The Economic Value of Fishing in the Henrys Fork Watershed

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EXECUTIVE SUMMARY

Anglers travel from around the country to fish the waters of the Henrys Fork watershed, spending tens of millions of dollars within the region. Assessing changes in angler behavior, preferences, and spending is important for developing management and conservation strategies, and for prioritizing access-facility maintenance and improvements. This study is the first since the 2004 to assess angler effort, demographics, spending, and net economic contribution of angling in the watershed. We distributed 1,899 survey instruments to anglers on Henrys Lake, Henrys Fork and tributaries, and the upper Teton River in 2016, 2017, and 2018, respectively. Survey return rate was 29.5%. Angler effort was estimated on these waters by Idaho Department of Fish and Game and other partners in 2019, 2017, and 2018, respectively. We used IMPLAN outputs to estimate the economic contribution of nonresident-angler spending to the economy in a six-county region consisting of Fremont, Madison, Teton, Clark, Jefferson, and Bonneville counties in Idaho. This study is one of the first to assess the additional economic contributions of part-year residents, who represent a hybrid group of recreationists that share characteristics of both residents and nonresidents. Key findings are:

- Angler effort and spending on Henrys Lake and Henrys Fork changed relatively little between 2003-2004 and 2017-2019, averaging around 150,000 angler days and $50 million (inflation-adjusted), respectively.
- In 2017, 64% of angling effort on the Henrys Fork occurred downstream of Riverside Campground, compared with only 38% in 2004.
- Angler effort and spending on the Teton River has increased by factors of four and nine, respectively, since 2003. Spending is now on par with that of Henrys Lake.
- Anglers on the study waters spend $41 million per year in the six-county region.
- Expenditures by nonresident anglers, considered an export, account for around $17 million and 317 jobs in the six-county eastern Idaho region. This is 11% of the regional entertainment/recreation economic sector
- Expenditures by nonresident anglers support around 0.2% of the regional export economy, compared with around 4% for agriculture.
- Part-year residents make up only 15% of all anglers but 25% of angling effort. Additional days fished by these residents relative to other anglers account for 23% of all nonresident spending.
- Part-year resident anglers pay an estimated $14 million in annual property taxes within the region.
- Henrys Lake and Henrys Fork anglers place the highest value on catching trophy-sized fish, whereas Teton River anglers place the highest value on catching native Cutthroat Trout.
- The only access-related issue of importance to anglers across the watershed is need for adequate parking space and facilities.
- Crowding due to non-angling recreational floaters may limit angling experience, effort, and economic value on the Teton River.

ACKNOWLEDGMENTS

This study was a collaborative effort of the Henry's Fork Foundation, Idaho Fish and Game Department, Friends of the Teton River, and Weber State University. Henry's Fork Foundation staffed field surveys on Henrys Fork and its tributaries and the Teton River, coordinated the other groups' efforts, maintained the database of distributed and completed survey instruments, conducted most of the data analysis, and wrote the report. Idaho Fish and Game conducted aerial angler counts on Henrys Lake and Henrys Fork and its tributaries, distributed the survey instrument at Henrys Lake, and provided a vehicle for the Henrys Fork field surveys. Friends of the Teton River helped staff the Teton River Survey. Weber State University distributed all electronic surveys, received all returned electronic and paper surveys, compiled all survey data, and conducted preliminary analysis.

Funding was provided by the Community Foundation of Teton Valley and an anonymous donor. The IMPLAN model and guidance on its application was provided by Garth Taylor and Greg Alward from the University of Idaho. Damon Keen, Dan Garren, Jon Flinders, and Jenn Vincent of Idaho Department of Fish and Game provided substantial effort, guidance, and data. Henry's Fork Foundation interns Maggie Dunn, Elliot Martin, Sam Cochran, Zac Espinosa, Gary Anderson, Drew Barnard, Sonja Wolke, Liz Todd, and Zach Clayton assisted with field work. Henry's Fork Foundation technician Amber Roseberry created the study area map.

INTRODUCTION

The major fisheries of the Henrys Fork Snake River watershed—Henrys Lake, Henrys Fork, and the Teton River—have long been considered some of the most renowned in the world (Van Kirk and Gamblin 2000; Nowell and Kerkvliet 2000; Lawson 2012). The waters of the Upper Snake River Basin provide anglers with wild fish and scenic landscapes (Loomis 2006). Those who live within the Henrys Fork watershed and those who travel from afar to utilize its resources have remarked on its beauty and recognize the river's inherent value (Nowell and Kerkvliet 2000). However, quantifying the value of fishing to local and regional economies as well as to participants themselves is necessary for policy makers, agencies, and conservation groups to make informed management decisions and prioritize conservation efforts. The purpose of this study was to quantify angling use and its economic value on Henrys Lake, Henrys Fork and its major tributaries, and the Teton River.

We considered two types of value, that to the regional economy and that to the angler. The value to the regional economy consists of direct angling-related expenditures in the region and its net economic value. The net value to the regional economy includes the effects of secondary circulation within an economy. A simplified example would be the summed economic activity from an angler purchasing guide services, the guide using the revenue to purchase gasoline, and the gasoline station using its revenue to purchase janitorial services.

The value of the angling experience is measured by consumer surplus, the difference between the maximum the angler is willing to pay for the experience and the amount the angler actually spent for the experience (Taylor et al. 2014). In order to estimate the maximum amount the angler is willing to pay we used the contingent valuation method to illicit the value of the experience. The contingent valuation method (Venkatachalam 2004) asks anglers to estimate

their own benefit by answering a survey question of the form "if the cost of your daily fishing trip were $*x* greater, would you still have taken the trip?" The second type of contingent valuation question administered was designed to quantify the additional value to the angler of a hypothetical *change* in angling experience such as increased catch rate, increased size of fish caught, or more river access (Loomis 2006). This information allows resource managers, agencies or conservation groups to quantify how management actions such as changing fishing regulations, improving fish habitat, or adding access sites would change angler spending. We used stated-preference choice questions to assess how angler effort would change in response to hypothetical changes in experience (Hicks 2002; Criddle et al. 2003).

In order to properly assess expenditures, anglers are usually split into two basic groups: residents and nonresidents (Loomis 2005; Southwick Associates 2017). In this study, "residents" are anglers residing in the upper Snake River region, which we define as Bonneville, Clark, Fremont, Jefferson, Madison, and Teton counties in Idaho and Teton County, Wyoming. The six Idaho counties were selected because they form a local region of similar economic activity and because anglers residing in these counties can access the water bodies under study in less than two hours of driving. Teton County, Wyoming was included because many anglers who fish the Teton River live on the Wyoming side of the state line in Teton Valley, only minutes from the upper Teton River. However, because the economy of Teton County, Wyoming is dominated by tourism in the Jackson area and therefore differs substantially from that of the Idaho counties, we excluded it from the regional economic analysis. We also excluded neighboring Montana counties because of large differences between the economies of those counties and those of the six Idaho counties, despite closer geographic proximity to some fisheries in the watershed. We refer to anglers whose permanent residence is not located within the seven-county region as

"nonresidents". We refer to angler expenditures within the seven-county region as "in-region spending," to distinguish it from money spent on angling outside of this region.

Although standard in economic analysis of outdoor-related tourism, the distinction between residents and nonresidents does not fully account for a hybrid category of recreationists who own a home within the region but do not live in that home year-round. These part-year residents and the expenditures they make are often difficult to distinguish from similar expenditures made by residents (Jones 2015). When calculating the cost of a day's fishing for nonresidents it is common to include the cost of lodging as part of economic impact. For residents however, no similar cost is included if they spend the previous night in their home. The most recent census of vacation homes in the United States, conducted in 2000, revealed that 5.3% of homes in Idaho were for seasonal or recreational use (U.S. Census Bureau 2000). In 2003, Fremont County ranked first out of all Idaho counties in economic value of recreational fishing (Grunder et al. 2008). As a result of the popularity of this area for fishing and other outdoor recreation, it is likely a large fraction of homes in the Henrys Fork watershed are homes owned and maintained by part-year residents for extended recreational visits. If the recreational home was purchased as a direct result of the angling opportunities on the waters being studied, some part of these expenditures should be reflected in quantifying the economic impact of the resource. Despite the growing trend of owning vacation homes, little research has been done to assess the economic impacts of these homes (Huhtala and Lankia 2012). This study attempts to account for the economic impacts of part-year residents who fish in the Henrys Fork Watershed through treatment of vacation homes as a lodging option not usually represented in traditional surveys, relative contribution of part-year residents to total angler effort, and estimates of county property taxes paid on homes owned by part-year residents.

The most recent economic analyses of fishing on the Henrys Fork were conducted in 2003 (Grunder et al. 2008) and 2004 (Loomis 2005), respectively, and can be used as benchmarks against which to evaluate the results of our study. This research not only updates these older studies but is also the first to apply methodology similar to that of Loomis (2006) to the Teton River. This study can also be used as a benchmark for future studies, given that recreational use and value is likely to continue changing. We hope that policy makers, agencies and conservation groups will use this study to inform decisions regarding the management of important recreational fisheries in the Henrys Fork watershed.

