a copy easily available?
YES NO UNK

3. What are names of the media outlets you regularly get news from? (For example. Bay City Times, Saginaw News, Radio stations, TV stations etc..)

_____

_____

_____

Section B. Fish Consumption Patterns

4. Do you eat fish from this WB?

YES --------→ CONTINUE TO QUESTION 5.

NO --------→ Please list a reason_____,

THEN GO TO QUESTION 15.

5. Which months of the year do you fish this WB?

____January	____July	
____February	____August	
____March	____September	[Mark all that Apply with ✓]
____April	____October	
____May	____November	
____June	____December	

6. Have you ever noticed any odd smells or tastes in fish harvested from this WB?

NO --------→ GO TO QUESTION 7.

YES --------→ CONTINUE TO 6a.

6a. If yes, how long ago was it that you noticed these odd odors or tastes:

_____ Within the Last Year
_____ Within the Last 5 years
_____ Between 5 and 10 years ago.
_____ Greater than 10 years ago.

6b. If yes, please describe the smell or taste:_____

7. How many fish (any species) from this WB have you **caught** in the past **7 days**?

_____

8. How many meals of fish from this WB have you **eaten** in the past **7 days**?

_____

8a. Does number of meals eaten also apply to people living in your household? YES NO UNK

9. How many fish (any species) from this WB have you **caught** in the past **30 days**?

_____

10. How many meals of fish from this WB have you **eaten** in the past **30 days**?

_____

11. Is this (Q 10) a **typical number** of fish meals you eat per **month** from this WB? YES NO UNK

11a. IF NO, What is a typical (average) number per month? _____

12. In recent years, (past 5 years), what is the **MOST** number of fish meals **in any single month** you have eaten from this WB? _____

13. In recent years (past 5 years), which species have you **eaten** from this WB and what amount (e.g. 5%, 25%, 50%, 100%) of your consumption do the *Sport Fish*

List of Fish by Group	**Fish you have Eaten? (✓ All those that apply)**	**Your percentage of sport vs bottom feeding fish consumption?**
Sport Fish		
Bass-Smallmouth		
Bass-Largemouth		
Bluegill / sunfish		
Crappie		
Northern Pike		
Muskellunge		
Perch		
Smelt		
Walleye		
Whitebass		
Bottom Feeding		
Bullhead		
Carp		
Catfish		
Sheephead (Freshwater Drum)		
Suckers		

versus *Bottom Feeding* fish make up in your fish diet (e.g. 75% sport fish and 25% bottom feeding)?

14. List the top three fish species you **eat** the most from this WB, from greatest to least?

1st _____

2nd _____

3rd _____

ALL TYPES OF FISH CONSUMPTION

15. Have you eaten any other meals of fish **not** from this WB, but from another source including grocery stores or restaurants, in the past **7 days**? YES NO UNK

15a. IF YES, How many fish meals **not** from this WB have you eaten in the past **7 days**?_____

15b. Does this also apply to people living in your household? YES NO UNK

16. Have you eaten any other meals of fish **not** from this WB, but from another source including grocery stores or restaurants, in the past **30 days**? YES NO UNK

16a. IF YES, How many fish meals **not** from this WB have you eaten in the past **30 days**? _____

16b. Does this also apply to people living in your household? YES NO UNK

17. Is this (16a) a **typical number** of fish meals **not** from this WB you eat per **month**?

YES NO UNK

17a. IF NO , What is a typical (average) number per month? _____

FAVORITE WATERBODIES TO FISH

18. What rivers, lakes, or bays in the Saginaw Bay Watershed do you regularly like to fish? (Bring Map to show watershed)

Body of Water	**County**	**Other Locational Information (nearest road)**

C. Demographic Information

19. What is your age? _____

20. What is your gender? _____Female
_____Male
_____ UNK

21. What is your race?
_____White
_____Black, African American
_____American Indian, Alaska Native
_____Asian Indian
_____ Native Hawaiian
_____Filipino Native Hawaiian, Other Pacific Islander
_____ Japanese
_____ Korean
_____ Vietnamese
_____Other race, please list: _____
_____Refused

