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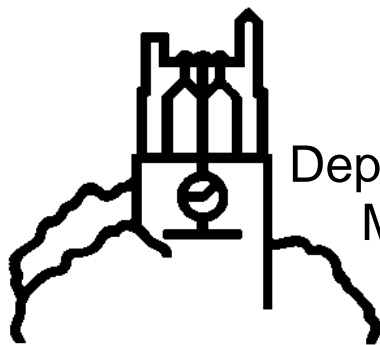
Staff Paper

**RECREATIONAL ANGLING TRIP EXPENDITURES
OF MICHIGAN RESIDENTS**

by
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RECREATIONAL ANGLING TRIP EXPENDITURES OF MICHIGAN RESIDENTS ¹

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Introduction

The primary goal of this report is to present an estimate of fishing trip related expenditures by resident anglers in Michigan. There are also three secondary goals. First, a statewide estimate of fishing trips is provided. Second, the regional allocation of fishing trip related expenditures is characterized. Third, the relationship between average trip expenditures the, type of angler, and the type of fishing trip is summarized.

For the purposes of this report, “trip related” expenditures are expenses that occurred specifically for or during trips which involved fishing activities. No attempt is made to estimate non-trip related expenditures such as expenditures on fishing equipment, boats, or other fishing durables. Expenditures are estimated for trips occurring between April 1, 1993 and November 15, 1993. Since non-residents and out of state trips by residents are not included in the data, only the expenditures made in Michigan by resident anglers are estimated here. The data for this report is from a pilot study of recreational fishing in Michigan. The study was funded by the Michigan Department of Natural Resources and the Michigan Department of Environmental Quality as part of a project to model the demand for recreational fishing in Michigan.

The first section of this report briefly describes the pilot survey. Next, the methods used to estimate statewide expenditures are described. The second section also presents our estimate of statewide expenditures. The third section estimates the portion of expenditures that occur in an angler's home county and the expenditures that occur away from home. This section also investigates the regional economic impacts of fishing trip expenditures. The fourth section examines how trip expenditures vary by the individual characteristics of angler's and by the type of fishing trip. The differences in the components of total trip costs are also presented in this section. The final section examine the potential for bias in the results. We close with a discussion

of some of the limitations and implications of the results.

Overview of the Pilot Survey

The data was obtained as part of a pilot survey on the recreational fishing activities of Michigan residents. The pilot survey served as the precursor to the larger survey reported in Lupi (2004). An important goal of the pilot survey was to obtain accurate data on the number of trips individuals take over the fishing season. The survey was designed to identify and follow a panel of anglers throughout the fishing season. Interviews were conducted via telephone. The panel study format allowed us to limit the recall periods for angler's who fish often. Previous research has indicated that many recreational surveys suffer from bias as a result of recall problems associated with trying to remember past angling events (Chase and Harada 1984; WESTAT 1989). Specifically, angler surveys with longer recall periods are prone to more recall bias, and this bias tends to inflate estimated effort levels (Fisher et al. 1991; Tarrant et al. 1993; Connelly and Brown 1995). Thus, the panel format with smaller recall periods was chosen to improve the accuracy of our data on the number of trips taken over the course of a season.

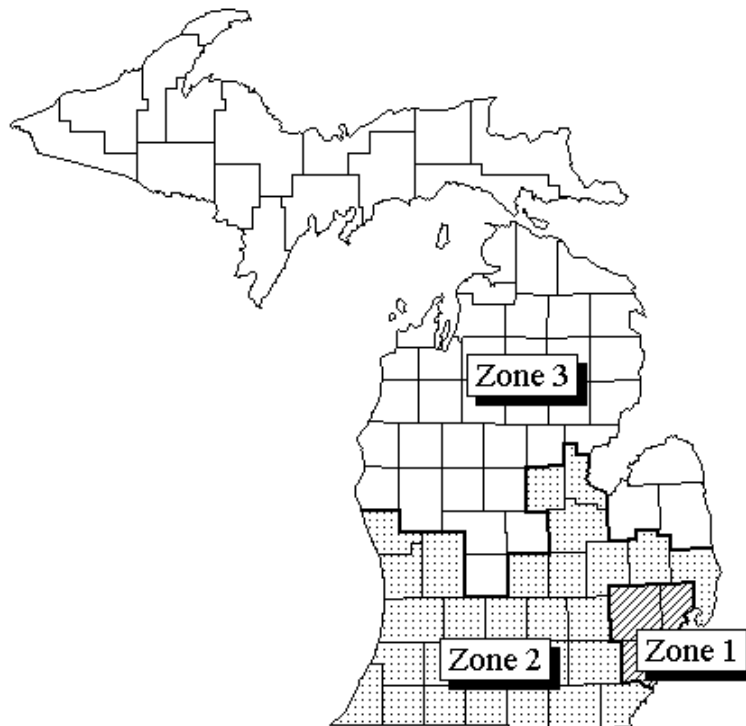
All of the telephone interviewing was conducted by the Survey Research Division (SRD) of the Institute for Public Policy and Social Research (IPPSR) at Michigan State University. SRD used a Computer Assisted Telephone Interviewing (CATI) system that allowed the programming of sophisticated telephone interviewing instruments with complex skip patterns.

