MONTANA BIOECONOMICS STUDY:

Warm Water Fishing in Montana:
A Contingent Valuation Assessment of Angler Attitudes
and Economic Benefits for Selected Waters Statewide.

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The objective of the warm water angler study was to estimate the net economic value of warm water fishing as well as provide attitudinal and preference information regarding anglers reasons for fishing. In addition, respondents were asked for their opinions concerning warm water fisheries management.

Surveys asking about angler characteristics, trip characteristics, and fisheries management preferences were mailed out to 1200 licensed resident and nonresident warm water anglers who had been identified as having fished one of the targeted thirteen rivers or reservoirs. The Dillman Total Design Method was used to administer the survey, resulting in a response rate of 73 percent. This is comparable to other mail surveys conducted by the Department of Fish, Wildlife and Parks.

Warm water angler characteristics and socio-demographic information reveals very little difference between resident and nonresident anglers. Their income and education level are very similar as well as the number of days fished per year and days fished per trip. Expenditures for the current trip vary considerably by residency, as expected. Nonresidents traveled 3.5 times farther (238 vs. 76 miles) as residents and spent over three times as much on trip related expenses ($197 vs. $60).

Angler's reasons for fishing centered around being outdoors, being with family/friends, and followed by reasons directly associated with fishing. The reasons for choosing a particular water were usually related to fishing. The fact the water was close to home was important in some cases.

The valuation of warm water fishing was accomplished by asking anglers to respond to three contingent valuation (CVM) questions. The question format presented anglers with a yes-no situation on whether or not the trip to the targeted water was worth some predetermined bid amount. Their answers to these three questions provided the data to estimate the net economic value of warm water fishing.

The net economic value (NEV) associated with the angler's current trip was $121.00 for the complete sample. Resident anglers were willing to pay $108.00 more per trip and nonresidents were willing to pay $197.00 more.

The next two CVM questions asked warm water anglers to value two hypothetical situations:
1. improved chances to catch large fish and
2. the chance to catch more fish.

Although these two situation were valued higher by anglers ($129 per trip for catching large fish and $132 for catching more fish) the difference was not significantly different from the current trip value.

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CHAPTER I

INTRODUCTION

Scope and Objectives

This report presents the results of the warm water angler survey conducted during the fall of 1989. The report provides estimates of net economic values for warm water fishing using the contingent valuation method (CVM) and details angler's attitudes about fishing as well as their preferences concerning management issues related to warm water fishing.

Specifically, the objectives of the study are:

1. To estimate the current value of warm water fishing.

2. To estimate the change in value associated with improvements in fishing quality (i.e. bigger or more fish).

3. To assess warm water anglers reasons for fishing, their demographic characteristics, and their preferences.

4. To determine warm water anglers' views about fisheries management issues and problems on lakes and rivers.

The objectives of this study focus attention on consumptive use values for warm water fishing. No attempt was made to address other areas of valuation like existence, option, or viewing. While these values can be a large component of total value their estimation is beyond the scope of this study. While the nonuse and nonconsumptive values assist in determining the impacts of large scale changes in the resource, the current trip values presented in this report are appropriate for examining incremental changes in warm water fisheries management.

Definition of Economic Benefits

The definition of economic benefits for a nonmarket resource like fishing is net willingness to pay. Net willingness to pay is the difference between the maximum amount an individual is willing to pay before foregoing the use of a resource or commodity and the amount they must actually pay.

Net willingness to pay or net economic value (NEV) provides a measure of the value of a resource and is recommended by the U.S. Water Resources Council Principles and Guidelines (1983) as the preferred measure of economic value for both marketed and nonmarketed resources. Current literature recommends using the

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concept of net willingness to pay when performing benefit cost analysis (Sassone and Schaffer,1978). Net economic value provides a measure of the allocative impacts of policy choice. The estimates of value shown can assist in making decisions concerning resource allocation decisions with marketed resources. This type of resource allocation process is based on the concept of economic efficiency; maximize the net present value of a resource from the standpoint of the whole society.

Net economic value differs from actual expenditures for recreation in that expenditures are measurable sums of money placed in the economy. These expenditures can be traced and their impact on local and/or regional businesses measured though the effects on local income, employment, and revenue generated through taxes and fees.

CHAPTER II

THEORY AND METHODS

Survey Design

The survey instrument was designed to gather a variety of information about warm water anglers: the reasons they fish, their thoughts on warm water fisheries management issues, and the value they place on their fishing experiences. The questionnarie is divided into five sections. The first two sections (I and II) ask about the respondents warm water fishing history, information on their most recent trip and the reasons they fish as well as why they chose to fish the sampled water. Section III asks anglers to value their most recent fishing trip. Section IV elicits anglers' opinions and attitudes concerning warm water management issues. The last section of the survey collects socio-demographic data about the respondents.

Data

The warm water angler questionnaire was a mail survey administered during September and October of 1989. The sample consisted of resident and non-resident anglers who purchased a Montana fishing license during 1989 and responded to the Statewide Fishing Use Mail Survey administered by Information Services of the Fisheries Division. Respondents to this survey indicated they had fished one of the targeted lakes or rivers. Due to the sampling scheme used for the Statewide Fishing Use Mail Survey, a number of waters were not included in this analysis. Dillman's Total Design Method (1978) was used to conduct the mail survey. The initial mailing contained a cover letter, survey form and a self-addressed, stamped return envelope. One week later a postcard reminder was sent to everyone. If an angler had not responded by the end of the second week, he/she was sent a second copy of the survey.

Targeted Waters and Response Rates

Thirteen lakes/reservoirs and rivers were chosen for this study by personnel in the Fisheries Division. These waters were selected to represent a cross section of the warm water lakes/reservoirs and rivers in the state. They were: Holter Reservoir, Cooney Reservoir, Bighorn Reservoir, Fort Peck Reservoir, Lake Francis, Fresno Reservoir, Swan Lake, Thompson Lakes, Tiber Reservoir, Tongue River Reservoir, Milk River, Missouri River from Great Falls to Ft. Peck Reservoir, and the Lower Yellowstone River. Approximately 1200 anglers were surveyed: 870 anglers returned their surveys, 22 were undeliverable and 9 responded they had not fished during 1989. The overall response rate was seventy three

(73) percent; an excellent response rate for a mail survey.

Contingent Valuation Method

The two methods approved by the U.S. Water Resources Council (1983) for valuing outdoor recreation are the travel cost method (TCM) and the contingent valuation method (CVM). The latter method is used in this study to estimate the net economic value for lake and reservoir fishing in Montana. A regional TCM application to Montana fisheries, for both streams and lakes, is described elsewhere (Duffield, Loomis and Brooks, 1987).