OBJECTIVES

- Estimate angling use on Henrys Lake, Henrys Fork and its tributaries, and the upper Teton River,
- Summarize demographic characteristics of anglers,
- Estimate angler spending and regional economic value of each water body individually and in sum and analyze demographic factors affecting spending,
- Estimate additional economic value to anglers, in the form of consumer surplus and willingness to pay for improved angling experience, and
- Estimate the additional economic value of vacation homes that would not have been captured by traditional surveys methods.

METHODS

Study area

The study waters are Henrys Lake, Henrys Fork and its major tributaries (Buffalo River, Warm River, and Fall River), and the Teton River upstream of Harrop's Bridge on Highway 33 (Figure 1).

The initial study plan was to conduct effort estimates on Henrys Lake and the Teton River in 2016, Henrys Fork and its tributaries in 2017, and the South Fork Snake River in 2018. We were unable to collect sufficient economic survey data on the South Fork, so it was dropped from the study. Similarly, the 2016 Teton River survey did not generate enough economic information, in part because survey effort was distributed across the entire Teton River, most of which is difficult to access and supports little angling effort. Thus, we redesigned the Teton River survey and conducted the revised survey in 2018. To most efficiently apply resources, we surveyed only the upper Teton River (upstream of Highway 33), the most accessible and highly used reach of the river.

On Henrys Lake, we received a large number of economic survey responses in 2016, but due to abnormally warm, dry conditions, favorable early-season fishing conditions had ended before the season even opened in late May, and angler effort was very low after opening weekend. Further, effort in the ice fishery that year was only 30% of that observed in other recent years (Jenn Vincent, Idaho Department of Fish and Game, personal communication). Based on discussions Idaho Department of Fish and Game personnel (Damon Keen, Idaho Department of Fish and Game [retired] and Jenn Vincent; personal communications) we decided that 2016 angler effort on Henrys Lake was not representative of typical effort there and thus that economic value would be substantially underestimated if the 2016 effort estimates were used. We therefore elected to use Henrys Lake effort estimates from the subsequent creel survey there,

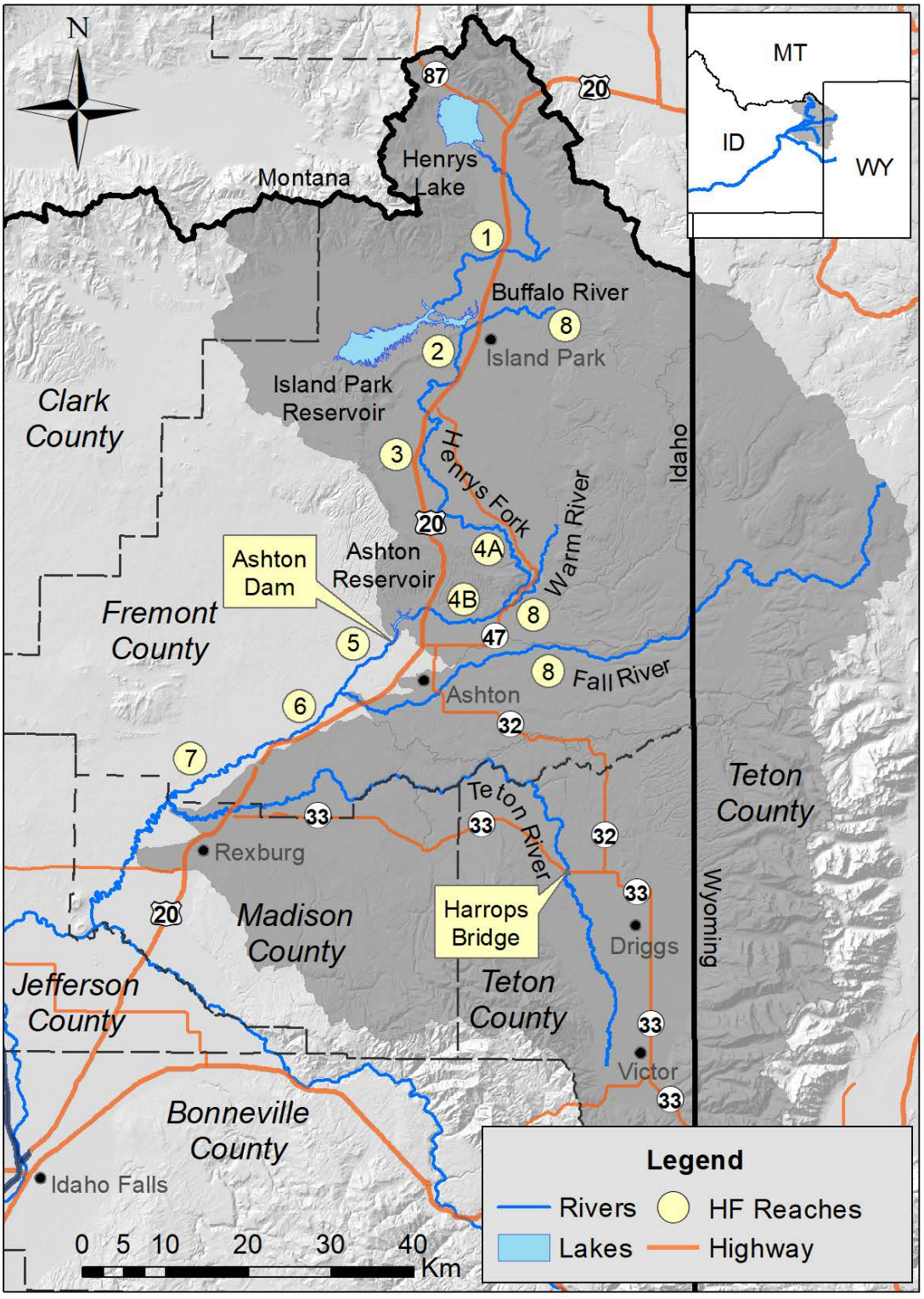

Figure 1. Study area map. Henrys Fork reaches correspond to those listed in Table 1.

which was performed in 2019. To assess potential bias in pairing the 2016 spending information with the 2019 effort estimate, we compared the fraction of nonresident anglers in the 2016 economic survey to that in the 2019 effort survey. In addition, we analyzed long-term trends in angler effort to assess sensitivity of the economic value of the Henrys Lake fishery to variability in effort.

Angler effort

Creel surveys traditionally use angler hours as the unit of effort. In this study, we defined effort as an angler day, for compatibility with angler spending characteristics. Most angler expenditures (e.g., lodging, food, fuel, guide fee) are associated with a single day of angling, regardless of duration of the daily trip. In count-based effort estimates, counts are conducted at random times during the day, and the count is multiplied by the number of daylight hours to obtain the number of angler hours (Pollock 1994). In this study, we divided the angler-hour estimate by the mean duration of a daily trip, as estimated from completed-trip interviews (Henrys Lake and Henrys Fork) or survey responses (Teton River), to obtain effort in angler days.

Henrys Lake

The 2016 Henrys Lake survey was conducted May 28, 2016 through January 1, 2017, which included both the open-water fishery and the ice fishery. Survey effort was stratified by weekday and weekend/holiday day types, and survey days were randomly selected within each fishery type and day type. Daylight hours were divided into three equal time intervals that defined work shifts for conducting angler interviews and distributing economic survey instruments on the selected survey days and were randomly selected within selected survey days. In-person angler contacts were made at access sites. Anglers were asked for standard creel-

survey information such as hours fished, number and species of fish caught, and satisfaction with their angling experience. We also asked if the angler was willing to complete an economic survey instrument (described below).

The 2019 Henrys Lake survey was conducted May 25, 2019 through January 1, 2020 (Heckel et al. 2020). The open-water season was stratified into two-week intervals, with opening weekend separated as a single stratum. Aerial counts were made on two randomly selected weekend days and two randomly selected weekdays during each open-water stratum. Interviews were conducted on the same dates as aerial counts. Interviews were conducted using weighted time periods and randomly assigned to morning (60%), afternoon (20%), and evening (20%). In addition to the aerial counts we conducted ground counts at all the main access points on the lake at two random intervals throughout the creel shift. Clerks traveled by truck around the lake in a randomly selected direction (clockwise or counter-clockwise), counting the number of vehicles, bank anglers and boats in the vicinity of that access point. Interviews were conducted at access points, using a roving method that maximized the number of interviews obtained on each survey day.

Effort in the ice fishery was estimated separately from that in the open water fishery. Aerial counts were conducted on two randomly selected weekend days and on two randomly selected week days every two weeks from the beginning of full ice-on through January 1. We assumed equal effort across time periods (33% for morning, afternoon, and evening). As days began to shorten we switched to only AM or PM shifts (0800-1230 and 1230-1700). Counts in the ice fishery were also conducted using a roving ground survey in addition to the aerial survey. Clerks drove around the lake in a randomly selected direction, stopping at each main access point and counting the number of vehicles, ice huts and non-hut anglers. Binoculars were used for

counts at locations without vehicle access. Interviews were conducted both at access points and on the ice, prioritizing anglers leaving the ice to obtain as many completed-trip interviews as possible. As with the open water fishery, interviews were conducted in a roving manner to obtain as many interviews as possible throughout each survey day.