22. Are you Spanish/ Hispanic/Latino?
_____ No
_____ Yes, Mexican, Mexican American, Chicano
_____ Yes, Puerto Rican
_____ Yes, Cuban
_____ Yes, Other, please list:_____

23. Is your permanent, primary residence in Michigan?
_____ No
_____ Yes, current county of residence_____

24. Number of people living in you home (Fill in numbers):

Males (15 years or older) _____
Females (15 years or older) _____
Children (under 15 years old) _____

25. What is your highest level of education completed?
_____Less than high school
_____High school
_____Some college, no degree currently
_____2-yr college degree
_____4-yr college degree or more

26. What is your current employment status?

_____ Full-time employment
_____ Part-time employment
_____ Self-employed
_____ Stay at home parent
_____ Student
_____ Retired
_____ Unemployed

MICHIGAN DEPARTMENT OF COMMUNITY HEALTH
DIVISION OF ENVIRONMENTAL AND OCCUPATIONAL EPIDEMIOLOGY
LANSING, MICHIGAN

CONSENT TO BE IN SURVEY ABOUT FISH CONSUMPTION PATTERNS

Purpose The Michigan Department of Community Health (MDCH) in cooperation with Saginaw Bay Watershed Initiative Network (WIN) and the Agency for Toxic Substances and Disease Registry (ATSDR) is conducting a survey of people within the Saginaw Bay Watershed to better understand fish consumption patterns. The purpose is to improve the usefulness, accuracy, and clarity of future fish consumption advisories in the Saginaw Bay Watershed.

How were you selected? You have been chosen to complete this survey because you are engaging in activities along the Saginaw, Shiawassee or Tittabawassee Rivers. We are looking for individuals who regularly harvest and consume fish from the Saginaw Bay Watershed.

What We Will Ask You to Do. You are free to answer the survey or not. If you start the survey, you are free to stop at any time. The survey will take less than 20 minutes to complete.

Privacy Your name or other personal identifying information will not be collected with this survey, thus your responses will be anonymous.

What the Survey Will Tell Us

1. General demographics of people consuming fish.
2. The type of fish people like to consume.
3. The amount and frequency with which people consume fish.
4. Are you aware of the state fish consumption advisory.

Compensation There is no compensation for completing this survey.

Contact Person If you have any question about this surveys please contact:

Kory Groetsch, Michigan Department of Community Health
P.O. Box 30195 Lansing, Michigan 48909
Direct: 517-335-9935 or Toll-free: 1-800-648-6942

If you do not understand this project or what we are asking you to do, please ask questions.

Appendix C: Locations of Common Survey Locations

Survey Locations for Shiawassee / Bad River between Chesaning and St. Charles.
Locations described starting in Chesaning then heading north to St. Charles.

Site 30: **Chesaning Dam Park** In Chesaning where Hwy 57 crosses the Shiawassee River just past Front Street. The site starts in the park. The people fish on the north side of the dam. You can walk along the river once the snow melts.

Directions from site 30 to 31, within Chesaning, drive west on Hwy 57 three or four blocks, turn north on Line Street. Line street turns into Sharon Road which follows the Shiawassee River. Turn Right onto Gary Road.

Site 31: Gary Road Bridge. People fish along the banks and the fishers park around the Gary Road Bridge. You should be able to walk along the bank of the river to talk to the fishers. It may be muddy.

Directions from site 31 to site 32. Return to Sharon Road and go north. Turn Right on Marion Road which turns north again (1/4 mile or less) and become Sharon Road again. Turn Right onto Fergus Road.