The pilot panel survey tracked a sample of potential anglers from April, 1993 through November, 1993. The pilot survey was undertaken in several stages. The first stage involved the screening of randomly chosen individuals to build the panel. In the screening interviews, we recruited people who indicated they were likely to go fishing or boating in Michigan. The

subsequent stages are follow up calls to ask panel members about fishing activities. These stages, which we refer to as the screening and as waves, are described below.

Screening: In the screening stage, people were called using randomly generated phone numbers purchased from Survey Sampling in Fairfield, CN. The sample was geographically stratified by three regions of the state: the Detroit tri-county area, the Upper Peninsula along with the Upper Lower Peninsula (Upper Michigan), and the remaining central and southern areas (Mid Michigan). Figure 1 depicts the three regions of the state. We over-sampled the Upper Michigan area to get adequate representation in the less populated areas of the state.

Figure 1: Michigan Zones for Stratified Sample of Residents



The screening interviews were conducted in April of 1993. The screening interviews were completed with the adult at the household who celebrated the most recent birthday, i.e., a random member of the household. All respondents were asked some general demographic questions. In addition, we asked when they last went fishing and when they last went boating. We also asked the likelihood that they will go fishing or boating in Michigan from April 1st through March 31, 1994. Those that responded "very likely", "somewhat likely", or "somewhat unlikely" were then asked to participate in the panel study. Those that responded "very unlikely" were not recruited into the panel study. Out of 1215 completed screening interviews, 314 were in the "very unlikely" to go category. Of the 901 other people, 679 (75%) agreed to participate in the panel study. The percentage of people who said yes was not significantly different across the regional strata.

Wave 1: After conducting numerous pretests, the first main wave of questioning began June 28, 1993. In the first wave, we asked how many times a person had fished since April 1, 1993, and then we collected the times and dates of these fishing trips. The recall period for the first wave averaged three months, less than the four month recall period used in the National Survey of Fishing, Hunting, and Associated Recreation (NSFHWAR 1991). We defined fishing as going with the intent of catching fish. We explicitly stated that going with someone or watching someone who fished did not count. Trips were defined as each separate occasion they were fishing from the time they left their home until they returned home. The exact questions and definitions for "going fishing" and "times fished" appear in Appendix 1. Our definition of a trip is consistent with the definition used in the NSFHWAR.

Wave 2: As in the first wave, the instrument for the second wave contained questions on the time and date of trips since our last call. In addition, we asked detailed questions about each of these trips. The details questions about each trip included party size, length of stay, transportation types, trip expenditures, purpose of trip, sites visited, and fish caught and released by species by sites. The expenditure questions are listed in Appendix 1. Only those respondents who indicated in wave one that they had fished or were likely to fish were called in wave 2. The wave two interviews began in August and covered the period since the completion of the wave one interview. The average recall period was two months.

Waves 3 and 4: Everyone who fished in wave 1 or 2, was called back in early October to ask about any fishing trips they may have taken since wave 2. The instrument contained the same questions as the instrument for wave two. The recall period for this wave was about one month. Calling for the final wave, wave 4, began on November 10, 1993. All the panel members were called during the fourth wave. The recall period ranged from about a month for respondents who had been fishing, to about four months for respondents who indicated in wave one that they hadn't fished and were unlikely to go the rest of the season.

Overall Panel Attrition: The screening identified 679 people that were willing to participate in the panel. Of these, 25 were not kept in the panel because they were used in pretests.² Of the 654 remaining people, final wave four interviews were completed with 506 of them (77%). Thus, the panel attrition rate was about 23%. Of the 610 people who completed the

² Some of the cases used in pretesting were kept in the panel because the questions we asked them were only slightly different from the final versions.

wave 1 interviews, 83% (506) completed wave four. Across the waves, there were 19 refusals (19/654 = 2.9%) with 13 of them occurring after the first wave. These attrition and refusal rates are low when the seasonal commitment and the amount of information being asked about each trip are taken into consideration.

Methods for Estimating Statewide Expenditures

Our basic approach to estimating statewide expenditures related to fishing trips involves the following steps. First, we calculate average trip expenditures. We then multiply this by average trips per season to get average expenditures for the season. Since our sample is of adults, we will multiply average expenditure for the season by the adult population to get an aggregate figure. Because the sample is stratified by region, we will need to make all of these calculations separately for each region.

Table 1: Population of adults per region based on 1990 Census figures for persons 18 or older by counties in Michigan.

	Adults	Mean	Percent	Counties
Mid Michigan	2,956,683	101,955	43.2	29
Upper Michigan	977,323	19,163	14.3	51
Detroit Metro Area	2,903,418	967,806	42.5	3
	=====	=====	===	==
Statewide Totals	6,837,424	82378.6	100	83

The number of adults per region was obtained from 1990 Census figures, and the totals are reported in table 1. The Detroit metro area is composed of Wayne, Oakland and Macomb counties. The Mid-Michigan area contains 29 counties from Mid-Michigan with average

population of about one hundred thousand adults per county. The Upper-Michigan area contains the Upper Peninsula and the Upper half of the Lower Peninsula. The Upper-Michigan area has 51 counties with an average population of twenty thousand adults per county.