The CVM method is based on the notion that a realistic yet hypothetical market situation can be described to the respondents. Based on this information they will be able to express their valuation of the resource. Key features that are necessary for CVM to provide sound estimates of value are: 1) a description of the resource being valued; 2) the means of payment; 3) the value elicitation or "question format" (e.g. the means of extracting a response) procedure.

The description of the market should be clear and leave no doubt as to what is being valued. The means of payment must be realistic and emotionally neutral and appropriate for the situation. For this study the means of payment was an increase in trip costs associated with the fishing trip.

The value elicitation procedure used in this study is the closed-ended dichotomous choice approach (Bishop and Heberlein, 1979; Hanemann, 1984). This technique combines some of the better features of the open-ended and iterative bidding approaches. In the dichotomous choice the respondent is faced with a specific dollar bid and their response is a simple yes/no like in a real market. The dollar bids the respondents are asked to respond to cover a large range and are varied randomly across the sample.

While there are advantages and disadvantages to all the techniques, the dichotomous choice format provides good approximations to actual market transactions (Bishop and Heberlein, 1980; Welsh, 1986). The major disadvantage of a dichotomous CVM format is the complex analysis that is necessary when compared to the other two mentioned approaches. A more detailed comparison of these techniques is given by Duffield and Allen (1988).

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CHAPTER III

DESCRIPTIVE STATISTICS

The survey contained a number of questions that describe the anglers who responded: where they're from, the reasons they fish, what type of fishing they enjoy, their attitudes about possible warm water management issues, the economic value they place on the fishing experience, and some basic demographic information.

This chapter details the responses to the questions concerning the anglers' fishing and demographic information. The information is reported for the complete sample first and then broken down by individual waters.

Angler Characteristics

*   Montana residents comprised 87 percent of the sample.

*   80 percent of the anglers interviewed were men.

*   The median age was 42.

*   They had been fishing 30 years (median) and fished 12 days per year (median).

*   Only 19% of the sample belonged to a sport or conservation group

*   78 percent of the anglers rated warm water fishing as either their favorite or one of their favorite activities.

*   Of the anglers surveyed, 67 percent were employed full or part-time, 18 percent were retired and 3 percent were unemployed.

*   Median household income was $27,500. Two percent of the sample had incomes over $75,000 and three percent made less than $5,000 per year. Median income for residents and nonresidents was $27,500.

Tables 1-3 detail the important characteristics and differences of resident and nonresident anglers. Generally there are some obvious socio-demographic differences between resident and nonresident anglers, but in this case these two group are very similar.

Nonresident anglers spent significantly more than resident anglers in all catagories listed. This is not unusual given that nonresidents traveled almost four times farther, 70 vs. 240 miles.

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Table 1. Warm water angler characteristics and trip information
          for resident and nonresident fishermen (Mean values).

Characteristic	Resident	Nonresident
Years fished	29	35
Days fished per year	22	22
Days fished this trip	2	2.5
Age	43	49
Education	Some college	Some college
Income	$31,126	$34,384

Table 2. Most recent warm water fishing trip characteristics by
          residency.

Characteristic	Residents	Nonresidents
Percent hiring a guide	1	2
Percent fishing from:		
1. Boat	38	23
2. Shore	42	43
3. Both	20	34
Average miles driven	76	238
Average driving time	2	6

Table 3. Warm water anglers expenditures by residency

Statistic	Residents	Nonresidents
Transportation Costs	$ 24.67	$ 86.28
Food, Beverages, Lodging	22.73	74.63
Guide Fees, Equip. for trip	12.00	36.67
Total per trip	$ 59.40	$ 197.58
Average Per Day Expenditure	$ 29.70	$ 79.03

Angling Experiences

There are many reasons why a person chooses to fish. The survey asked the anglers to respond to nine general reasons for fishing. Their responses provide insight into the types of fishing experiences they are looking for as well as an indication of their management preferences. Table 4 shows the relative importance of these nine reasons for fishing.

Table 4. General reasons for fishing (reported in percentage).

	Very Important	Important	Not Very Important	Not at all Important
a.Catch wild fish	16	42	28	14
b.Catch many fish	10	36	43	12
c.Learn about fish	10	38	32	21
d.Get away from it all	54	36	7	2
e.To catch large fish	25	42	29	5
f.To be outdoors	68	29	2	1
g.To catch fish to eat	23	43	24	10
h.Test my fishing skills	20	40	26	13
i.Be with family/friends	49	39	8	4

As this table illustrates, the most important reasons for going fishing are related to enjoying the outdoors, getting away from it all, or being with family/friends followed closely by reasons directly associated with fishing.

Asked to choose the three most important reasons of the nine, the anglers again picked to be outdoors, to get away from it all and to be with family and friends.

Anglers choose to fish a specific body of water for many reasons; it may be close to home, fishing has been good before, little angler pressure, or the expectation of catching a big fish. The following tables (Tables 5a-5m) provide a summary of the importance of these reasons for the thirteen sampled waters. Their responses provide valuable insight into the types of anglers fishing a particular water and illustrate the reasons they chose to fish a specific lake/reservoir or river. Percentages across rows in the following tables may not add to 100% due to rounding.

Table 5a. Reasons for fishing Bighorn Reservoir (reported in percentage).

	Very Important	Important	Not very important	Not at all important
a.Good fishing before	33	59	7	
b.Fish somewhere new		23	36	41
c.Close to home	24	32	28	16
d.Scenery	23	46	23	8
e.Few anglers	4	38	42	17
f.Boat ramps available	27	38	19	15
g.Public fishing access	28	48	12	12
h.To catch big fish	39	36	25	
i.Specific fish here	44	40	8	8
j.Commercial services	4	17	25	54
k.Heard about from family		17	25	58
l.To catch lots of fish	15	50	35	

Table 5b. Reasons for fishing Cooney Reservoir (reported in percentage).