No economic information was collected in 2019.

Henrys Fork and tributaries

The survey on the Henrys Fork and its tributaries was conducted January 1 through December 31, 2017. The study waters were divided into nine reaches on the mainstem Henrys Fork, Ashton Reservoir, and Buffalo, Warm, and Fall rivers (Figure 1, Table 1). For each reach, a seasonal period of use was defined based on known patterns of angling use (Table 1). On any given sample day, all zones whose period of use included that day were sampled. Aerial surveys were used from March to mid-October to count angler use, whereas access point surveys were used over the remainder of the year. Anglers were counted within three groups defined by the location of the angler within the river: bank, wading, or boat. Sampling dates were stratified by weekday and weekend/holiday day types. Within each stratum, individual sampling days were selected randomly. For the duration of the aerial surveys 33 weekdays and 32 weekend days were sampled between March 1 and October 15. In January and February the two weekend days and two randomly selected weekdays were sampled each week. During November and December, one weekday and one weekend day were randomly selected to be sampled each week. The starting zone, direction traveled, and sampling time of day were also randomized. Angler interviews and survey instrument distribution were conducted at access points, and to the greatest degree possible, anglers were intercepted immediately after completing their fishing trip.

Table 1. River reaches used in the Henrys Fork survey. Zone identifiers are those used by Idaho Department of Fish and Game.

Zone	Description	Season of use
1	Henrys Lake Outlet to Island Park Reservoir (McCrea's Bridge)	May 26 to Oct. 15
2	Island Park Dam to Harriman State Park (i.e. log jam)	May 26 to Oct. 15
3	Upper Harriman State Park (i.e. log jam) to Riverside	May 26 to Oct. 15*
4A	Riverside to Stonebridge	May 26 to Oct. 15
NA	Ashton Reservoir	Mar. 1 to Oct. 15
4B	Stonebridge to Highway 20 Bridge (Ashton)	Jan. 1 to Dec. 31
5	Ashton Dam to Chester Dam	Jan. 1 to Dec. 31
6	Chester Dam to St. Anthony Railroad Bridge	Jan. 1 to Dec. 31
7	St. Anthony Railroad Bridge to Warm Slough	May 26 to Oct. 15
8	Tributaries (Buffalo, Warm, Fall)	May 26 to Oct. 15

*Note: Harriman State Park opens to fishing on June 15, but the section from the southern boundary to Riverside Campground is open all year. Thus, effort from May 26 to June 14 applied only to this shorter reach.

Teton River

The Teton River survey was conducted May 26, 2018 through September 30, 2018 and included non-angling river recreation. However, we report only the results of angling use and its economic value in this report. We estimated recreational effort using an open-population mark-recapture method commonly used in estimating fish and wildlife populations (Seber 2002, Appendix A). Because application of mark-recapture methods to recreational use estimates is relatively new (e.g., Hansen and Van Kirk 2018), we simultaneously conducted a count-based estimate to validate the mark-recapture methodology. Details of the count-based methodology and the validation analysis are given in a separate report on the Teton River.

Stratified random sampling was used to select survey days on the Teton River. Strata were Memorial weekend (May 26) through Labor Day (September 3) and September 4 through September 30. In proportion to a priori estimated total use, 43 days were sampled in stratum 1, and 9 days were sampled in stratum 2. Within each stratum, days were assigned a sampling

probability such that each weekend day and holiday had 2.5 times the probability of being selected as each weekday. The access-point survey method was used to count vehicles at each of the six primary access sites on the upper Teton River: Fox Creek East, South Bates, Bates, Rainey (Big Eddy), Cache (Packsaddle), and Harrop's. The access points were visited in spatial order along the river, but direction of travel was randomized.

Interviewers contacted recreationists to distribute the survey instrument as the recreationist was either arriving at or leaving the river. The recreation day was divided into two survey shifts: morning (8:00 am – 2:00 pm) and evening (2:00 pm – 8:00 pm). One of the two shifts was randomly selected per survey day. The economic survey instrument (described below) included a defined-choice question requesting the angler to specify their recreational use type: angling only, non-angling recreation only, or both angling and non-angling recreation. Those who selected the first or third options were considered anglers for the purposes of this study. In addition to distributing the economic survey instrument, the interviewer asked for relevant information needed for the mark-recapture method and the validation analysis.

Economic Value

Because annual inflation was in the range of 1.3-2.4% over the three years during which we collected economic information and our statistical margin of error in calculating spending estimates was on the order of 30%, we did not adjust any of the spending or valuation figures for inflation across the three study years. We consider our 2016-2018 data to represent 2017 dollars. However, we did adjust economic figures estimated by other studies in 2003 and 2004 to 2017 dollars for comparative purposes.

Survey Instrument

We developed a survey instrument (Appendix C) to collect information needed to meet all of our valuation objectives: spending, contribution to the regional economy, additional value to the anglers, and contribution of anglers with vacation homes. Upon encounter of a fishing party at an access site, we asked one member of each party if they were willing to take the economic survey. By distributing the instrument to only one member of the party, we met the statistical assumption of independent observations to the greatest degree possible. If the angler was willing to take the survey, they were given the choice of receiving a paper or electronic survey instrument. If they preferred paper, they were given a paper survey booklet with a unique number, which we retained on a card with their contact information. The paper survey instruments were self-addressed and stamped. If the angler preferred an electronic survey, we asked for their email address and sent them a unique link to the survey instrument. If a response was not received within three weeks, a reminder email or letter was sent to the survey recipient.

The survey instrument consisted of four sections. Sections A and B were specific to the angler's daily trip on the day they received the survey instrument and to the river reach/water body they fished that day. Section A asked the respondent to describe their river recreation experience, including number of annual trips to that water body, their lodging the night before the fishing trip, travel time and distance between their lodging and the fishing location, and ranking of various aspects of their fishing experience. Section B asked the respondent to report their recreation-related expenditures for the trip by category, location of the expenditure (in or out of the seven-county region), and how many people shared the reported expenses. Section B also asked whether the angler would have taken the daily trip if it had cost more. Section C asked how potential changes to the management of the river would affect the respondent's recreational use, and section D asked demographic questions, including ZIP code of permanent residence and

those needed to determine home ownership and value. The survey wording differed slightly across water bodies to accommodate different use patterns and information specific to each water body.

Because angler residency is the single most important factor determining the value of their expenditure to the regional economy, we used the Henrys Fork 2017 data to conduct an analysis of potential survey non-response bias. Anglers reported the ZIP code of their permanent residence in these access-site interviews and also independently on the survey instrument, which allowed a statistical comparison of the fraction of nonresidents represented in the sample of returned surveys to that in the sample of anglers interviewed at river access sites and offered the survey instrument.

Angler spending

Expenditures per person per day were separated by angler residency and into money spent within our seven-county region and money spent outside of this region. Therefore, there are four types of spending, each with distinct relevance to the regional economy:

1. Spending by residents in the region (e.g., someone from Idaho Falls bought lunch in Ashton the day of the fishing trip). This is money that was already in the regional economy but contributes to intra-region economic activity via fishing.
2. Spending by residents out of the region (e.g., someone from Idaho Falls bought a fishing rod in Boise to use on their fishing trip). This is money that leaves the regional economy.
3. Spending by nonresidents in the region (e.g., someone from California stayed in their vacation home in Island Park the night before the fishing trip, and paid maintenance

cost on their home to a local contractor). This is new money brought into the regional economy because of fishing opportunities in the region.

4. Spending by nonresidents out of the region (e.g., someone from California bought his waders at a shop in California before coming to their vacation home in Island Park to fish for the summer). This money has no effect on the regional economy; it originated and was spent outside of the region.

We divided reported daily expenses by the number of people who shared those expenses to calculate spending per angler for the daily trip described by a single survey response. We then multiplied the mean spending per angler per day by effort in angler days to obtain total expenditure within each of the four categories above. Summing total expenditure over these categories produced an estimate of total spending for the particular water body, and summing over the three water bodies produced an estimate of total spending for the study area.

A small but nontrivial number of survey respondents who reported nonzero expenditures entered "0" in response to the question "including yourself, how many people in your group shared these expenses with you today?" We assumed these individuals overlooked the phrase "including yourself," so we changed these "0" responses to "1" but otherwise left responses to that question as reported.

Demographic data collected in the survey were used to assess trends in angler spending for each water body. A suite of models was created using age, gender, education level, household income, and residency as variables to predict in-region spending. Relative model performance was assessed using Akaike's Information Criterion (AIC) following the parsimonious, a priori model-selection methods detailed in Burnham and Anderson (2002).