All the data used to derive the estimated statewide quantities were weighted to account for different probabilities of being sampled. Recall that the screening stage of the panel was based on a sample of randomly generated phone numbers for Michigan. This procedure yields a simple random sample of phone numbers. Once a number was called, we selected a random adult member of the household. We need to weight this data for two reasons. First, individuals from households with multiple phone lines are more likely to be sampled. Second, individuals in households with multiple adults are less likely to be sampled. Thus, the data used to construct the statewide estimates were weighted by the number of adults in the household divided by the number of separate phone lines. Weighting the data seemed to have little effect on summary statistics such as the average number of trips and average costs per trip.

We made every attempt to make sure our estimates of expenditure per trip and average trips are representative of the population. One area which required some attention was the degree to which the behavior of our panel mirrored the general population. Willingness to participate in our panel portion of the study did not vary by region. However, a closer look at the data revealed that willingness to participate in the panel did vary by chances of fishing. Screening respondents who stated they were less likely to fish were also less likely to participate in the study. This effect was statistically significant. Importantly, fishing behavior varies by stated chances of fishing, i.e., people who indicate they are very likely to go this year took more trips. Since the behavior of non-respondents (people who were asked but did not want to participate in the panel) differs from respondents, we have to adjust for this non-response bias when we estimate trips. To avoid

overestimating trips, we will extrapolate results using average behavior based on categories for the different chances of going fishing.

Table 2: Weighted crosstab of "chances" by "region".

	Mid Michigan	Upper Michigan	Detroit Metro	Row Total
Very likely to go	54.3	56.0	46.9	52.8
Somewhat (un)likely to go	19.6	24.8	24.8	23.1
Very unlikely to go	26.0	19.1	28.3	24.1
Column Total	33.5	37.5	29.0	100.0

Further tests revealed that the main difference in panel participation was between people who, at the screening interview, stated they were very likely to go fishing and those who stated they were less likely to go fishing. We found that there was not a significant difference between willingness to participate for people who were somewhat likely or somewhat unlikely to go fishing or boating in 1993. Thus, we created a variable "chances" with three categories; one category for those who said they were very likely to go, another category for respondents who said they were either somewhat likely or somewhat unlikely to go, and a final category for respondent who stated they were very unlikely to go. This reduced the four categories of chances of fishing to three categories. We calculate all trip related quantities separately for each of these three chances categories. This procedure should remove any bias associated with the differences in behavior based on stated chances of going fishing. The weighted frequency distribution of

individuals by categories of "chances" for each region are reported in table 2. The distributions for "chances" are calculated from the 1215 completed screening interviews.

Table 3: Weighted average number of fishing trips by region and by chances of fishing. Based only on those who completed panel.

Average trips by "chances"	Mid Michigan	Upper Michigan	Detroit Metro
Chances: Very likely to go	3.48	7.00	1.67
Chances: Somewhat (un)likely to go	0.29	0.89	0.86

We calculated average trips by region for each of the "chances" categories. We only use the respondents who completed the panel when we derive the average trips per season. We assume that those not recruited did not participate, i.e., trips equal zero if "chances" equals very unlikely to go. The weighted average trips by region by "chances" categories are found in table 3. Average trips differ across regions and differ within regions by chances of fishing. As expected, people with higher stated chances fish more, and people from Upper Michigan fish the most while those in the Detroit area fish the least.

For each person, we calculated expenditures per trip as the sum of each separate expenditure category used in the survey. Expenditure categories included: vehicle fuel, lodging, boat costs, parking and entrance fees, bait, restaurants, and groceries. The exact questions from the survey instrument are given in Appendix 1. Per trip expenditures were calculated for the trips we had complete expenditure data on. Since expenditures per trip were reported on a

household basis, we adjusted them so that they would match our sampling unit, which is individual adults. This was done to avoid overstating per trip expenditures. Essentially, we divided the total expenditures for each trip by the number of adults from the household that were on the trip. The details of this adjustment are provided in Appendix 2. Table 4 provides the weighted average expenditure per trip by region.

We estimated the expected number of trips for an adult from each region using the regional distributions of "chances" and the average trips by categories of "chances" (see table 4, column 2). This figure is calculated as the sum over the chances categories of the product of average trips and the fraction of adults from the region in that category. For example, Mid Michigan residents are estimated to take 1.95 trips per adult. Using the results from tables 2 and 3 we see that $1.95 = 3.48 \times 0.543 + 0.29 \times 0.196$. Table 4, column 5, presents our estimate of the total fishing trips per region which is the average trips per adult times the number of adults per region.

Table 4 also contains the information we used to estimate trip-related expenditures. To get expected seasonal expenditures per adult per region, we multiplied expected trips per adult by average expenditures per trip. This was multiplied by the adults per region to derive our estimates of trip-related seasonal expenditures per region (column 6). The resulting statewide total for trip related expenditure is 437 million dollars.³

From table 4 we see that residents of Upper Michigan take over four time more fishing trips per capita (averaged over the entire regional adult population) than residents of the Detroit

³ Note that our total expenditure estimate would be slightly higher if we had simply multiplied the average statewide expenditure per trip by the average statewide trips per capita, i.e., $37.38 \times 1.857 = 474,617,460$ which is 8.5% larger than the result of our regional aggregation procedure.

area and twice as many as residents of Mid Michigan. However, the rankings of the total trips per region change because Upper Michigan is less populated. Over the course of the open water season, residents of Upper Michigan spent about \$90 per adult on fishing trips. Residents of Mid Michigan spend about \$80 per adult, and residents of the Detroit area spend about \$39 per adult. Even though they spend less per fishing trip, Upper Michigan residents have the highest per capita spending on fishing trips because a higher percentage of people in Upper Michigan fish and those who do fish take more trips.