	Very Important	Important	Not very Important	Not at all important
a.Good fishing before	22	53	15	9
b.Fish somewhere new	3	11	18	68
c.Close to home	55	31	9	5
d.Scenery	1	23	47	28
e.Few anglers	1	19	44	36
f.Boat ramps available	20	36	20	25
g.Public fishing access	27	62	4	7
h.To catch big fish	12	36	32	19
i.Specific fish here	13	39	28	20
j.Commercial services	7	5	27	61
k.Heard about from family	3	10	21	67
l.To catch lots of fish	16	33	32	19

Table 5c. Reasons for fishing Fort Peck Reservoir (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	22	47	18	13
b.Fish somewhere new	9	14	33	45
c.Close to home	27	48	12	13
d.Scenery	11	44	28	18
e.Few anglers	10	29	48	12
f.Boat ramps available	36	33	11	20
g.Public fishing access	34	43	11	10
h.To catch big fish	36	47	10	5
i.Specific fish here	45	37	15	3
j.Commercial services	12	14	37	36
k.Heard about from family		11	46	42
l.To catch lots of fish	19	49	24	7

Table 5d. Reasons for fishing Lake Francis (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	32	49	14	5
b.Fish somewhere new	11	14	31	44
c.Close to home	24	22	16	38
d.Scenery		17	36	47
e.Few anglers		20	57	23
f.Boat ramps available	24	47	21	8
g.Public fishing access	38	46	14	3
h.To catch big fish	26	56	15	3
i.Specific fish here	56	36	5	3
j.Commercial services		16	41	43
k.Heard about from family	6	17	40	37
l.To catch lots of fish	8	49	35	8

Table 5e. Reasons for fishing Fresno Reservoir (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	41	50	6	3
b.Fish somewhere new	4	15	42	38
c.Close to home	50	28	19	3
d.Scenery		21	55	24
e.Few anglers		36	57	7
f.Boat ramps available	29	26	16	29
g.Public fishing access	32	42	13	13
h.To catch big fish	45	32	23	
i.Specific fish here	32	55	13	
j.Commercial services	7	3	21	69
k.Heard about from family	7	17	17	60
l.To catch lots of fish	25	41	25	9

Table 5f. Reasons for fishing Holter Reservoir (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	36	46	11	7
b.Fish somewhere new	3	12	28	57
c.Close to home	28	38	18	16
d.Scenery	21	46	25	7
e.Few anglers	2	22	44	31
f.Boat ramps available	28	38	13	21
g.Public fishing access	30	51	10	8
h.To catch big fish	28	45	17	9
i.Specific fish here	27	44	16	12
j.Commercial services	4	10	33	52
k.Heard about from family	4	13	23	60
l.To catch lots of fish	15	38	26	20

Table 5g. Reasons for fishing Milk River (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	34	45	17	3
b.Fish somewhere new	4	14	36	43
c.Close to home	53	37	10	
d.Scenery	4	32	36	25
e.Few anglers	29	50	11	11
f.Boat ramps available		4	19	74
g.Public fishing access	11	30	19	37
h.To catch big fish	31	34	14	21
i.Specific fish here	43	39	11	7
j.Commercial services			22	74
k.Heard about from family	4	7	30	56
l.To catch lots of fish	21	32	25	18

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Table 5h. Reasons for fishing the Missouri River (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	30	38	17	16
b.Fish somewhere new	5	31	36	28
c.Close to home	25	34	12	29
d.Scenery	17	41	27	14
e.Few anglers	10	44	32	15
f.Boat ramps available	5	18	25	52
g.Public fishing access	15	39	27	19
h.To catch big fish	34	55	9	2
i.Specific fish here	42	36	14	8
j.Commercial services		5	22	73
k.Heard about from family	8	19	24	48
l.To catch lots of fish	21	35	31	13

Table 5i. Reasons for fishing Swan Lake (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	29	33	13	25
b.Fish somewhere new	9	18	14	59
c.Close to home	21	25	33	21
d.Scenery	29	46	17	8
e.Few anglers	16	36	36	12
f.Boat ramps available	4	50	17	29
g.Public fishing access	14	50	14	23
h.To catch big fish	38	58		4
i.Specific fish here	46	29	21	4
j.Commercial services		4	39	57
k.Heard about from family		4	26	70
l.To catch lots of fish	9	22	39	30

Table 5j. Reasons for fishing Thompson Lakes (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	27	42	21	9
b.Fish somewhere new	3	12	29	56
c.Close to home	12	24	32	32
d.Scenery	9	63	19	9
e.Few anglers	16	34	38	13
f.Boat ramps available	13	33	27	27
g.Public fishing access	29	41	18	12
h.To catch big fish	25	38	28	9
i.Specific fish here	22	50	19	9
j.Commercial services	3	3	15	79
k.Heard about from family		13	26	61
l.To catch lots of fish	6	52	24	18

Table 5k. Reasons for fishing Tiber Reservoir (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	27	47	22	3
b.Fish somewhere new	2	17	28	54
c.Close to home	21	30	14	34
d.Scenery		13	31	56
e.Few anglers	6	24	57	13
f.Boat ramps available	19	46	19	16
g.Public fishing access	25	59	14	2
h.To catch big fish	38	36	23	3
i.Specific fish here	41	39	13	7
j.Commercial services		7	35	58
k.Heard about from family	4	10	35	52
l.To catch lots of fish	14	43	34	9

Table 5l. Reasons for fishing Tongue River Reservoir (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	31	53	9	7
b.Fish somewhere new	10	28	25	38
c.Close to home	21	26	32	21
d.Scenery	7	20	40	33
e.Few anglers	5	29	44	22
f.Boat ramps available	20	23	23	34
g.Public fishing access	31	49	11	9
h.To catch big fish	13	57	22	9
i.Specific fish here	46	42	6	6
j.Commercial services	2	20	38	40
k.Heard about from family	3	28	28	43
l.To catch lots of fish	17	67	7	9

Table 5m. Reasons for fishing the Lower Yellowstone River (reported in percentage).

	Very Important	Important	Not very Important	Not at all Important
a.Good fishing before	23	49	16	12
b.Fish somewhere new	2	20	29	48
c.Close to home	45	36	4	14
d.Scenery	13	42	25	20
e.Few anglers	18	42	27	14
f.Boat ramps available	6	18	25	50
g.Public fishing access	32	42	12	14
h.To catch big fish	30	42	20	8
i.Specific fish here	29	39	20	12
j.Commercial services	1	11	21	66
k.Heard about from family	6	17	23	54
l.To catch lots of fish	18	36	22	24

Management Preferences

The management of the warm water fisheries throughout the state is a complex job. Fish managers are faced with problems that are biological as well as social e.g. crowding, conflicts between competing user groups, etc. To assist with the decisions that need to be made a number of questions were asked that address these issues. The following tables provide insight into what anglers feel are problems on the sampled waters.

Table 6a.   Major problems associated with Big Horn Reservoir.