Regional economic contribution

We estimated regional economic impact of direct angler spending using IMPLAN, commercial software that uses economic Input-Output (I/O) and Social Accounting Matrix (SAM) data and analyses to assess multiplier effects (IMPLAN, Huntersville, NC, https://www.implan.com/). Dr. Garth Taylor and Dr. Greg Alward of the University of Idaho (personal communication) provided the IMPLAN analysis for the six Idaho counties we considered as our region of economic impact. While I/O and SAM results are often used to estimate changes that would occur from addition of a proposed new sector to a regional economy, we used the analysis to estimate the regional economic impact of angling as an existing sector.

Taylor and Alward recommended IMPLAN economic sectors to map to the expenditure categories we provided in the survey instruments, as well as categories that should be treated as retail and the retail-margin fractions for those categories. When cost of goods sold is a predominant cost and is represented in another sector's activity or is a purchase from outside the region, the business selling the goods to the public is treated as retail, and the retail-margin fraction is applied. Wholesale/retail businesses generally do not produce the commodities they sell, so data in the purchaser price I/O data frame must be reorganized into a second I/O data frame in "producer prices". This unbundling from purchaser-to-producer pricing is called "margining" and is applied to trade and distribution sectors. For example, the purchase of beef at a grocery store is unbundled into the purchase of the commodity and re-allocated to the beef sector while the purchase of the retail service (the "retail margin") remains with the grocery store sector that produces the retail service. In most sectors, like restaurants that produce meals, the there is no difference between producer and purchaser prices, and no margining is needed.

The categories, sectors and IMPLAN data that we used are summarized in Table 2. We separated the in-region expenditures and applied the retail-margin fraction to those, to obtain the direct spending that effectively occurred within the six-county economy. As previously explained, we further partitioned that spending into spending by residents and spending by nonresidents. The spending by nonresidents represents new money within the region, and we applied IMPLAN-produced economic multipliers to these expenditures to represent the additional economic activity that derives from this new money. The multipliers are reported in Table 2.

Table 2. Expenditure Categories, IMPLAN Sectors, Retail Margin and Multipliers.

Expenditure category	IMPLAN Sector	Retail margin	Base output multiplier	Base value-added multiplier	Base jobs multipliers (Jobs per $1 million regional exports)
Gas and oil	44-45 Retail trade	0.2	1.72	1.02	19.2
Restaurant food	72 Accommodation & food services	1.0	1.62	0.92	19.5
Store food	44-45 Retail trade	0.2	1.72	1.02	19.2
Fishing supplies	44-45 Retail trade	0.2	1.72	1.02	19.2
Motel/hotel	72 Accommodation & food services	1.0	1.62	0.92	19.5
Public camping	92 Government & non NAICs	1.0	1.62	1.30	18.7
Private camping	72 Accommodation & food services	1.0	1.62	0.92	19.5
Short-term rental	72 Accommodation & food services	1.0	1.62	0.92	19.5
Equipment rental	44-45 Retail trade	0.2	1.72	1.02	19.2
Guide fees	71 Arts- entertainment & recreation	1.0	1.81	0.96	18.6
Fishing license	44-45 Retail trade	0.2	1.72	1.02	19.2
Vehicle shuttle	71 Arts- entertainment & recreation	1.0	1.81	0.96	18.6
Rental car	81 Other services	0.2	1.87	0.92	18.3
Other	81 Other services	1.0	1.87	0.92	18.3
Home upkeep	23 Construction	1.0	1.62	0.75	11.6

IMPLAN provides multipliers for gross and base activity. Across all sectors in an economy, gross and base effects sum to the same dollar amount, but the assignment to individual sectors differs. We used base activity multipliers because they are adjusted to assign secondary effects to the initial activity that brought new dollars into the regional economy and are more

appropriate for analysis of recreational effects (Alward, personal communication). Output multipliers represent the total economic activity directly or indirectly associated with an expenditure, while value-added multipliers represent the amount that total output exceeds intermediate inputs. We report both, though Taylor and Alward recommend that value-added generally provides the best indication of true contribution to a regional economy.

Additional value to anglers

Assuming rational behavior and free choice, the angling experience must be worth at least the direct expenditures; otherwise, the angler would have expended those funds elsewhere. However, the angler is not compelled to pay more than the price of goods in the market, even though the experience may be worth more. The difference between actual expenditures and what the angler would have been willing to pay for the experience represents the consumer surplus enjoyed by the individual angler. The survey asked respondents, "If the total cost of your river recreation today had been $*x* higher, would you have taken your fishing trip to this water body (Henrys Lake, Henrys Fork, Teton River) today?" Randomizing the dollar value *x* across surveys allowed us to fit a logistic regression curve to the data. This fitted curve gives the probability that an angler will take the fishing trip, as a function of the increased cost *x*. The point at which the probability is equal to 50% is the cost at which half of the anglers would take the trip and the other half would not. This median value is an estimate of consumer surplus. We calculated this value for resident and nonresident anglers and multiplied it by effort on each of the three respective water bodies to determine total consumer surplus. We also reported consumer surplus relative to actual spending to provide a relative measure of the additional value of fishing to the angler.

The survey instrument also asked several questions of the form "If XXX aspect of your recreational experience changed by YYY, would you recreate less, more, or the same? If less or more, how many days fewer/more would you recreate?" The goal is to extrapolate from survey responses the total change in season-long effort that would result from the hypothetical change in experience that could occur through some management action. The subtlety in the extrapolation is that total effort was estimated through instantaneous counts of non-identifiable anglers, whereas the information in survey instrument responses is based on behavior of identifiable anglers. In particular, each individual angler in the population fishes a certain number of days per year, which is recorded in survey responses but is neither known nor used in calculating the count-based total effort. The only link between the counts and the survey responses is that the survey instruments were distributed to anglers on the same days as the counts occurred. Absent any nonresponse bias, we can assume that survey respondents constitute a random sample of all anglers in the population. The particular sample-based estimator we used to calculate net change in effort to change in management across the whole angling population is derived in Appendix A.

Estimating this change in angler effort relies on subjective angler responses to the particular survey question and usually has no way of being objectively validated. Fortunately, long-term data on catch rate and angler effort are available for the Henrys Lake fishery and were provided by Jenn Vincent of Idaho Department of Fish and Game, so we were able to use these data to compare self-reported change in effort per unit change in catch rate to observed values for the Henrys Lake fishery.

Contribution of part-year residents

Using data from survey responses, we defined part-year residents as anglers who reported owning a home within the seven-county region and reported spending 11 months or fewer in that home. Because we do not know whether the home owned by these part-year residents is a "second" home, we refer to the in-region home owned by these part-year residents as a "vacation" home. We used three methods for assessing economic contributions from part-year residents over and above those attributable to other anglers in the population.

First, we compared the value of vacation homes as a lodging option to other options available to anglers. The survey contained a question that asked the respondent to identify where they stayed the night before the fishing trip on which they received the survey instrument. In addition to traditional options such as camping, hotel/lodge, or short-term rental, "other private residence" was included as a lodging option. Respondents who chose "other private residence" as their lodging option *and* were identified as part-year residents by the criteria above were considered to have used their vacation home as lodging the night before they went fishing. We then estimated the nightly value of the home as the annual maintenance cost of the home (taken to be 1% of the reported home value) divided by the number of days per year spent in the vacation home. Regardless of whether the angler fished every day they spent in the vacation home in a particular year, this nightly value applied to all nights spent in the home and so applied to all nights preceding a day on which the owner fished. Thus, this nightly value was reported as the lodging expense for that angler for the day of fishing described by the survey response.

Second, we estimated the fraction of season-total angling effort contributed by part-year residents relative to their fraction in the total population of anglers, and calculated the total spending due to additional angling days by part-year residents over and above the average daily effort by other anglers.

Third, we estimated the total amount of property taxes paid by part-year residents to regional counties. Our general approach was to estimate mean county property tax for vacation homes within each of the home-value categories used on the survey instrument (Appendix C), multiply this tax by the number of part-year residents in the angling population who reported owning a home in the particular value category, and sum over all categories. We applied tax information from Fremont County to part-year residents identified in the Henrys Lake and Henrys Fork surveys and that from Teton County, Idaho to part-year residents in the Teton River survey, under the assumption that the homes owned by part-year residents fishing Henrys Lake and Henrys Fork would be located in Fremont County and those belonging to part-year residents fishing the Teton River would be located in Teton County, Idaho. However, we acknowledge that by our definitions, the home owned by part-year residents could be located in any of the seven counties.

Home value and property tax information were collected from each county's online parcel database (https://maps.greenwoodmap.com/fremontid/map, accessed August 9, 2019 and https://tetonidaho.maps.arcgis.com/home/index.html, accessed August 9. 2019). Within each county, we randomly selected 10 homes with values in each of the five home-value categories from selected locations known to contain concentrations of vacation homes (Figures 2 and 3). We recorded permanent mailing address, property value, and 2018 property tax for each selected home. To ensure that the homes were owned by part-year residents, we included a home in the sample only if the permanent mailing address was out of the seven-county region.