Table 4: Regional and statewide estimates of average and total fishing trips and expenditures for fishing trips.

Region	Average spending per trip ^a	Average trips per adult ^b	Total adults ^c	Estimated total trips ^d	Estimated expenditures ^e
Mid Mich.	\$41.14	1.949	2,956,683	5,762,575	\$237,072,340
Upper Mich.	\$21.78	4.139	977,323	4,045,140	\$88,103,150
Detroit area	\$38.81	0.995	2,903,418	2,888,901	\$112,118,240
State averages and totals	\$37.38	1.857	6,837,424	12,696,616	\$437,293,730

a Weighted average per trip expenditures by region.

b Weighted average trips per adult per region calculated as the sum of average trips by "chances" categories (table 2) times the fraction of the regions adults in that category (table 3).

c Adult population per region based on 1990 census numbers (table 1).

d Estimated regional and statewide fishing trips for April-Nov. 15, 1993 (item b times item c).

Comparison with NSFHWAR: In this subsection we examine how our estimates compare to the Michigan results of the NSFHWAR. The NSFHWAR estimated that in 1991, in-state annual trip related expenditures by Michigan residents was 440,990,600. This is almost exactly

what we have estimated. However, the NSFHWAR also predicted that Michigan residents took 19,467,600 fishing trips in Michigan in 1991. This estimate for trips is about 50% higher than ours. Likewise, our estimate for expenditures per trip is about 50% higher than the one from the NSFHWAR.⁴ Moreover, since the NSFHWAR uses a broader definition of trip related expenses, a comparable definition would make our estimate of trip expenses even larger. For example, under the category of boating costs the NSFHWAR includes storage, mooring, maintenance, and insurance costs. We have not included any of these unless they were temporary slip fees incurred only for a specific trip.

Our estimate of total fishing trips statewide is 12.7 million which compares quite favorably to the approximately 12 million user days estimated trips for 1994 from a larger survey for a comparable time period (Lupi 2004), although it is lower than the 19.5 million trips estimated by the 1991 NSFHWAR. Bence and Smith have noted that the national survey also exceeds the estimated fishing effort at Great Lakes sites when compared to estimated effort based on creel surveys (Bence and Smith, 1999). Unlike our estimate, the NSFHWAR estimate for annual fishing trips includes winter fishing and fishing trips taken by 16 and 17 year old's. We can make some adjustments to our estimate of trips to make the two more comparable. If we were to include winter fishing, our estimate of trips might increase by about 2.5 million statewide.⁵ Adjusting for

⁴ We can derive a per trip expenditure from the NSFHWAR by dividing \$440 million by 19.5 million trips to get \$22.65 per trip. The same procedure applied to our estimates yields \$34.44 per trip which is 52% higher.

⁵ From the pilot data, the percentage of "last years trips" for ice versus non ice are 5% in Detroit, 40% in Upper MI, 14% in Mid MI. Using these percentages and taking a weighted average would yield about 2.5 million ice fishing trips.

16 and 17 year old's could add approximately half a million trips.⁶ Therefore, a better comparison would be based on an estimate of 15.6 million trips based on our study verses 19.5 trips from the NSFHWAR. With these adjustments, the NSFHWAR estimate remains larger than ours, but it is now only 25% larger.

Expenditures "at home" and "away from home"

This sections describes how we estimate the amount of expenditures that were made at home and away from home. This information gives an indication of how much fishing trip expenditures contribute to each angler's local economy. The assumptions that go into the "at home" and "away from home" decomposition are not meant to be exact. They are intended to give us a picture of the regional impacts of fishing trip related spending.

We defined "at home" as anywhere within the same county as an angler's permanent residence. Since we know the destination of each trip, we assume that if the destination of a trip was in the same county as the respondent's residence, all expenditures were made "at home". Any trip made outside an angler's home county involves both "at home" and "away" expenditures. Our survey questions did not distinguish between trip related expenditures that were made at home, made on the road, or made at the location fished. In order to approximate home and away expenditures for trips with destinations outside an angler's home county, we made the following simplifying assumptions. We assumed that all parking and entrance fees, boat launch fees, boat rental fees, lodging, and restaurant expenditures were made away from home. We divided vehicle

⁶ From the NSFHWAR, 16 and 17 year old's are about 4% of the anglers which is the same percentage they are of the general population. Suppose the 16-17 year old's increase trip by 4% because they are 4% of the population, i.e., on average they take no more or less trips than the general population. This would only add one half a million trips to our estimate.

fuel, bait, and grocery expenditures equally between home and away. For boat fuel, if they did not tow the boat, all the cost was assumed to be away from home. If the boat was towed to the site, we equally split boat fuel expenditures between home and away.

The resulting weighted average expenditures that are made at home and away from home are provided in table 5. About half of all trip related expenditures made by anglers living outside of the Detroit Metro Area are made outside of an angler's county. For angler's residing in the Detroit area, sixty percent of their trip related expenditures are made outside their own county.

Table 5: Average home and away expenditures per trip by regions.