		Count	Percent
a.	Too many nonfishing users	3	7 %
b.	Too many anglers	3	7 %
c.	Too many boats	2	4 %
d.	Too few fish	7	15 %
e.	Fish are too small	4	9 %
f.	Water levels	12	26 %
g.	Intro of new species	2	4 %
h.	Access not adequate	4	9 %
i.	Poor fish habitat	1	2 %
l.	Water quality	2	4 %
m.	Lack of forage fish	3	7 %
n.	Other	3	7 %

Table 6b. Major problems associated with Cooney Reservoir.

		Count	Percent
a.	Too many nonfishing users	37	18 %
b.	Too many anglers	8	4 %
c.	Too many boats	34	16 %
d.	Too few fish	32	15 %
e.	Fish are too small	24	12 %
f.	Water levels	12	6 %
g.	Intro of new species	4	2 %
h.	Access not adequate	11	5 %
i.	Poor fish habitat	10	5 %
k.	Too much access	3	1 %
l.	Water quality	5	2 %
m.	Lack of forage fish	5	2 %
n.	Other	23	11 %

Table 6c. Major problems associated with Fort Peck Reservoir.

		Count	Percent
a.	Too many nonfishing users	2	1 %
c.	Too many boats	3	2 %
d.	Too few fish	33	21 %
e.	Fish are too small	4	3 %
f.	Water levels	45	29 %
h.	Access not adequate	28	18 %
i.	Poor fish habitat	13	8 %
j.	Fishing derbys	3	2 %
k.	Too much access	2	1 %
l.	Water quality	1	1 %
m.	Lack of forage fish	13	8 %
n.	Other	8	5 %

Table 6d.   Major problems associated with Lake Francis.

		Count	Percent
a.	Too many nonfishing users	1	1 %
b.	Too many anglers	4	5 %
c.	Too many boats	3	4 %
d.	Too few fish	10	14 %
e.	Fish are too small	20	27 %
f.	Water levels	15	20 %
g.	Intro of new species	4	5 %
h.	Access not adequate	6	8 %
l.	Water quality	1	1 %
m.	Lack of forage fish	2	3 %
n.	Other	8	11 %

Table 6e.   Major problems associated with Fresno Reservoir.

		Count	Percent
a.	Too many nonfishing users	6	5 %
b.	Too many anglers	2	2 %
c.	Too many boats	4	4 %
d.	Too few fish	19	17 %
e.	Fish are too small	14	12 %
f.	Water levels	27	24 %
g.	Intro of new species	3	3 %
h.	Access not adequate	7	6 %
i.	Poor fish habitat	7	6 %
l.	Water quality	10	9 %
m.	Lack of forage fish	6	5 %

Table 6f. Major problems associated with Holter Reservoir.

		Count	Percent
a.	Too many nonfishing users	19	7 %
b.	Too many anglers	16	6 %
c.	Too many boats	33	12 %
d.	Too few fish	65	23 %
e.	Fish are too small	30	11 %
f.	Water levels	6	2 %
g.	Intro of new species	4	1 %
h.	Access not adequate	34	12 %
i.	Poor fish habitat	5	2 %
j.	Fishing derbys	1	0 %
k.	Too much access	3	1 %
l.	Water quality	3	1 %
m.	Lack of forage fish	9	3 %
n.	Other	50	18 %

Table 6g. Major problems associated with Milk River.

		Count	Percent
a.	Too many nonfishing users	1	2 %
d.	Too few fish	13	21 %
e.	Fish are too small	8	13 %
f.	Water levels	15	25 %
g.	Intro of new species	2	3 %
h.	Access not adequate	5	8 %
i.	Poor fish habitat	3	5 %
l.	Water quality	7	11 %
m.	Lack of forage fish	2	3 %
n.	Other	5	8 %

Table 6h. Major problems associated with the Missouri River.

		Count	Percent
b.	Too many anglers	4	3 %
d.	Too few fish	24	18 %
e.	Fish are too small	8	6 %
f.	Water levels	30	23 %
g.	Intro of new species	2	2 %
h.	Access not adequate	19	15 %
i.	Poor fish habitat	8	6 %
k.	Too much access	3	2 %
l.	Water quality	13	10 %
m.	Lack of forage fish	8	6 %
n.	Other	12	9 %

Table 6i. Major problems associated with Swan Lake.

		Count	Percent
a.	Too many nonfishing users	4	10 %
b.	Too many anglers	1	2 %
c.	Too many boats	2	5 %
d.	Too few fish	9	21 %
e.	Fish are too small	8	19 %
f.	Water levels	1	2 %
g.	Intro of new species	3	7 %
h.	Access not adequate	3	7 %
i.	Poor fish habitat	2	5 %
l.	Water quality	1	2 %
m.	Lack of forage fish	1	2 %
n.	Other	7	17 %

Table 6j. Major problems associated with Thompson Lakes.

		Count	Percent
a.	Too many nonfishing users	1	2 %
b.	Too many anglers	1	2 %
c.	Too many boats	4	7 %
d.	Too few fish	18	30 %
e.	Fish are too small	10	17 %
f.	Water levels	2	3 %
g.	Intro of new species	4	7 %
h.	Access not adequate	5	8 %
i.	Poor fish habitat	2	3 %
j.	Fishing derbys	3	5 %
k.	Too much access	2	3 %
l.	Water quality	4	7 %
n.	Other	4	7 %

Table 6k. Major problems associated with Tiber Reservoir.

		Count	Percent
a.	Too many nonfishing users	2	2 %
b.	Too many anglers	1	1 %
c.	Too many boats	1	1 %
d.	Too few fish	29	23 %
e.	Fish are too small	14	11 %
f.	Water levels	34	27 %
g.	Intro of new species	2	2 %
h.	Access not adequate	6	5 %
i.	Poor fish habitat	10	8 %
j.	Fishing derbys	2	2 %
m.	Lack of forage fish	15	12 %
n.	Other	11	9 %

Table 6l. Major problems associated with Tongue River Reservoir.

		Count	Percent
a.	Too many nonfishing users	19	16 %
b.	Too many anglers	3	2 %
c.	Too many boats	13	11 %
d.	Too few fish	9	7 %
e.	Fish are too small	9	7 %
f.	Water levels	25	20 %
h.	Access not adequate	9	7 %
i.	Poor fish habitat	5	4 %
j.	Fishing derbys	1	1 %
k.	Too much access	2	2 %
l.	Water quality	5	4 %
m.	Lack of forage fish	5	4 %
n.	Other	17	14 %

Table 6m. Major problems associated with the Lower Yellowstone River.