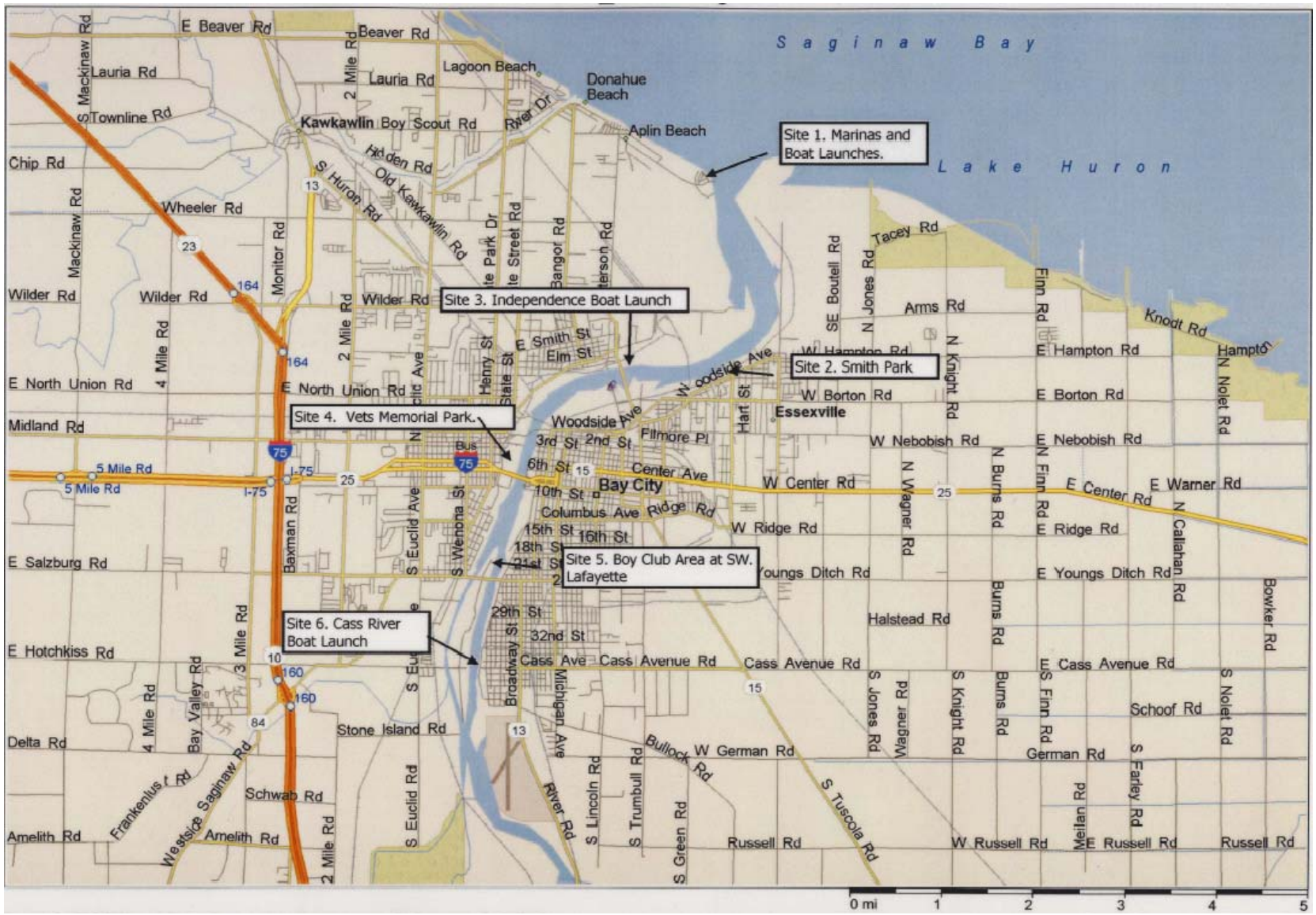
Site 32: Fergus Road Bridge. People fish along the banks and the fishers park around the Fergus Road Bridge. You should be able to walk along the bank of the river to talk to the fishers. It may be muddy.

Directions from site 32 to site 33. Return to Sharon Road and go north. Turn right onto Ryan Road. This road is very rough. If it is wet, do not drive on it because it can be really muddy.

Site 33: Ryan Road. This road can be very muddy, and if it is not dry, it is possible you could get your car stuck in the mud. If you do not see any cars, then nobody is likely to be fishing.