	At home	% of total	Away	% of total	Total \$/trip
Mid Michigan	\$21.56	52.4	\$19.58	47.6	\$41.14
Upper Michigan	\$10.89	50.0	\$10.89	50.0	\$21.78

The estimates of at home and away from home expenditures give us an idea of the regional impacts of fishing trip expenditure. We estimate that fishing trip related expenditures that are made in the Detroit metro area are approximately \$52,915,200. This is about 12% of all fishing trip related expenditures in Michigan. By implication, about 88% of fishing trip related expenditures are made outside of the Detroit Metro area. Therefore, fishing trip related expenditures are a relatively more important source of income for non-Metro counties.

The figure for expenditures made in the Detroit Metro area is derived by adding four components. First, we include all of the \$44,959,414 of at home expenditures for residents of the

Detroit region. Second, we estimate that \$6,715,800 of the "away" expenditures made by Detroit area residents stays in the region.⁷ Finally, we estimate that \$931,700 of the "away" expenditures from Mid-Michigan and \$308,400 of the "away" expenditure from Upper-Michigan are made in the Detroit area. The last two figures represent 1.5% and 0.7% of the away expenditure for Mid and Upper Michigan. The percentages are based on our sample percentages of trips from Mid-Michigan and Upper-Michigan that are taken to one of the three Detroit area counties.

Breakdown of Per Trip Expenditures

This sections examines how average expenditures vary with the individual characteristics of anglers. We also examine differences in average expenditures by the type of fishing trip that was taken. All the averages are decomposed into major component categories such as food, lodging and transportation. These breakdowns are presented in table 6 for individual characteristics, and in table 7 for trip characteristics.

The component categories for expenditures are based on the questions found in Appendix 1. We did not collect expenditure amounts for items such as gifts, antiques, repairs, or other expenses that may have been incurred during a trip because we decided these other expenses were not attributable to fishing. The categories of fishing expenditures collected were aimed at isolating the amount of angler expenditures that are directly tied to fishing trips, and hence are termed "trip-related" expenditures. The boating category is a composite of expenses on boat fuel,

⁷ The figure for the amount of "away" spending by Detroit area residents was estimated by taking 10% of the away spending as the portion of spending that occurred outside a residents county, but remained within the region. For example, some of the "away" trips of Wayne county residents were taken to Macomb county. 10% is the population weighted average of the trips away from home that remained in the Detroit area for the sample members that live in the Detroit area.

rental fees, and/or slip fees. Since few individuals reported rental fees or slip fees, the majority of the boating costs are due to fuel costs. Lodging costs represent spending for campgrounds, hotels, motels, lodges or rental units. If a person stayed in their own cabin or with a friend/relative, we did not ask about any lodging expenses. The bait and tackle category only includes tackle items that could not be used again such as line or lost lures. No equipment or durable goods are included in this category. The groceries and snacks category includes any spending on alcohol and ice.

The breakdown of the averages expenses provides some insight into the composition of total expenses and identifies factors which influence trip-related expenditures. These averages are not intended to be used to derive statewide averages because all the averages reported in this section are based on unadjusted raw data. Specifically, the data have not been weighted to reflect differences in the probability of being sampled due to different household sizes and numbers of phone lines. Also, the data have not been divided by our estimate of the number of adults from the household that were on the trip. For the entire population, average cost per fishing trip is about \$48.90. This is higher than the \$37.38 amount from table 4 which was adjusted for the respondents share of the costs and weighted by household size and phone lines.

Table 6. Fishing Trip Expenditures by Individual's Characteristics.

		Gas	Lodging	Boating	Parking, entrance	Bait, tackle	Restaurant	Groceries, snacks	Total cost
Overall		10.60	4.00	6.50	0.90	3.30	8.90	19.30	48.90
% of total		21.7%	8.2%	13.3%	1.8%	6.7%	18.2%	39.5%	100%
Gender	female	9.60	1.80	3.80*	0.30	2.00*	8.30	28.50*	43.50
	male	11.10	5.00	7.80	1.20	4.00	9.20	15.00	51.40
Age	less than 40	11.60	6.20 ^{*12}	7.70	0.90	4.00	10.40	23.20	61.40 ^{*12}
	40 to 59	11.20 ^{*23}	1.30	5.90	1.20	3.00 ^{*23}	8.70	17.50	40.90 ^{*23}
	60 or older	5.60 ^{*31}	3.50	3.60	0.00	1.80 ^{*31}	3.70	8.00 ^{*31}	21.40 ^{*31}
Education	no college	9.60	3.40	6.10	0.50	3.00	5.70*	14.00*	42.00*
	some college	11.80	4.70	7.00	1.30	3.70	12.50	24.00	57.00
Income	< \$40,000	10.80	3.70	5.70	1.00	3.60	17.90*	17.40	47.20
	>=\$40,000	10.60	4.50	7.30	0.80	3.20	38.30	22.20	52.30
Children	yes	10.60	5.10	6.40	1.00	4.30*	11.50*	24.00*	55.70*
	no	10.70	2.90	6.60	0.80	2.30	5.90	13.90	41.10
Residence	Mid Michigan	15.30 ^{*12}	3.80	5.70	1.60	4.40 ^{*12}	11.80 ^{*12}	27.40 ^{*12}	60.20 ^{*12}
	Upper Michigan	6.40 ^{*23}	4.30	5.00 ^{*23}	0.20 ^{*23}	2.20 ^{*23}	5.90 ^{*23}	13.50	36.30 ^{*23}
	Detroit Metro	13.30	3.40	12.90 ^{*31}	1.50	4.70	12.20	19.90	64.50

- Notes: 1. The hypothesis that means are equal is tested between different groups by two tail t-tests at the significant level of 5%.
 2. * indicates that when there are only two groups, the hypothesis of equal means is rejected.
 3. When there are three groups, means are compared between group 1 and group 2, group 2 and group 3, and group 3 and group 1. Accordingly, *12, *23, *31 indicate that H_0 is rejected for $\mu_1 = \mu_2$, $\mu_2 = \mu_3$, and $\mu_3 = \mu_1$ respectively.