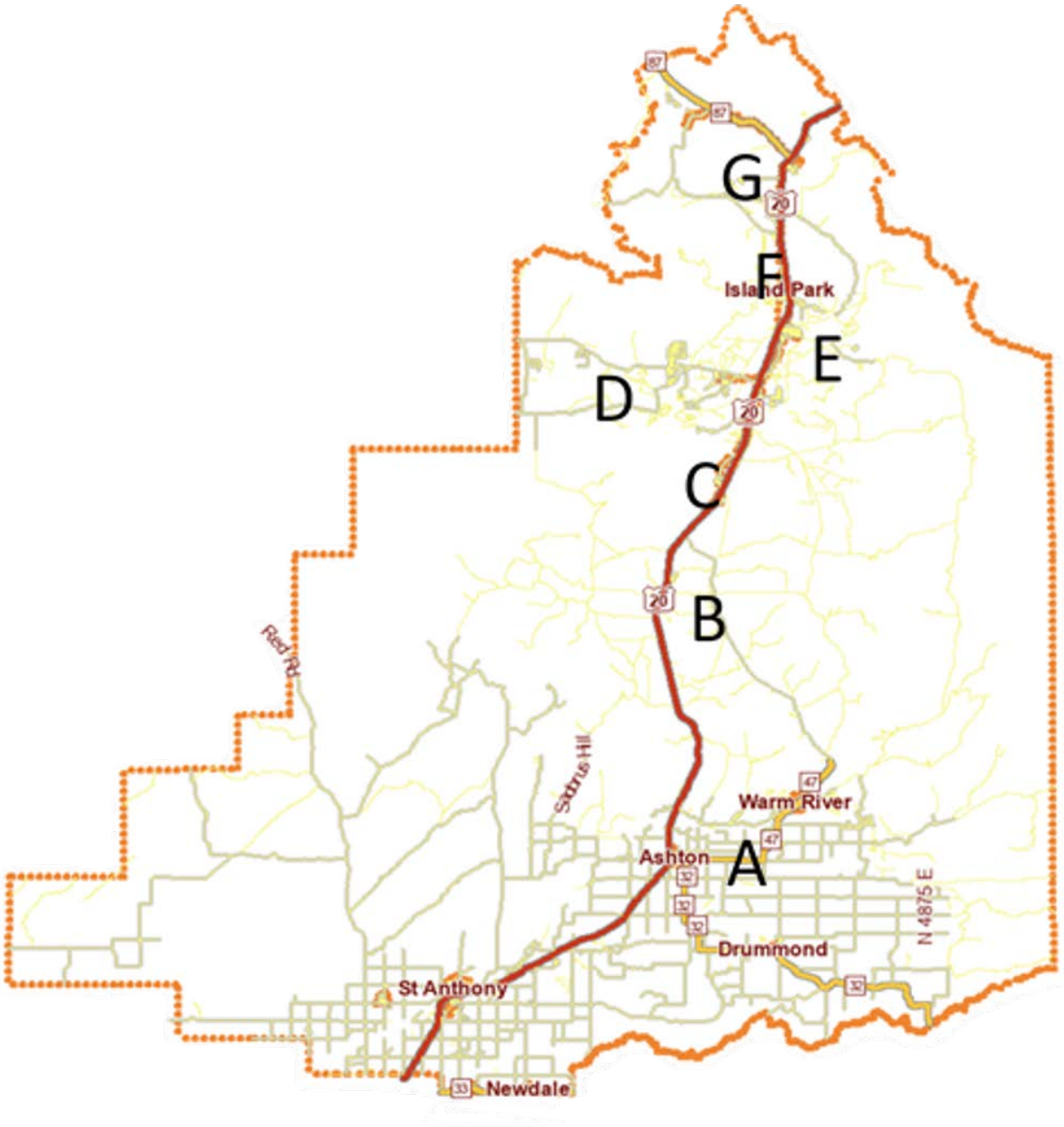

Figure 2. Fremont County. Labels indicate areas sampled for vacation-home property tax payments. A: Fisherman's Dr., B: Pinehaven, C: Box Canyon, D: Shotgun, E: Mack's Inn, F: Sawtelle, G: Henrys Lake.

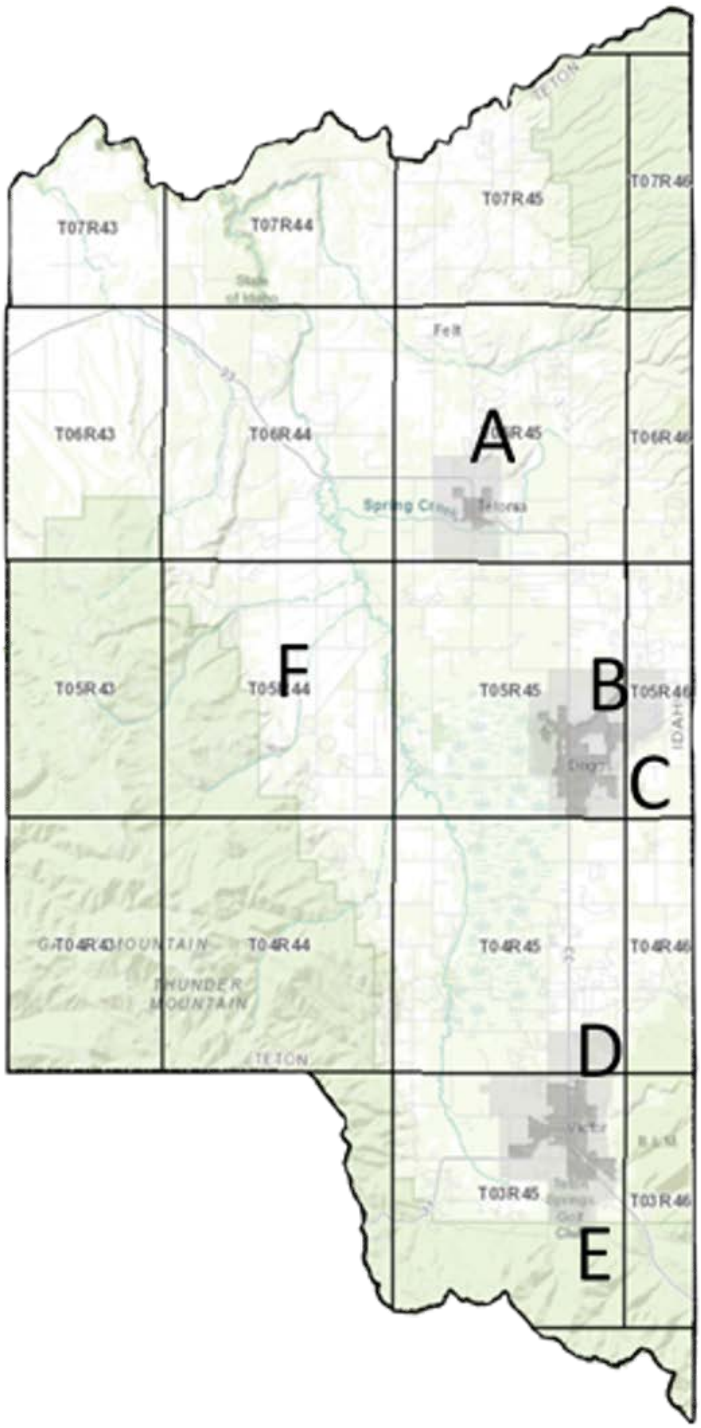

Figure 3. Teton County. Labels indicate areas sampled for vacation-home property tax payments. A: Leigh Creek, B: Canyon, C: Ski Hill Road, D: Fox Creek, E: Teton Springs, F: "West valley."

To estimate total property taxes paid by part-year residents who fished a particular water body, we needed to estimate the number of part-year anglers in the angling population. This estimation required the same type of analysis described above for changes in angler behavior, because home ownership is identifiable only from the sample of survey respondents, whereas the total number of anglers in the population is known only from the independent, count-based estimate of effort. Assuming no bias in survey response, the mean number of days fished per year per angler can be estimated from survey instrument responses. Dividing total annual effort in angler days by the mean number of days per year per angler gives an estimate of the total number of anglers in the population. Multiplying this by the fraction of part-year residents yielded an estimate of the total number of homes owned by part-year resident anglers within each home value category (Appendix A).

Statistical methods

Throughout all analyses, we used statistical methods that minimized bias in estimates and produced "honest" confidence intervals (i.e., a nominal 95% confidence interval would actually contain the true population value in 95% of all randomized replications of the study). Angler effort calculations were consistent with stratification and sampling probabilities used in angler count methodology. Because effort sampling periods were selected from a finite sampling frame, the finite population correction factor was applied to the calculation of standard errors of effort estimates (Lohr 2006). Where study design allowed estimation of parameters such as consumer surplus either using pooled data or separately across variables such as water body or angler residency, we used hypothesis testing to assess differences in response across these independent variables and made separate parameter estimates only where we found significant differences.