		Count	Percent
a.	Too many nonfishing users	8	3 %
b.	Too many anglers	13	5 %
c.	Too many boats	5	2 %
d.	Too few fish	58	22 %
e.	Fish are too small	16	6 %
f.	Water levels	47	18 %
g.	Intro of new species	5	2 %
h.	Access not adequate	38	15 %
i.	Poor fish habitat	11	4 %
l.	Water quality	26	10 %
m.	Lack of forage fish	6	2 %
n.	Other	27	10 %

The items that anglers mentioned most frequently were water levels, too few fish or fish are too small. Anglers on a number of waters also felt that access was not adequate or there were too many nonfishing users. Fifty anglers or 18% of the respondents on Holter Reservoir checked the "other" category. Examining their written responses revealed a wide variety of concerns ranging from too much night fishing to the wind was a problem.

The questions regarding fisheries management issues presented anglers with ten management options for the water they fished (See Section IV, question 1 of the questionnaire for a complete list of options). Anglers were asked to rank their first and second choices. Three management options were ranked either first or second by the majority of anglers across all the sampled waters. These were: maintain water/stream levels favorable to fish, stocking water with hatchery fish, and develop self-sustaining populations. The following tables present the results of this question.

Table 7. Management options favored by warm water anglers, by water.

Water	Management Options	
	First Choice	Second Choice
Big Horn	water levels	stocking
Cooney	stocking	water levels
Fort Peck	water levels	stocking
Lake Francis	water levels	stocking
Fresno	water levels	stocking
Holter	stocking	water levels
Swan Lake	self sustaining pop	stocking
Thompson	self sustaining pop	stocking
Tiber	water levels	stocking
Tongue River Res.	water levels	stocking self sustaining pop
Milk River	stocking	self sustaining pop
Missouri River	self sustaining pop	water levels
Lower Yellowstone	water levels	access

Warm water anglers were also asked to rank their first and second
choices of possible regulations for increasing or maintaining large
fish in a water. Table 8 presents a summary of the top ranked
choices.

Table 8.   If more restrictive regulations were needed to increase or maintain
the number of large fish in a water, which of the following
regulations would you prefer?

Water	Restrictive Regulation		
	First Choice	Second Choice	Third Choice
Big Horn	slot limit	keep only 1 large fish	reduce total limit
Cooney	keep only 1 large fish	slot limit	reduce total limit
Fort Peck	slot limit	1 large fish	reduce total limit
Lake Francis	slot limit	1 large fish	reduce total limit
Fresno	slot limit	1 large fish	reduce total limit
Holter	slot limit	1 large fish	reduce total limit
Swan Lake	slot limit	1 large fish	reduce total limit
Thompson	reduce total limit	slot limit	1 large fish
Tiber	slot limit	1 large fish	reduce total limit
Tongue R. Res.	slot limit	reduce total limit	1 large fish
Milk River	slot limit	1 large fish	reduce total limit
Missouri River	slot limit	1 large fish	reduce total limit
Lk Yellowstone	1 large fish	1 large fish	reduce total limit

The following table shows which species of fish anglers were after
when fishing these lakes and rivers. Respondents were asked to
indicate their top three choices.   A majority of the anglers
simply indicated which species they were fishing for with a check.

Table 9. Primary fish species you chose this water for.

Water	Species	Count	Percent
Cooney	Kokanee	1	1
	Salmon	1	1
	Trout	72	54
	Walleye	59	44
Thompson Lakes	Kokanee	14	15
	Largemouth Bass	22	24
	Perch	27	30
	Pike	12	13
	Trout	16	18
Missouri River	Catfish	25	15
	Paddlefish	28	17
	Perch	1	1
	Pike	26	16
	Salmon	1	1
	Sauger	31	19
	Sturgeon	4	2
	Trout	8	5
	Walleye	40	24
Holter	Brown	65	16
	Perch	75	18
	Rainbow	156	38
	Salmon	20	5
	Walleye	88	22
Swan Lake	Bass	9	20
	Perch	7	16
	Pike	17	38
	Salmon	5	11
	Trout	7	16
Fort Peck Res.	Drum	1	1
	Pike	38	22
	Sauger	26	15
	Smallmouth Bass	19	11
	Sturgeon	1	1
	Trout	31	18
	Walleye	57	33
Big Horn	Catfish	9	15
	Crappies	6	10
	Largemouth Bass	5	8
	Perch	4	7
	Trout	13	22
	Walleye	22	37

Water	Species	Count	Percent
Tongue River	Catfish	9	7
	Crappie	38	29
	Perch	2	2
	Pike	1	1
	Sauger	5	4
	Smallmouth Bass	32	25
	Walleye	42	33
Yellowstone River	Catfish	88	28
	Ling	23	7
	Paddlefish	13	4
	Sauger	64	22
	Smallmouth Bass	16	5
	Sturgeon	20	6
	Walleye	82	26
Tiber Reservoir	Ling	9	5
	Perch	44	27
	Pike	42	26
	Trout	11	7
	Walleye	58	35
Milk River	Catfish	12	16
	Pike	21	28
	Sauger	12	16
	Trout	5	7
	Walleye	26	34
Lake Francis	Ling	5	5
	Perch	27	27
	Pike	31	31
	Walleye	37	37
Fresno	Perch	23	28
	Pike	29	35
	Walleye	31	37

CHAPTER IV

CONTINGENT VALUATION ESTIMATES

Contingent Valuation Questions

The warm water angler survey asked respondents to provide information about their most recent trip. To estimate the net economic value of warm water fishing, anglers were asked to respond to a dichotomous choice contingent valuation question. The first question asked:

Suppose that your share of the expenses to visit (Water name) increased, would you still have made the trip if they had been $ xxxx more?

The angler was given the opportunity to respond yes or no to this question. The dollar amounts that were written in varied from $5.00 to $2000.00 and were randomly distributed across the sample.

In addition to the current trip question, two CVM questions were asked that presented hypothetical situations based on the angler's current trip. The questions presented the anglers with situations of improved quality, either in their chances of catching a large fish or the number of fish they caught. These two questions are presented below.

Imagine that everything about this last trip was the same, except that your chance of catching a large fish was **twice** as great and your trip costs were $xxxx more than your actual costs. Would you still have made the trip under these circumstances.

If you caught at least one fish, imagine that everything about this last trip was the same, except that you caught **twice** as many fish as you actually did and that your trip costs were $xxxxx more than your actual costs. Would you still have made the trip under these circumstances?

These two questions determine anglers' willingness to pay for improved conditions - either larger fish or more fish.