Directions from Site 33 to Site 34. Return to Sharon Road and follow the road north into St. Charles. Take a Right onto Hulien Road. This is a dirt road that goes a mile or more east then turns north on an even narrower road that runs along a culvert. Follow road to the end (1/2 mile to 1mile) to reach an open area where cars will be parked if people are fishing.

Site 34: Hulien Road. Once you reach the open parking area. Go across the bridge and turn left. Walk about 15 minutes and you will reach the fishing area. The river next to the parking area is the Bad River. You can interview people fishing on the Bad River also, You can note on the survey it was on the Bad, I will be grouping the Bad River data with the Shiawassee River.


Saginaw Bay
Lake Huron
Site 1. Marinas and Boat Launches.
Site 2. Smith Park
Site 3. Independence Boat Launch
Site 4. Vets Memorial Park.
Site 5. Boy Club Area at SW. Lafayette
Site 6. Cass River Boat Launch
Bay City
Essexville
E Beaver Rd
Beaver Rd
Lauria Rd
Townline Rd
Kawkawlin Boy Scout Rd
Lagoon Beach
Donahue Beach
Aplin Beach
River Dr
Hidden Rd
Old Kawkawlin Rd
S Huron Rd
Chip Rd
Wheeler Rd
Mackinaw Rd
Monitor Rd
2 Mile Rd
4 Mile Rd
Wilder Rd
E North Union Rd
Midland Rd
5 Mile Rd
I-75
Baxman Rd