We matched distributional models to the data, and used standard methods that assume a normal distribution only when supported by the data. This was rare, given the nature of the data. For small-integer counts such as number of anglers per vehicle or ice hut, we assumed a Poisson distribution and used either square-root or logarithmic transformation (Ramsey and Schafer 2002). All angler count and spending data were right skewed but contained numerous 0 values, so we used $\log(x + 1)$ transformations with these data and assumed lognormal distributions. All proportions (e.g., fraction of nonresident anglers) were estimated with logit transformation and the binomial distribution (Ramsey and Schafer 2002). For normally distributed data, models were fit using the "lm" function in R (R Core Team 2020), and hypothesis tests were performed with standard *F*-tests (Sokal and Rohlf 2012). For all other distributions, models were fit using R's "glm" function, and the likelihood ratio was used for hypothesis testing (Pawatin 2001). We performed all hypothesis tests at the 0.05 level of significance.

Most of our estimated quantities were calculated as arithmetic combinations of two or more fundamental parameters. For example, total spending was the product of angler effort and spending per angler. To propagate sampling error in the fundamental parameters properly through these calculations, we used bootstrapping to estimate confidence intervals around the final quantities. Our bootstrap method randomly selected 5000 values from the sampling distribution of each estimated parameter and used those to generate 5000 possible values of the final quantity. The 0.025 and 0.975 percentiles of that set of 5000 random values were the lower and upper bounds of the 95% confidence interval (CI) for the final quantity. Because most of the underlying data were skewed, most confidence intervals were skewed. When confidence intervals are symmetric, error can be reported as something like "25 ± 5" or "25 ± 20%", meaning that the estimate is 25, and the error is 5 (25%) on either side of the estimate. In this

case, the width of the confidence interval is 10, half of which occurs on either side of the estimate. Skewed confidence intervals cannot be reported this way, so we provide the full confidence interval in mathematical notation [lower bound, upper bound] and/or report relative errors as the half-width of the confidence interval divided by the estimate, as a percent. We use 95% confidence intervals.

RESULTS

Angler effort

Estimated effort was 53,221 angler days (95% CI [34707,82048]) on Henrys Lake in 2019, 126,293 angler days (95% CI [115944,150987]) on the Henrys Fork and its tributaries in 2017, and 32,114 angler days (95% CI [24898,41,494]) on the upper Teton River in 2018 (Table 3, Figure 4). Nonresidents accounted for 52% of total effort over all three water bodies: 50% on Henrys Lake, 54% on Henrys Fork and tributaries, and 47% on Teton River. Nonresident effort on Henrys Lake was higher in the open-water fishery than in the ice fishery. On Henrys Fork, nonresident effort exceeded 70% of total effort on all reaches upstream of Riverside Campground, was less than 38% of total effort downstream of Chester Dam, and was near the watershed average elsewhere. Daily trip duration was similar across water bodies, averaging 4.1 hours per trip on the Henrys Lake open-water fishery, 4.0 hours per trip on the Henrys Fork, and 4.3 hours per trip on Teton River. Mean trip duration for the Henrys Lake ice fishery was higher, at 5.1 hours per trip. Sampling errors were 44% for Henrys Lake, 14% for Henrys Fork, and 26% for Teton River. In accordance with statistical theory, sampling errors were inversely related to sampling effort; sample sizes for angler counts were $n = 30$ for Henry's Lake, $n = 108$ for Henrys Fork, and $n = 51$ for Teton River.

Table 3. Total angler effort by water region.

Water body/river reach	Total effort (angler days)	% effort from nonresident anglers	% effort from boat anglers
HL open-water fishery	45418	51.9%	78.9%
HL ice fishery	7803	39.5%	NA
Henrys Lake Total	**53221**	**50.1%**	NA
HF1. Henrys Lake Outlet to IP Reservoir	15061	75.5%	39.5%
HF2. Island Park Dam to Harriman State Park	16790	70.3%	63.0%
HF3. North HSP boundary to Riverside	13476	73.9%	26.2%
HF4a. Riverside to Stonebridge	5238	45.3%	64.5%
HF4b. Stone Bridge to Ashton Reservoir	16914	45.3%	73.1%
Ashton Reservoir	9489	45.3%	43.6%
HF5. Ashton Reservoir to Chester Dam	20109	56.0%	69.4%
HF6. Chester Dam to Railroad Trestle	11287	16.8%	49.5%
HF7. Railroad Trestle to Warm Slough	4923	37.5%	50.6%
HF8a. Buffalo River	3532	45.2%	10.7%
HF8b. Warm River	5294	45.2%	1.5%
HF89c. Fall River	4180	45.2%	24.5%
Henrys Fork Total	**126293**	**54.1%**	**50.2%**
Upper Teton River	**32114**	**46.7%**	NA
TOTAL	**211628**	**52.0%**	

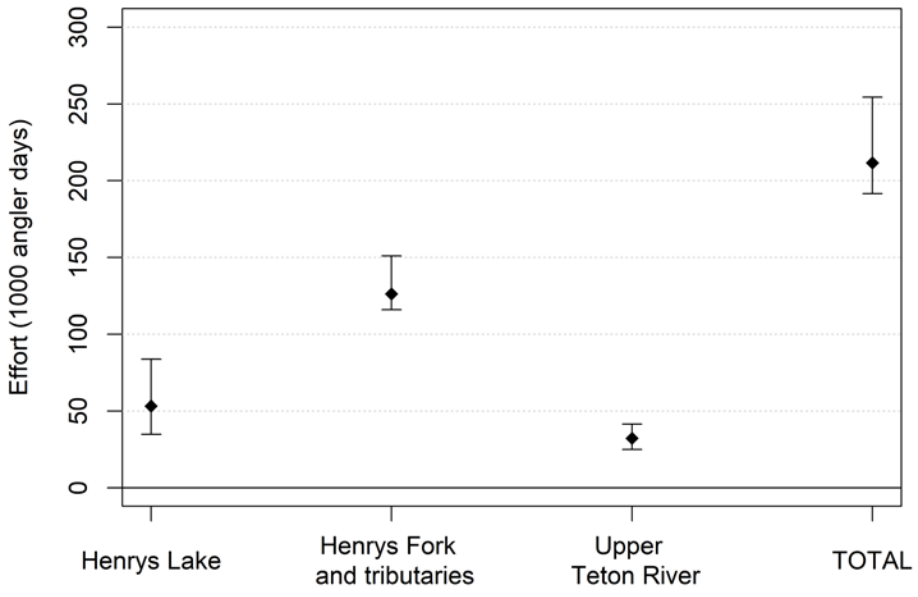

Figure 4. Total angler days per year, by water body, with 95% confidence intervals.

Economic Value

Survey responses and angler demographics

We distributed a total of 1,899 survey instruments, of which 29.5% were returned at least partially completed (Table 4). Return rate was highest for Henrys Lake and lowest for Henrys Fork. On Henrys Lake and Henrys Fork, return rates were similar across electronic and paper surveys, while on the Teton River return rate for paper surveys was 50%, versus 33% for electronic surveys. Henrys Lake anglers slightly preferred paper over electronic survey instruments, but anglers on Henrys Fork and Teton River greatly preferred to complete their survey instrument online. We found no evidence of non-response bias based on residency in the 2017 Henrys Fork survey; the fraction of nonresidents among survey respondents was not significantly different from that among on-river interviewees (Likelihood Ratio Test, $\chi_1^2 = 2.23, P = 0.14, df = 1122$). For subsequent analyses, we therefore assumed that the sample of anglers who returned survey instruments was a random sample of the angling population.

Table 4. Survey response rates for each water body.

	Surveys distributed			Surveys returned			Return rate		
	Paper	Online	Total	Paper	Online	Total	Paper	Online	Total
Henrys Lake	194	176	370	82	70	152	42.3%	39.8%	41.1%
Henrys Fork	89	923	1,012	16	216	232	18.0%	23.4%	22.9%
Teton River*	24	493	517	12	164	176	50.0%	33.3%	34.0%
TOTALS	307	1,592	1,899	110	450	560	35.8%	28.3%	29.5%

*Teton River total includes 80 surveys returned by non-anglers

Although percentage of nonresident angling effort was similar across water bodies, the geographic distribution of permanent residences of anglers was not. Around 90% of Henrys Lake anglers reported permanent residences in Idaho (71.0%) and northern Utah (19.3%), whereas

primary residences of Henrys Fork anglers were more widely distributed across the country (Figure 5). Eleven states accounted for 90% of anglers on the Henrys Fork; the top seven, accounting for 83% of all anglers, were Idaho (46.6%), Utah (16.3%), California (6.3%), Montana (5.8%), Texas (2.9%), Wyoming (2.9%), and Colorado (2.4%). Teton River anglers were even more geographically diverse; 13 states were required to account for 90% of anglers there. The top six, accounting for 77% of all anglers, overlapped with the top seven on the Henrys Fork: Idaho (54.0%), California (8.7%), Utah (4.0%), Wyoming (4.0%), Texas (3.3%), and Colorado (2.7%). Four states in the midwestern and eastern U.S. each accounted for 2% or more of Teton River anglers.