Protest Bids and Outliers

There are two types of responses to the CVM questions that require scrutiny to insure that the benefit estimates are not biased upward. The first type is referred to as protest responses. The Water Resources Council recommends asking a followup question to determine if any protest responses have occurred. The followup question in the warm water survey was: "If no, would you have made the trip if your share of the expenses had been only $1.00 more?" If the angler responded no to this question, he/she was asked to

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explain why. The responses that were considered to be protests to the market situation included:

  * Anglers saying they did not understand the question.
  * Those anglers that said they opposed any increase in taxes or fees.

The second type of response that was considered for exclusion were those anglers who said they would pay the stated bid amount but based on their income level would be unable to do so.

A respondents' ability to pay was calculated as the percentage of their income they were willing to spend on warm water fishing:

  Percent = (Actual out of pocket costs + bid amount) X (the number of trips the angler said he would take) /income.

If Percent was greater than one, those persons were excluded from the analysis since they obviously could not afford to pay the stated bid amount. This resulted in one percent of the sample being excluded.

Model Specification

The estimates of net economic value for warm water fishing presented later are based on the sampled anglers' responses to the CVM questions. Anglers reponses were analyzed using a logistic regression model. Duffield and Patterson (1991) furnish a comprehensive discussion of this method.

Economic theory suggests that as the bid amount increases, the probability of a yes response will decrease. By using a bivariate form of the logit model where the anglers' response (yes or no) is regressed against the bid amount, benefits estimates can be calculated. The following bivariate model was used in this study:

  (1) $\ln(p/1-p) = B_o - B_1 \ln(bid)$

The estimated equations are shown in Appendix B. The coefficients for the independent variable ln(bid) had the expected sign and the statistics associated with the goodness of fit for the estimated models were generally good. These results indicated the responses are consistent with economic theory and the model used provides a good fit to the data.

Benefit Estimates

The net economic values associated with warm water fishing for the complete sample are presented in Table 10. The method used to calculate these net economic values is MEAN-LOGIT. The measure of net economic value used is the mathematical expectation or the mean of maximum willingness to pay. The probability of a yes response

is plotted against the bid level. At low bid levels the acceptance or yes response is high. As the bid amount increases, acceptance decreases and asymptotically approaches zero at the higher bid levels. Integrating the area under the curve from a bid level of zero to some upper limit provides an estimate of the mean (MEAN-LOGIT). The upper level of integration in this study was $2000. In the tables this truncated mean measure of net economic benefits is designated as "MEAN-LOGIT". The t statistics associated with the bivariate equations are significant at the 95% level. The goodness of fit statistics, Chi-squared, related to the equations showed good fit for the disaggregated models, i.e. resident, nonresident, individual waters, but not for the complete sample model.

Table 10. Net economic values for warm water fishing for the current trip – per trip and per day: Complete sample and residency subsamples.

	State	Residents	Nonresidents
PER TRIP VALUES:			
Mean-Logit	$121.42	$108.00	$197.00
PER DAY VALUES:			
Mean-Logit	$ 60.71	$54.00	$78.80

As Table 10 shows, there is considerable difference between the resident and nonresident values. This is consistent with the results of other studies and points out on average nonresidents place a higher value on their fishing experience than do residents.

Previous studies have also reported net economic values based on the median. Generally these values are lower than the estimates using the mean values. The median shows the amount that at least half the sample would be willing to pay but overlooks those respondents that are willing to pay substantially more than the median. To estimate the total benefits of warm water fishing, the MEAN-LOGIT estimates are the correct measure. See Duffield and Patterson (1991) for a discussion of the choice of welfare measures.

Analysis of Values for Improved Conditions

An objective of the warm water angler survey was to estimate the net economic values for the current trip under hypothetically improved conditions. The improved conditions were 1) doubling an anglers chances of catching a large fish and 2) catching twice as many fish as they actually did.

The benefit estimates for the complete sample (presented in Table 11 - Section A) from these two economic questions indicated that the sampled anglers did not value the improved conditions higher than the current trip. The benefit estimates for the two improved condition situations by individual water are shown in Section B, Table 11.

Table 11. Net economic values per trip associated with improved conditions - lake and reservoir fishing.

Section A		
Complete Sample	MEAN-LOGIT	
Current Trip	$121.00	
Chance to catch large fish	$129.00	
Catch more fish	$132.00	
Section B		
	MEAN-LOGIT	
Lakename	Current trip	Chance to catch large fish	Catch more fish
Cooney Res.	60.00	123.00	100.00
Fort Peck	261.00	194.00	126.00
Holter Res.	97.00	129.00	125.00
Missouri River	155.00	166.00	132.00
L. Yellowstone	108.00	105.00	88.00

Note: The truncation point for the Mean-Logit value estimates was the maximum bid level of $2000.

Due to insufficient sample sizes, benefit estimates were not calculated for the other waters. Comparison of the reported benefit estimates between waters should be done with caution. Confidence intervals have not been calculated for these estimates and there may not be any statistical differences between waters due to sample size differences.

Comparison of Results to Previous Studies

A 1987 travel cost model study of Montana's lake and stream fishermen provides the most current comparison for this study's results. The TCM study by Duffield, Loomis and Brooks (1987) found that a lake fishing trip in Montana had an average net economic value of $88.00 per trip or $70.00 per day compared to a net economic value of $166.00 per trip or $63.00 per day for this CVM study. A major difference between the studies was the average (mean) number of days fished per trip. Mean days fished for the TCM study was 1.17 while the mean number of days fished for this study was 2.6.

A study by Brown, et.al. (1987) using the information from the 1980 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation estimated the net economic value for a day of trout fishing at $12.00 per day in 1980 dollars.

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APPENDIX A.

Survey Instrument

TONGUE RIVER
ANGLER SURVEY

SUMMER 1989

I. First, we have some general questions about your fishing.

1. How many years have you been fishing? _____ Years

2. About how many days a year do you fish for species other than trout or salmon? _____ Days

3. How would you rate fishing compared to other outdoor recreation activities you do? (please check one)

_____ It's my favorite outdoor recreation activity

_____ It's one of my favorite outdoor recreation activities

_____ It's just one of several outdoor recreation activities that I do

_____ I prefer to participate in other outdoor recreation activities

4. About what percent of your fishing time do you spend at each

Large lakes (Greater than 100 acres) _____ %

Small Lakes (Public) _____ %

Small Lakes (Private) _____ %

Large rivers _____ %

Small rivers _____ %

Total _____ 100

II. The next few questions ask about your MOST RECENT FISHING TRIP to the Tongue River and your evaluation of the fishing there.