E Salzburg Rd
E Hotchkiss Rd
3 Mile Rd
Bay Valley Rd
Stone Island Rd
Delta Rd
Frankenlust Rd
Westside Saginaw Rd
Schwab Rd
Amelith Rd
S Euclid Ave
S Euclid Rd
Henry St
State St
Park Dr
Bangor Rd
Peterson Rd
E Smith St
Elm St
Woodside Ave
W Woodside Ave
Fillmore Pl
3rd St
2nd St
6th St
Center Ave
10th St
Columbus Ave
Ridge Rd
15th St
16th St
18th St
21st St
29th St
32nd St
Cass Ave
Broadway St
Michigan Ave
River Rd
S Wenona St
Hart St
SE Bouteil Rd
N Jones Rd
Tacey Rd
Arms Rd
W Hampton Rd
E Hampton Rd
Knodt Rd
N Knight Rd
W Borton Rd
E Borton Rd
W Nebobish Rd
E Nebobish Rd
N Wagner Rd
N Burns Rd
Finn Rd
E Center Rd
W Center Rd
E Warner Rd
N Callahan Rd
W Ridge Rd
E Ridge Rd
Youngs Ditch Rd
E Youngs Ditch Rd
Halstead Rd
Bowker Rd
Cass Avenue Rd
S Jones Rd
S Knight Rd
S Finn Rd
Schoof Rd
S Nolet Rd
S Farley Rd
W German Rd
German Rd
Bullock Rd
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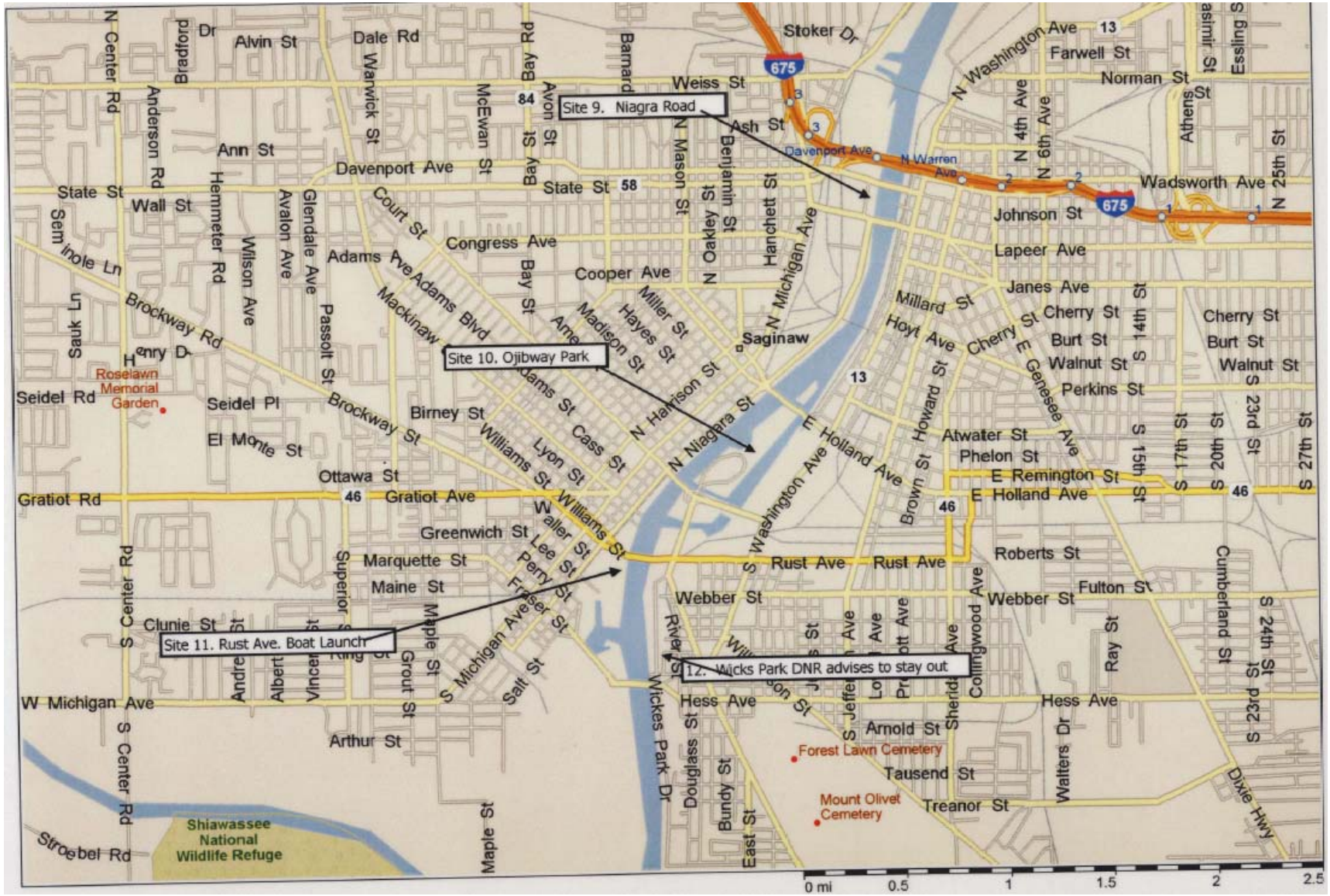
Site 9. Niagra Road
Site 10. Ojibway Park
Site 11. Rust Ave. Boat Launch
12. Wicks Park DNR advises to stay out
Stoker Dr
675
Weiss St
Ash St
Davenport Ave
N Warren Ave
Wadsworth Ave
Johnson St
Lapeer Ave
Janes Ave
Millard St
Cherry St
Burt St
Walnut St
Perkins St
Atwater St
Phelon St
E Remington St
E Holland Ave