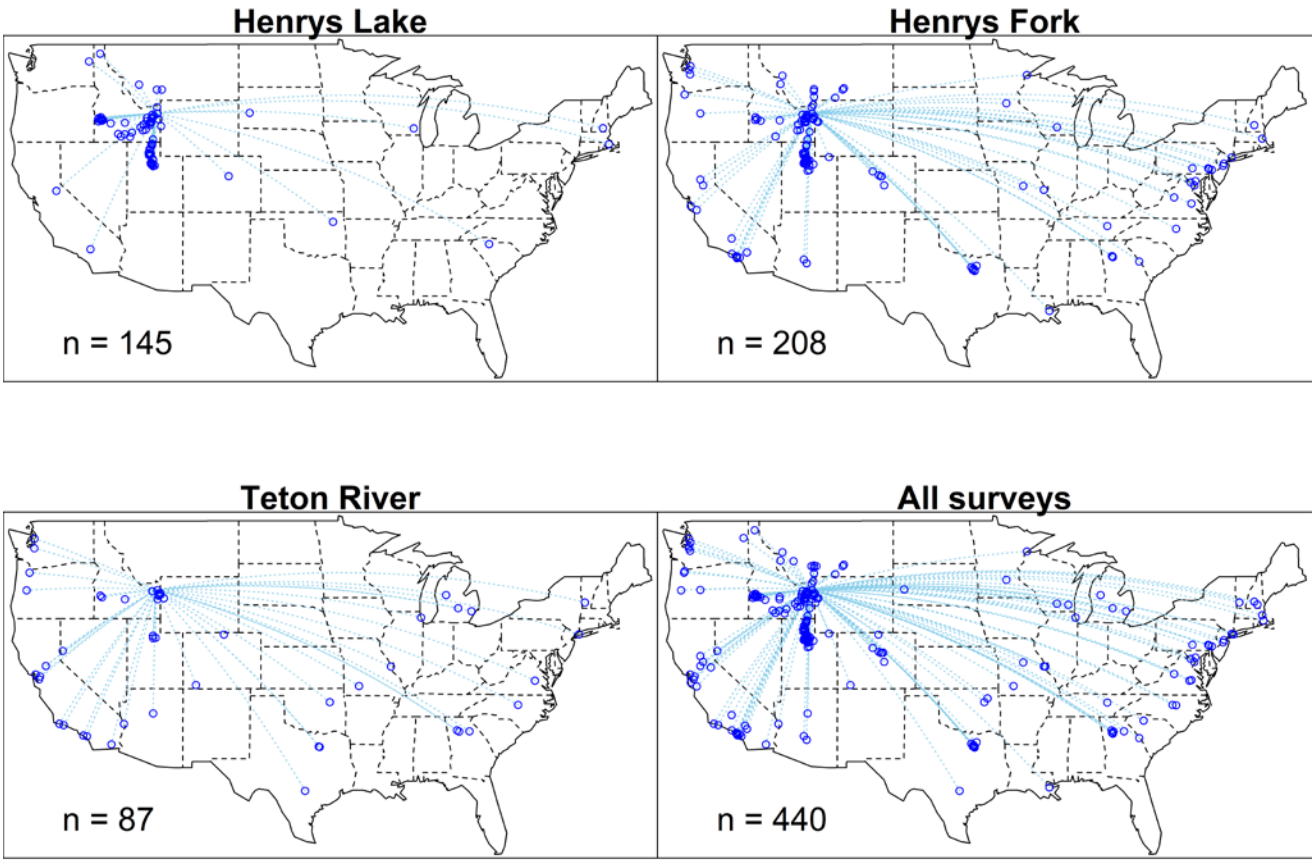

Figure 5. Permanent residence locations of survey respondents, by water body.

The median distance traveled by nonresident anglers from their primary residence to fisheries in the Henrys Fork watershed was 324 km (201 mi) for Henrys Lake anglers, 416 km (258 mi) for Henrys Fork anglers, and 1,278 km (792 mi) for Teton River anglers. The median distance traveled by resident anglers from their primary residence to the water body on which they were interviewed was 54 km (33 mi) for Henrys Lake, 51 km (32 mi) for Henrys Fork, and 42 km (26 mi) for Teton River.

The median number of trips taken by nonresident anglers to the Upper Snake River region to fish was two trips per year. The modes of travel for nonresidents anglers to the Upper Snake River region were 69% automobile, 10% plane, 9% recreational vehicle (RV), and 12% by a combination of these three (Figure 6). Nonresident Henrys Lake anglers traveled primarily by automobile and RV, nonresident Henrys Fork anglers traveled by a mixture of automobile, RV, and/or plane, and nonresident Teton River anglers primarily traveled by automobile and plane.

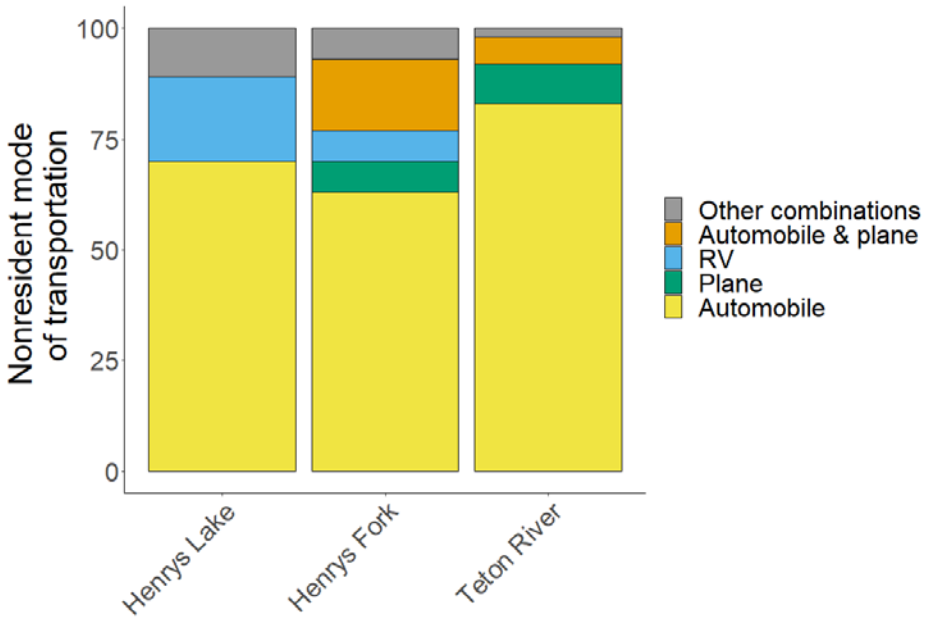

Figure 6. Distribution of travel modes of nonresident anglers, expressed as a percent.

While in the Upper Snake River region, the majority of Henrys Lake nonresident anglers stayed at a private residence (45%) or a public campground (31%). Henrys Fork nonresident anglers stayed at a mixture of private residences (32%), public campgrounds (25%), hotels (18%), and short-term rentals (14%). Teton River nonresident anglers stayed primarily at a private residence (56%), and secondarily at a short-term rental (19%) or hotel (18%). Among both resident and nonresident anglers, travel time and distance between their lodging and fishing location on the day of their reported fishing trip averaged 54 minutes (35 miles). Average travel time was 30 minutes greater than the watershed average for Henrys Lake, near average for Henrys Fork, and 30 minutes below the average for Teton River (Table 5).

Table 5. Average travel times and distances between lodging and the fishing location on the day of the fishing trip.

Site	Average Travel Time (Minutes)	Average Travel Distance (Miles)
Henrys Lake	81	53
Henrys Fork	50	31
Teton River	19	17
Total	54	35

The median age for respondents was 52 years old with a range of 17 to 85 years old, and 87% of survey respondents were male. Roughly 75% of Henrys Fork and the Teton River anglers were employed full-time or part-time, and 25% reported that they were retired. In contrast, nearly half of the anglers fishing Henrys Lake were employed full-time or part-time, the other half self-reporting as retired. Of the anglers who were employed, 84% of Henrys Lake anglers, 78% of Henrys Fork anglers, and 72% of Teton River anglers said they took paid time off of work to go fishing.

Anglers were asked to rate the importance of certain aspects to their fishing experience on a scale of 1-10, with 1 being not at all important and 10 being very important. The most important aspect to anglers on Henrys Lake was the opportunity to catch trophy-sized trout (Table 6). On the Henrys Fork, catching Rainbow Trout was equally important to catching trophy-sized trout. The most important aspect to anglers on the Teton River was the opportunity to catch Cutthroat Trout, the native trout to the region's waters. The opportunity to catch Mountain Whitefish was of least importance to anglers on all three water bodies. Henrys Lake anglers rated the importance of access facilities, particularly boat ramps and parking, about the same as they rated catch-related aspects of their fishing experience. Anglers on the Henrys Fork rated access facilities as less important than catch-related aspects of their fishing experience, and anglers on the Teton River were somewhere in between. Across the four access facility features, the most important to anglers on all three water bodies was adequate parking.

Table 6. Mean angler responses regarding importance of trip attributes, rated on a scale of 1-10.