Table 7. Fishing Trip Expenditures By Trip Characteristics.

		Gas	Lodging	Boating	Parking, entrance	Bait, tackle	Restaurant	Groceries, snacks	Total cost
Overall		10.60	4.00	6.50	0.90	3.30	8.90	19.30	48.90
Trip Purpose	fishing	8.00*	3.30	6.30	0.70	3.30	7.40*	19.00*	39.90*
	other including fishing	21.40	6.90	7.40	1.50	3.40	14.80	79.30	88.00
Destination	home county	3.20*	0.00*	4.50*	0.20*	2.60*	2.70*	7.00*	20.40*
	other counties	18.70	9.00	8.90	1.80	4.30	15.70	32.70	82.60
Water body	Great lakes	8.10	4.40	12.70 ^{*12}	0.80	2.10 ^{*12}	6.20	11.10 ^{*12}	41.60
	inland lakes	11.60	2.50	4.70	0.60	3.90	11.80	24.50	53.00
	rivers	12.00	6.90	4.80 ^{*31}	1.30 ^{*31}	3.70	6.70	16.80	50.10
Fishing for	trout/salmon	15.70*	3.60	8.60	1.50	2.20*	11.60	18.40	46.90
	other species	9.30	5.50	6.00	0.70	3.60	8.20	19.50	56.80
# sites	1	9.50*	3.20*	6.60	0.60*	3.20	8.30	16.90*	44.20*
	>= 2	25.40	14.90	5.70	4.60	4.80	17.60	51.50	112.00
Trip days	1	6.30 ^{*12}	0.00 ^{*12}	6.00	0.50 ^{*12}	2.80	4.30 ^{*12}	9.20 ^{*12}	28.20 ^{*12}
	2	25.50	9.60 ^{*23}	9.70	4.20	4.20	19.70	34.60 ^{*23}	103.70 ^{*23}
	>= 3	35.30 ^{*31}	40.00 ^{*31}	8.30	1.70 ^{*31}	6.80 ^{*31}	38.60 ^{*31}	93.50 ^{*31}	198.00 ^{*31}

- Notes: 1. The hypothesis that means are equal is tested between different groups by two tail t-tests at the significant level of 5%.
 2. * indicates that when there are only two groups, the hypothesis of equal means is rejected.
 3. When there are three groups, means are compared between group 1 and group 2, group 2 and group 3, and group 3 and group 1. Accordingly, *12, *23, *31 indicate that H_0 is rejected for $\mu_1 = \mu_2$, $\mu_2 = \mu_3$, and $\mu_3 = \mu_1$ respectively.

Discussion of Table 6:

1. The first row reports the breakdown of the overall average for the population. The second row gives the percentage distribution of the total overall average costs. On average, most of the expenditures are made on restaurants and groceries, 58%. Vehicle fuel costs account for 22% of average expenses. On average, lodging costs are low because most trips are day trips and the lodging for about half of overnight trips is a cabin or a friend/relatives house.
2. On a fishing trip, male angler's tend to spend more than female angler's on gas, lodging, boating, parking and entrance, tackle and restaurants. However, males tend to spend less on groceries. Hypothesis tests suggest that such differences are statistically significant for boating, tackle, and grocery costs.
3. Anglers are grouped by age into three groups: 1) less than 40 years of age; 2) between 40 and 59; and 3) greater than or equal to 60. Table 6 suggests that youngest group tends to spend more, but the differences in all cost categories between group 1 and group 2 are statistically insignificant. Significant cost differences on gas and bait are found between the oldest age group and the other groups. For spending on groceries, there is a significant difference between the oldest and youngest groups.
4. Anglers with some college tend to spend more on all items than anglers without any college experience, but the difference is only significant for restaurant expenditures.
5. Similarly, an angler whose household income is greater than \$40,000 tends to spend more on lodging, boating, restaurant and groceries. The result is significant for total costs and spending at restaurants and on groceries.
6. Anglers who have children spend more on bait, restaurants, and groceries than those who do not have any children. These results are all statistically significant.
7. Residence seems to be an important factor. Anglers who live in Mid-Michigan and the Detroit metropolitan area spend more on gas, bait, and restaurants than those who live in Upper-Michigan. Detroit anglers spend more on boating than people of both Mid and Upper Michigan. Mid-Michigan anglers spend more on groceries than those of upper Michigan. All these results are statistically significant.