1. Approximate date(s) of this last trip: _____
(a trip could be anything from an hour to several days)

2. How many days did you fish the Tongue River on this trip?

_____ Days

3. About how many hours per day did you fish?

_____ Hours per day

4. What type of fishing equipment did you use? (check all types used)

_____ Live Fish   _____ Snagging Hook

_____ Other Bait   _____ Set Lines (trotline, Jugs)

_____ Lures   _____ Spear Fishing

5. Would you estimate the current market value of the equipment you have purchased over the years primarily for warmwater fishing (ie. boat, motor, trailer, fishing gear, ect.)

$ _____ Total

6. About how many fish did you catch on this trip?

Species	Number Caught	Number Kept
1. Smallmouth Bass	_____	_____
2. Channel Catfish	_____	_____
3. Sauger	_____	_____
4. Walleye	_____	_____
5. Crappie	_____	_____
6.	_____	_____
7.	_____	_____

8. Did you use a fishing guide or outfitter?
_____ Yes   _____ No

7. Did you fish from shore, from a boat, or both?

_____ Shore   _____ Boat   _____ Both

8. How many other anglers were in your party?

_____ # of other anglers that came with me

9. Was this your first visit to the Tongue River?

_____ Yes

_____ No. If no, how many years have your been fishing the Tongue River?
_____ Years

10. How many separate trips did you make from your home to the Tongue River this year?

_____ Separate trips from home this year

11. People fish for many reasons. We'd like to know some of the general reasons you fish to help us understand different types of anglers and their preferences.

Following is a list of possible reasons for fishing. Please check the box that says whether that reason was very important, important, not very important, or not at all important.

	Very Important	Important	Not very Important	Not at all Important
a. To catch wild fish	☐	☐	☐	☐
b. To catch many fish	☐	☐	☐	☐
c. To learn more about fish	☐	☐	☐	☐
d. To get away from it all	☐	☐	☐	☐
e. To catch large fish	☐	☐	☐	☐
f. To be outdoors	☐	☐	☐	☐
g. To catch fish to eat	☐	☐	☐	☐
h. To test my fishing skills	☐	☐	☐	☐
i. Companionship with family/friends	☐			

12. Please look back over this list and circle the **THREE** most important reasons

13. Was this water the main (or only) water you fished on this trip, or did you fish other waters? (Please check one)

_____ This water was the main (or only) place I fished on this trip.

_____ Fishing at other waters was just as important as fishing this one.

_____ Fishing other waters was more important than fishing this place this trip.

14. Was fishing the main purpose of your trip when you fished this water or did you make the trip for other reasons such as business or a family vacation?

_____ Fishing was the main purpose of this trip

_____ Fishing was one of several reasons for making the trip

_____ The main purpose of this trip was not to fish, but for other reasons.

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15. Based on your fishing experience do you think any of the following are major problems on this water?

_____ Too many nonfishing users   _____ Access not adequate

_____ Too many anglers   _____ Poor fish habitat

_____ Too many boats   _____ Fishing Derbys

_____ Too few fish   _____ Too much access

_____ Fish are too small   _____ Water quality

_____ Water levels   _____ Lack of forage fish

_____ Introduction of new species   _____ Other: _____

16. How did the number of recreationists present affect your enjoyment of this trip?

_____ Water was too crowded

_____ No effect

_____ Presence of others added to my enjoyment

17. Do you plan to continue fishing the Tongue River?

_____ Yes   _____ No

18. If yes, about how frequently do you plan to fish the Tongue River? (check one)

_____ As frequently as I do now

_____ More frequently than I do now

_____ Less frequently than I do now

_____ I'm not sure

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20. Please indicate the reasons you chose to fish the Tongue River this trip. The following list gives some of the possible reasons. Indicate whether the reason was very important, important, not very important, or not at all important.

	Very Important	Important	Not very Important	Not at all Important
a. I've had good fishing here before	☐	☐	☐	☐
b. To fish somewhere new	☐	☐	☐	☐
c. It's close to home	☐	☐	☐	☐
d. Because of the scenery	☐	☐	☐	☐
e. There are few anglers here	☐	☐	☐	☐
f. Boat ramps available	☐	☐	☐	☐
g. Available public fishing access	☐	☐	☐	☐
h. Chance to catch large fish	☐	☐	☐	☐
i. Presence of specific fish species	☐	☐	☐	☐
j. Commercial services available	☐	☐	☐	☐
k. Heard about it from friends / media	☐	☐	☐	☐
l. Chance to catch many fish	☐	☐	☐	☐

21. Please look back over this list and circle the letters of the **THREE** most important reasons you chose to fish the Tongue River.

22. How does the Tongue River compare to other waters in Montana? (please check one)

_____ It's my favorite place to fish

_____ It's one of my favorite places to fish

_____ It's one of many places where I fish

_____ I prefer to fish other places

23. If you could not have fished the Tongue River, where might you have fished instead? _____ Name of water

24. About how far is it from your home to this alternative fishing location?

_____ Miles

25. How does it compare to fishing the Tongue River?

_____ Tongue River is much better

_____ Tongue River is better

_____ Same

_____ Tongue River is worse

_____ Tongue River is much much worse

III. The next few questions will help us to understand the value people place on fishing the Tongue River.

We realize you aren't used to considering fishing this way, but please think about it and give us your best estimate!

1. About how far is it from your home to where you fished the Tongue River this trip?

_____ Miles (one-way)

2. How long did it take to travel from your home to the Tongue River?

_____ Hours (include any stops made en route)

4. About how much did you personally spend on this trip:

_____ Amount I spent for transportation (gas, car rental, airfare, any other transportation costs)

_____ Amount I spent on food, beverages, lodging

_____ Amount spent on equipment purchased just for this trip, guide fees, other expenses.

_____ TOTAL SPENT ON THIS FISHING TRIP.

5. Suppose that your share of the expenses to visit the Tongue River increased, would you still have made the trip if they had been $ _____ more?