Roberts St
Fulton St
Webber St
Rust Ave
Hess Ave
Arnold St
Tausend St
Treanor St
Forest Lawn Cemetery
Mount Olivet Cemetery
Saginaw
N Washington Ave
Farwell St
Norman St
Athens St
Cherry St
Burt St
Walnut St
S 14th St
S 15th St
S 17th St
S 20th St
S 23rd St
S 27th St
Cumberland St
Ray St
Walters Dr
Dixie Hwy
Wickes Park Dr
Douglass St
Bundy St
East St
Maple St
Stroebel Rd
Shiawassee National Wildlife Refuge
W Michigan Ave
Arthur St
Clunie St
Gratiot Rd
Gratiot Ave
Ottawa St
Greenwich St
Marquette St
Maine St
Seidel Rd
Seidel Pl
El Monte St
Roselawn Memorial Garden
Brockway St
Brockway Rd
Birney St
Williams St
Lyon St
Cass St
Adams St
Adams Blvd
Mackinaw
Madison St
Hayes St
Miller St
Cooper Ave
Congress Ave
Court St
Davenport Ave
State St
Wall St
Ann St
Alvin St
Dale Rd
Bradford Dr
N Center Rd
S Center Rd
Anderson Rd
Hemmeter Rd
Wilson Ave
Avalon Ave
Glendale Ave
Passolt St
Warwick St
McEwan St
Bay St
Avon St
Barnard St
N Mason St
N Oakley St
Benjamin St
Hanchett St
N Michigan Ave
N Harrison St
N Niagara St
Howard St
Brown St
Genesee Ave
Washington Ave
Waller St
Lee St
Perry St
Fraser St
Michigan Ave
Salt St
Superior St
Grout St
Maple St
Albert St
Vincent St
Andre St
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Seminole Ln