Discussion of Table 7:

1. People spend less on trips in which fishing is the primary trip purpose than on fishing related trips with other primary purposes. The results are significant for total trip cost and costs on gas, lodging, restaurant, and groceries.
2. Fishing trips made within home counties cost much less for all cost items than trips made to places outside anglers' home counties. The result is statistically significant.
3. Boating costs are significantly higher for trips made to the Great Lakes than for trips to inland lakes or rivers. On the other hand, grocery costs are significantly lower for Great Lakes trips than for inland lake trips. Trips to rivers had higher parking and entrance fees than trips to Great Lakes.
4. If the angler was primarily fishing for any kind of trout or salmon, the trip involves higher fuel costs but lower costs on bait. The results are statistically significant.
5. Trip duration seems to be the most important factor in explaining trip costs. The longer the length of a trip, the higher the costs. Significant differences in total trip cost, lodging cost, and grocery cost are found between all trip types. Costs on gas, parking, and restaurant are significantly lower for 1 day trips, but not for 2 day trips compared to 3 or more days. No significant differences were found for boating cost for any of the trip lengths.

Assessment of Potential Bias in the Estimates

This section explores potential short-comings of the data used in this report. We review several types of bias which could affect the results, and we provide some judgments about the extent that each might affect the results. We also do the same for some of the principal assumptions used in other sections of this report.

Interview Non-Response: By interview non-response bias we mean bias due to differences in the behavior and characteristics of the people who respond to the interview when

compared to those who do not respond. At least four kinds of interview non-response bias can enter the data. First, people who complete the screening interview may be somewhat different from those that do not. We compared the mean age and education levels of our sample with census statistics and did not identify any systematic differences. In addition, if people who completed the screening are different than those who do not, they are likely to be more interested in fishing. If this is the case, we have overestimated expenditures to the extent that we have overestimated trips per capita. The NSFHWAR use census households and achieves a 95% response rate. They argue their approach is less subject to the kinds of non-response bias an RDD study might be, yet the NSFHWAR estimate of trips is greater than ours. Thus, non-response to the screening is unlikely to be a major source of bias.

Second, of those who complete the screening interview, people who are more likely to fish may be more likely to agree to participate in the full panel. This effect, along with our procedure for correcting for this bias, was discussed above.

Third, bias could enter the results if people who completed the screening interview but were not recruited into the panel actually fished. To assess any potential bias associated with the screening of "very unlikely" respondents, at the end of the season we called back a sample of these people. The follow up had a response rate of 91%. Only 2 respondents out of the 83 sampled had gone fishing. Both of these cases indicated that they had fished last year. Because of this we tried calling back all other cases who indicated they fished last year but were very unlikely to go this year--thus, they were not recruited into the panel. None of the additional interviews produced anyone who fished. Thus, any bias due to the omission of this small number of anglers is judged to be minimal.

Fourth, bias could result if people who we lose from the panel due to attrition are somehow different. We checked for any differences in trips based on responses to a question from the first wave. In the first wave we asked individuals how many times they fished last year. We didn't find any statistically significant differences in the number of trips taken last year (1992) between people who completed the panel and people lost due to attrition.

Item Non-Response: Item non-response bias occurs when unanswered questions bias the results. Item non-response bias has been demonstrated in mail surveys that ask for self reported trip related expenditures. In their survey of New York anglers, Connelly and Brown (1992) found that as distance traveled increased non-response to expenditures decreased substantially. Connelly and Brown found that for a question about "at-location expenditures", trips to sites within 25 miles had a non-response rate of 25% and trips to sites over 100 miles away had an 11% non-response rate. The mean expenditures for such trips were \$48 and \$247 respectively. In their case failure to adjust for item non-response would bias the results upward. In our telephone survey, item non-response was less than one percent for most of the expenditure questions. The auto fuel cost and boat fuel cost questions had the highest non-response at 2.1% each. Thus, item non-response bias is not considered a substantial problem with this data.

Trips Without Detailed Information: While item non-response is not a problem *per se*, many respondents did not report detailed information about all of their trips. Detailed trip information was provided for 80 percent of the total trips respondents stated that they had taken in waves 2 through 4, 585 of 724. If the respondent completed the panel, all stated trips were included in the calculation of average trips per season regardless of whether or not we had additional details about the trip. If trips which we do not have detailed information on tend to be short/close trips, there would be some upward bias in the per trip expenditure estimates. We have

no direct test to see if this is a problem. The case notes associated with each interview provide evidence that some of the unreported trips are short trips. However, among trips that are reported on, the proportion of short trips is high, and it is not clear from the case notes that the proportion of short trips is any higher for trips that were not reported on.

Trips From Wave One: We are assuming that trip expenditures from mid to end of season are the same as those at the beginning of season. Since trip expenditures were not reported in wave one, we do not have any trip expenditure data for trips taken prior to the wave one interview date. Half of the wave one cases were interviewed by the end of June; 95% were completed by mid July, and all were completed by the end of July. Thus, the trip expenditures are based on trips from July through November. We do not have any evidence that the trips from April, May, and June differ from trips in the latter half of the season. For example, the percentage of trips made outside the county of residence is not significantly different across waves. The percentage of overnight trips does not differ across waves either. (If anything the percentage of overnight trips is higher in the wave one data. This may be due to the longer recall period which meant we collected less information on the duration of short trips.)

Misc: Other possible errors or omissions in the estimated expenditures include the following factors: Our sample is of adults (persons 18 years of age or older). Thus, we miss any expenditures and/or trips made by children that are not captured by the reporting of their parents. Further, we are used 1990 population statistics to extrapolate the results which may omit any population changes that occurred by 1993. Finally, although the sample size is similar in magnitude to the Michigan sub-sample from the NSFHWAR, the relatively small sample size for individuals that actually were observed taking trips, 206, not overcome individual effects that result from the panel nature of the data.