_____ Yes, I would still have made the trip.

_____ No. If no, would you have made the trip if your share of the expenses had been **$1.00** more?

    _____ Yes

    _____ No. If no, could you briefly explain why not.

6. What was the primary fish species you chose this water for? (Please rank the top 3, 1 being most important)

_____ Smallmouth Bass   _____ Channel Catfish

_____ Sauger   _____ Walleye

_____ Crappie

7. For the **species** you primarily fished for on this trip, what do you consider to be a large fish?

_____ inches

8. For the primary fish you were after in the Tongue River, how many **LARGE** fish did you catch?

_____ Large fish caught

9. Imagine that everything about this last trip was the same, except that your chance of catching a large fish was **twice** as great AND your trip costs were $ _____ more than your actual cost. Would you still have made the trip under these circumstances? (Please check one)

_____ Yes, I would still have made the trip

_____ No. If no, would you have made the trip if your share of the expenses had been **$1.00** more?

    _____ Yes

    _____ No. If no, could you briefly explain why not?

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10. If you caught at least one fish, imagine that everything about this last trip was the same, except that you caught **twice** as many fish as you actually did AND your trip costs were $ _____ more than your actual cost. Would you still have made the trip under these circumstances?

_____ Yes, I would still have made the trip

_____ No. If no, would you have made the trip if your share of the expenses had been **$1.00** more?

    _____ Yes

    _____ No. If no, could you briefly explain why not?

IV. The next few questions ask your opinion on different statewide fisheries management options.

1. In general, which two of the following management programs do you favor the most for managing the Tongue River? (Please rank your top choice number 1 and your second choice number 2)

_____ Develop self sustaining populations

_____ Stocking waters with hatchery fish

_____ Artificial habitat improvement

_____ Maintaining water/stream levels favorable to fish

_____ Introduction of new game fish species

_____ Improve forage fish populations

_____ Controlling population levels of nongame fish

_____ More restrictive fishing regulations

_____ More liberal fishing regulations

_____ Improving fishing access

_____ Other

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2. In general, do you think Montana's warm water should be managed to provide:

___ Many fish, smaller average size, liberal limits

___ Fewer fish, larger average size, more restrictive limits

___ No opinion ___

3. Do you think a small number of waters with high potential should be managed specifically to produce large sized fish?

___ Yes

___ No

___ No opinion

4. If more restrictive regulations were needed to increase or maintain the number of large fish in a water, which two of the following regulations would you prefer? (Please rank your top choice number 1 and your second choice number 2)

___ Shorten season length

___ Catch and release all fish

___ Keep only small fish

___ Keep only one large fish

___ Reduce total limit

___ Slot limit (Catch and keep fish under a minimum size and one fish over a maximum size, release all others)

V. **These last few questions will help us understand your responses by knowing some basic information about you.**

1. Where are you from? City: ___ State: ___

2. What is your age ___ Years

3. Are you ___ Male ___ Female

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4. Are you a member of any fishing or conservation organization?

___ Yes   ___ No

5. If so, which ones?

6. What is the highest year of formal education you completed?

___ Some grade school   ___ Some college

___ Finished grade school   ___ Finished college

___ Finished junior high school   ___ Some postgraduate work

___ Finished high school   ___ Finished postgraduate

7. If you had not gone fishing this trip, would you have been working instead?

___ Yes   ___ No

8. During the fishing season this year, were you : (check one)

___ Employed full time   ___ Retired

___ Employed part time   ___ Homemaker

___ Unemployed   ___ Other:

9. Please check your household's income before taxes last year:

___ Under 5,000   ___ 20,000- 24,999   ___ 40,000-49,999

___ 5,000-9,999   ___ 25,000-29,999   ___ 50,000-74,999

___ 10,000-14,999   ___ 30,000-34,999   ___ 75,000-100,000

___ 15,000-19,999   ___ 35,000-39,999   ___ over 100,000

Thank you for your help. This information will be held in strict confidence and will be used for management purposes only. Is there anything else you'd like to tell us about fishing this lake? We would appreciate your comments on the next page.

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APPENDIX B

Estimated bivariate logit cvm equations for warm water fishing - complete sample, residency subsamples, improved conditions.

Model	Intercept (T-Stat)	Ln(Bid) (T-Stat)
Complete Sample: Current Trip	3.8057 (11.67)	-1.09 (-14.38)
Likelihood Ratio/Goodness of Fit Chi Square = 10 Degrees of Freedom = 8 Prob. = .25		
Residents: Current Trip	3.68 (10.69)	-1.088 (-4.98)
Likelihood Ratio/Goodness of Fit Chi Square = 11.4 Degrees of Freedom = 8 Prob. = .18		
Nonresident: Current Trip	4.7 (4.59)	-1.12 (-4.98)
Likelihood Ratio/Goodness of Fit Chi Square = 7.65 Degrees of Freedom = 8 Prob. = .4684		
Complete Sample: Large Fish	3.84 (11.07)	-1.075 (-14.34)
Likelihood Ratio/Goodness of Fit Chi Square = 17.6 Degrees of Freedom = 9 Prob. = .0395		
Complete Sample: More Fish	4.11 (12.84)	-1.116 (-15.08)
Likelihood Ratio/Goodness of Fit Chi Square = 8 Degrees of Freedom = 8 Prob. = .4225		

Estimated bivariate logit CVM equations by water: current and
improved conditions

Current Trip by water:					
	Model		Likelihood Ratio/Goodness of Fit		
	Intercept (T-Stat)	Ln (Bid) (T-Stat)	Chi Square	Degrees of Freedom	Prob.
Cooney	1.87 (1.8)	− .90 (−3.29)	9.11	8	.3333
Fort Peck	6.65 (3.37)	−1.38 (−3.78)	4.63	8	.7965
Holter	4.47 (5.59)	−1.26 (−6.63)	7.94	8	.4390
Missouri	4.52 (3.59)	−1.15 (−4.4)	11.66	8	.1670
Lake Yellowstone	3.38 (4.56)	−1.04 (−5.77)	12.05	8	.1491
Improved Conditions: Large Fish − by water:					
Cooney	2.68 (2.99)	− .88 (−4.36)	3.63	8	.8887
Fort Peck	4.86 (3.25)	−1.15 (−3.89)	7.31	7	.3976
Holter	3.64 (5.04)	−1.04 (−6.53)	8.15	8	.4187
Missouri	3.81 (3.14)	−1.00 (−4.00)	17.74	9	.0383
Lake Yellowstone	3.41 (4.32)	−1.06 (−5.73)	8.32	8	.4026
Improved Conditions: More fish − by water:					
Cooney	3.18 (3.64)	−1.02 (−4.62)	5.55	8	.6973
Fort Peck	3.86 (3.46)	−1.08 (−4.03)	11.70	8	.1651
Holter	3.85 (5.73)	−1.08 (−6.83)	8.40	8	.3958
Missouri	8.42 (3.54)	−1.92 (−3.88)	5.91	8	.6569

Current Trip by water:					
Lake Yellowstone	5.68 (5.46)	−1.59 (−5.74)	13.23	8	.1041