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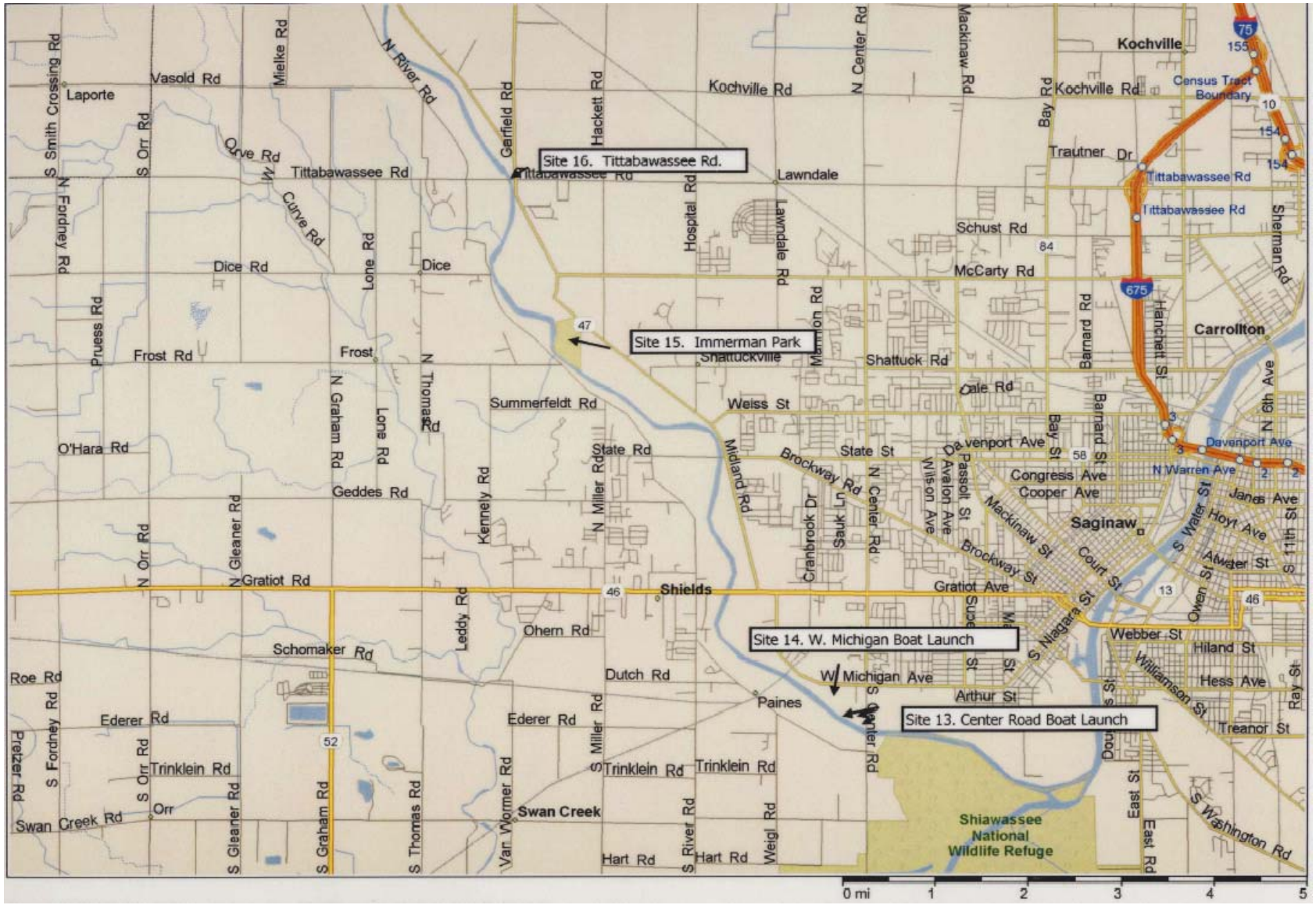
Site 16. Tittabawassee Rd.
Site 15. Immerman Park
Site 14. W. Michigan Boat Launch
Site 13. Center Road Boat Launch
Kochville
Carrollton
Saginaw
Shields
Swan Creek
Shiawassee National Wildlife Refuge
Laporte
Vasold Rd
Tittabawassee Rd
Dice Rd
Frost Rd
O'Hara Rd
Geddes Rd
Gratiot Rd
Schomaker Rd
Roe Rd
Ederer Rd
Trinklein Rd
Swan Creek Rd
Orr
Kochville Rd
Lawndale
Schust Rd
McCarty Rd
Shattuck Rd
Weiss St
Summerfeldt Rd
State Rd
State St
Ohern Rd
Dutch Rd
Paines
Hart Rd
Davenport Ave
Congress Ave
Cooper Ave
Webber St
Hiland St
Hess Ave
Arthur St
Treanor St
W Michigan Ave
Gratiot Ave
Census Tract Boundary
Trautner Dr
Tittabawassee Rd
N River Rd
Garfield Rd
Hackett Rd
N Center Rd
Mackinaw Rd
Bay Rd
Hospital Rd
Lawndale Rd
Mermon Rd
Barnard Rd
Hanchett St
Sherman Rd
N 6th Ave
Janes Ave
Hoyt Ave
Amater St
S 11th St
Ray St
Williamson St
Owen St
S Water St
Mackinaw St
Brockway Rd
Brockway St
Court St
Niagara St
Cranbrook Dr
Sauk Ln
Wilson Ave
Avalon Ave
Passolt St
Midland Rd
N Miller Rd
Kennely Rd
Leddy Rd
Van Wormer Rd
S River Rd
Weigl Rd
East St
East Rd
S Washington Rd
Pretzer Rd
S Fordney Rd
N Fordney Rd
Pruess Rd
S Smith Crossing Rd
Mielke Rd
Curve Rd