Summary

Resident angler's were estimated to have spent about 440 million dollars in Michigan for items directly related to fishing trips from April 1 through November 15, 1993. The estimate does not include expenditures made during the winter, expenditures on durable equipment, expenditure of minors on trips without adults, or expenditures by non-residents. The estimate of angling trip-related expenditures is comparable in magnitude to the estimate from the 1991 Michigan report of the National Survey of Fishing, Hunting and Wildlife-Associated Recreation (NSFHWAR). Although fishing trip expenditures account for a very small portion of Michigan's Gross State Product (about 0.25%), since 88% of all expenditures occur outside the Detroit Metro Area, expenditures related to fishing trips represent an important source of income for some regions of the state.

In the process of estimating statewide fishing trip expenditures, we also estimate the number of fishing trips statewide. For the open water season, we estimate that 12.6 million fishing trips were taken in Michigan by Michigan residents. This estimate is somewhat lower than the estimated 19.5 million fishing trips reported in the NSFHWAR (1993). While the NSFHWAR includes fishing trips during winter and trips by 16 and 17 year old's, accounting for these factors does not fully explain the difference between the two estimates making differences in survey methods, sample sizes, and recall periods more likely factors.

APPENDIX 1: Selected Survey Questions

Number of Times Fished. Questions A1 and A3 elicit the number of times a respondent went fishing. In waves two through four, the questions were asked with respect to the date of the last interview rather than April 1. Respondents were provided the date and location of their last trip to bound their recall of trips.

A1 First, we would like to ask you some questions about fishing. Going fishing can mean many things. Sometimes it might mean going with someone or watching someone who is fishing. However, for the purposes of this study, we want to focus on the times you go fishing with the intent of catching something yourself.

Have you gone fishing since April 1st of this year?

A3 Now we want to ask about the number of times you went fishing in Michigan. For the purpose of the study, we are interested in all the times you went fishing.

Each separate occasion you were away from home, counts as one time you went fishing. For example, if you left your home to go fishing for several weeks, please count that as one time. If you left your home to go fishing for an hour, also count that as one time.

How many times have you gone fishing in Michigan since April 1, 1993?

Expenditures. The following are the expenditure related questions as used in the pilot survey. The term "you/your household" is listed to reflect two versions of the questions. When the respondent had multiple household members on that trip, the version of the question with "your household" was used. The first question about vehicle fuel costs was preceded by a question on transportation mode.

B8 Thinking only about your share of the expense, how much did you/your household spend on gas and oil for this vehicle on this trip?

For people on multiple day trips, the next question followed questions about lodging type.

Bf4 In total for this trip, how much did you/your household spend for lodging?

The remaining expenditure questions followed one another. Only individuals who used a boat were asked B13-B15 about boat expenditures. All individuals were read the introductory statement.

Next, we would like to ask you about any (other) expenses you/your household may have had for this trip. This includes purchases made at home for this trip. Please include only the amount that you/your household spent for items.

- B13 For this trip, how much did you/your household spend on boat rentals and charter fees?
- B14 For this trip, how much did you/your household spend on boat gas and oil?
- B15 For this trip, how much did you/your household spend on boat launching and daily slip fees?
- B16 For this trip, how much did you/your household spend on parking and entrance fees?
- B17 For this trip, how much did you/your household spend on fishing supplies that you can not use again? This includes bait and any tackle items that can not be used again.
- B18 For this trip, how much did you/your household spend at restaurants?
- B19 For this trip, how much did you/your household spend on groceries, snacks, ice, and beverages, including alcohol?

APPENDIX 2: Approximating the number of adult household members per trip.

Our sample frame consists of individual adults rather than households. However, our survey questions elicit expenditure per household when multiple household members go on a trip. There is a potential for double counting if we gather household expenditures per trip and attribute these fully to the sampled member of the household. To avoid double counting of expenditures, we should use the respondents share of household expenses. Such data would be difficult for respondents to provide given the joint nature of such costs. An approximation to the share would be to divide per trip expenditure by the number of adults from the household that went on the trip. Since we do not know the number of adults from the household that are on the trip, this appendix describes how we approximated the number of adults per household that were on a trip. From the various parts of the survey, we know the following: the number of adults living in the household, Q4a; number of children living in the household, Q4; and number of household members on the trip, B4. Using these, we created a variable, X, to approximate the number of adults from the household that are on a trip. We defined X as follows:

- a. If $Q4a=1$ or if $B4=1$, then $X=1$. (There is only one hhd, or only one hhd member on the trip).
- b. If $Q4=0$, then $X=B4$. (If there are no kids in the hhd, all hhd members on trip are adults).
- c. If $Q4>0$ and if $Q4a \leq B4$, then $X=Q4a$. (The true X can't be bigger than Q4a).
- d. If $Q4>0$ and if $Q4a > B4$, then $X=B4$. (The true X can't be bigger than B4).

This approach should be conservative since we should never be underestimating the number of adults in the household that are on the trip. For cases a and b, our X is exact. For cases c and d, our X should always be equal or greater than the true value. Therefore, if we divide trip costs by X for each case, trip costs "per adult" will be the same or lower than if we knew the true X.

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