Lone Rd
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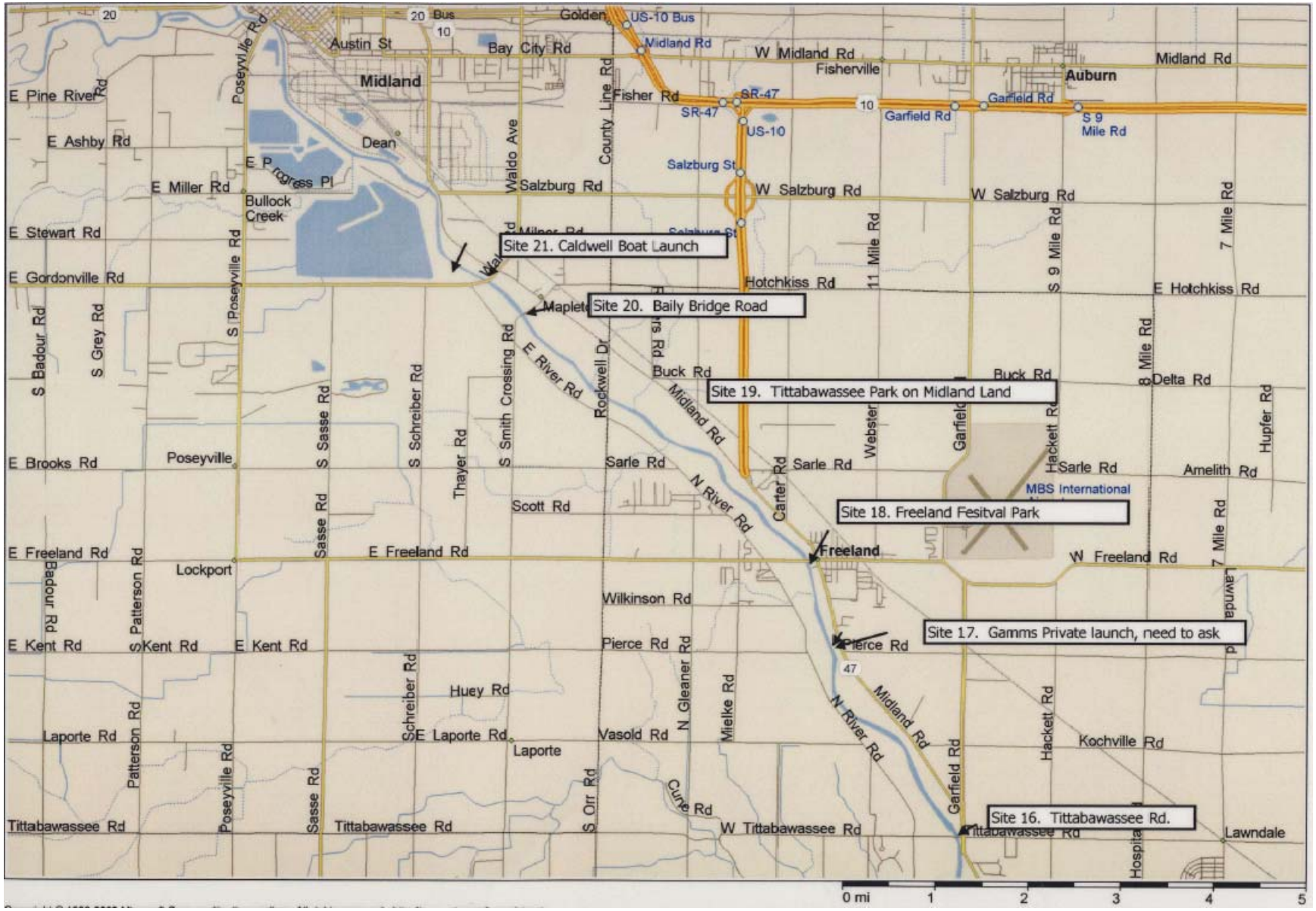
Site 21. Caldwell Boat Launch
Site 20. Baily Bridge Road
Site 19. Tittabawassee Park on Midland Land
Site 18. Freeland Fesitval Park
Site 17. Gamms Private launch, need to ask
Site 16. Tittabawassee Rd.
Midland
Auburn
Fisherville
Poseyville
Lockport
Laporte
Freeland
Dean
Bullock Creek
MBS International
Austin St
Bay City Rd
Midland Rd
W Midland Rd
Fisher Rd
SR-47
US-10
US-10 Bus
Garfield Rd
S 9 Mile Rd
Salzburg St
W Salzburg Rd
Waldo Ave
County Line Rd
E Pine River Rd
E Ashby Rd
E Miller Rd
E Progress Pl
E Stewart Rd
E Gordonville Rd
Hotchkiss Rd
E Hotchkiss Rd
11 Mile Rd
7 Mile Rd
8 Mile Rd
Delta Rd
Amelith Rd
Buck Rd
Sarle Rd
Scott Rd
Wilkinson Rd
Pierce Rd
Huey Rd
Vasold Rd
E Laporte Rd
E Freeland Rd
W Freeland Rd
E Brooks Rd
E Kent Rd
W Kent Rd
Tittabawassee Rd
W Tittabawassee Rd
S Badour Rd
S Grey Rd
S Poseyville Rd
S Sasse Rd
S Schreiber Rd
S Smith Crossing Rd
S Orr Rd
Thayer Rd
Rockwell Dr
E River Rd
N River Rd
Midland Rd
Carter Rd
Webster
Garfield
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Patterson Rd
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Kochville Rd
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