	Henrys Lake	Henrys Fork	Teton River
Catch Large Numbers of Trout	6.6	6.4	6.4
Catch Trophy-sized Trout	7.8	7.2	5.7
Catch Brook Trout	5.8	3.4	4.8
Catch Brown Trout	3.6	5.6	5.0
Catch Cutthroat Trout	6.1	4.7	6.9
Catch Cutthroat-rainbow Hybrid Trout	6.9	4.7	5.3
Catch Rainbow Trout	4.8	7.2	6.0
Catch Mountain Whitefish	2.1	2.6	2.9
Availability of Public Restrooms	5.5	4.3	4.8
Concrete Boat Ramp	6.2	3.8	5.1
Adequate Parking Space and Facilities	7.0	5.8	6.4
Info Posted at Access Point	5.7	5.3	6.3

The degree of crowding the angler experienced was rated on a 1-10 scale with, 1 representing no crowding and 10 representing a high degree of crowding. Mean crowding scores were 3.9 on Henrys Lake, 4.5 on Henrys Fork, and 5.0 on Teton River. Among Henrys Lake anglers who thought the lake was crowded, nearly 90% attributed crowding to other anglers (Figure 7). On the Henrys Fork, other anglers were also the primary contributors to crowding, but about 10% of anglers attributed crowding strictly to non-angling floaters. On Teton River, floaters of all types were by far the greatest contributors to perceived crowding.

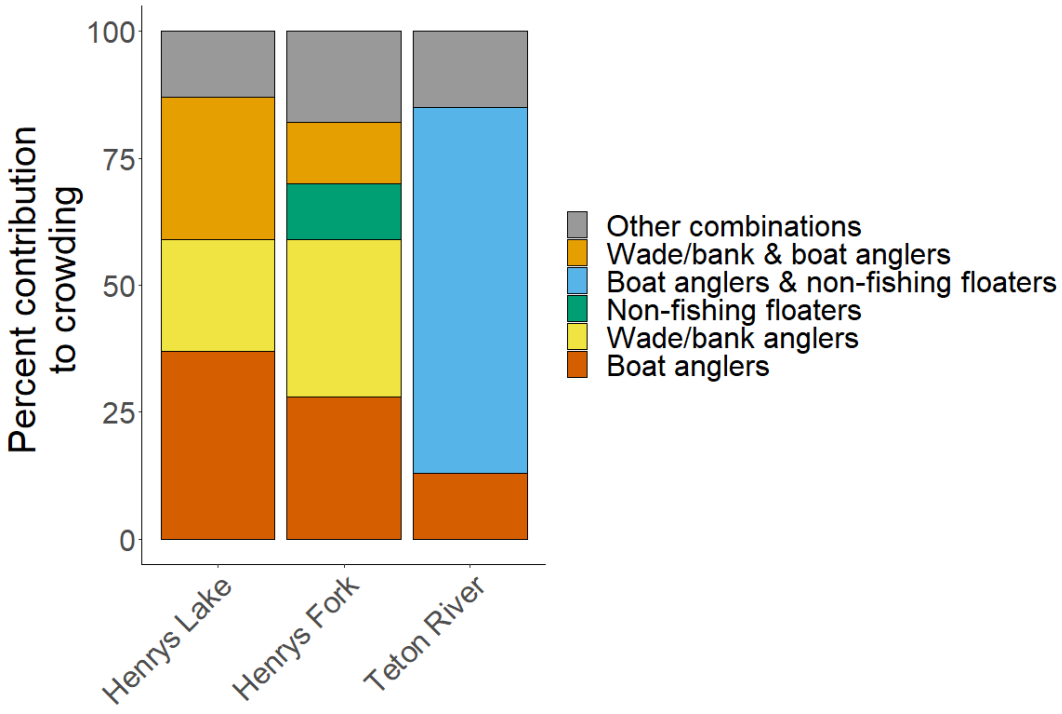

Figure 7. User perception of recreational user types contributing to crowding.

Complete summaries of all survey responses and demographic attributes appear in Appendix B.

Angler spending

Mean spending by nonresident anglers per day was $222 for Henrys Lake, $421 for Henrys Fork, and $469 for Teton River (Table 7). The portion of that spending that occurred in

the region was 64% on Henrys Lake, 81% on Henrys Fork, and 84% on Teton River. Residents spent an average of $82 per day on Henrys Lake, $109 on Henrys Fork, and $60 on Teton River. Of this, the portion spent in the region was 91% for Henrys Lake, 86% for Henrys Fork, and 100% for Teton River.

Table 7. Summary of all expenditures.

	Henrys Lake	Henrys Fork	Teton River	TOTALS (millions)
Nonresident daily expenditures in region	$143	$340	$393	
Nonresident daily expenditures outside of region	$78	$80	$76	
Total nonresident daily expenditures	$222	$421	$469	
Number of nonresident angler days	26,672	67,440	14,987	
Resident daily expenditures in region	$75	$94	$60	
Resident daily expenditures outside of region	$7	$16	$0	
Total resident daily expenditures	$82	$109	$60	
Number of resident Angler Days	26,549	58,853	17,128	
Total nonresident expenditures (millions)	$5.91	$28.40	$7.03	$41.3
Total resident expenditures (millions)	$2.19	$6.44	$1.04	$9.7
TOTALS (millions)	$8.1	$34.8	$8.1	$51.0

Results from the AIC model-selection analysis identified residency and household income, in combination, as the strongest predictors of spending across all three water bodies; in-region spending was highest among nonresident anglers and those with higher household incomes. The top AIC-ranked model for each water body was the one that contained these two predictors, without any others. Models containing these two variables, in various combinations with other predictors, accounted for 60% of model weight on Henrys Lake, 43% on Henrys Fork, and 98% on Teton River. However, the fraction of total variability in spending explained by these predictors was relatively low (R^2 = 8% for Henrys Lake, 11% for Henrys Fork, and 46% for Teton River).

We estimated total in-region spending at $41.2 million (95% CI [36.6,59.5]), over half of which was attributable to nonresident anglers on the Henrys Fork (Table 8). Total out-of-region

spending was $9.7 million (95% CI [7.5,17.9], Figure 8). Nonresidents accounted for 81% of total spending over all water bodies: 73% on Henrys Lake, 82% on Henrys Fork and tributaries, and 87% on Teton River. Relative sampling error in estimating spending ranged from 35% for Henrys Fork in-region spending to 158% for Teton River out-of-region spending. For the three water bodies combined, relative sampling error was 28% for in-region spending and 54% for out-of-region spending (Figure 8). Our application of 2019 effort data to 2016 effort data on Henrys Lake was generally justified based on comparison of nonresident effort between the two years. Nonresidents made up 56% percent of respondents to the 2016 economic survey and 50% of anglers interviewed on the lake in 2019, but this difference was only marginally significant (Likelihood Ratio Test, $\chi_1^2 = 3.61, P = 0.057, df = 1083$).

Table 8. Summary of total in-region expenditures, in millions. See Table 7 for fundamental quantities.

	Henrys Lake	Henrys Fork	Teton River	TOTALS
Total expenditures by nonresidents	$3.81	$22.90	$5.89	$32.60
Total expenditures by residents	$1.99	$5.53	$1.03	$8.55
TOTALS	$5.80	$28.43	$6.92	$41.15

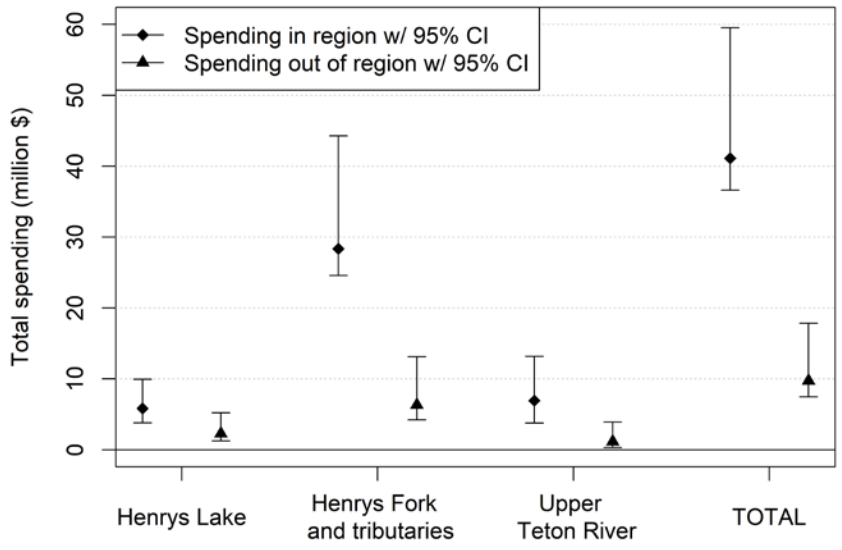

Figure 8. Spending in-region and out-of-region separated by water body, with 95% confidence intervals.

The highest in-region expenditures, by category, were “fuel” for Henrys Lake, “equipment rental” for Henrys Fork, and “lodging” for Teton River (Figure 9). The only category in which spending was comparable for all three water bodies was “food”, at about $25 per day, which combines restaurant and grocery categories. Further details on specific in-region and out-of-region expenditures are given in Appendix B.

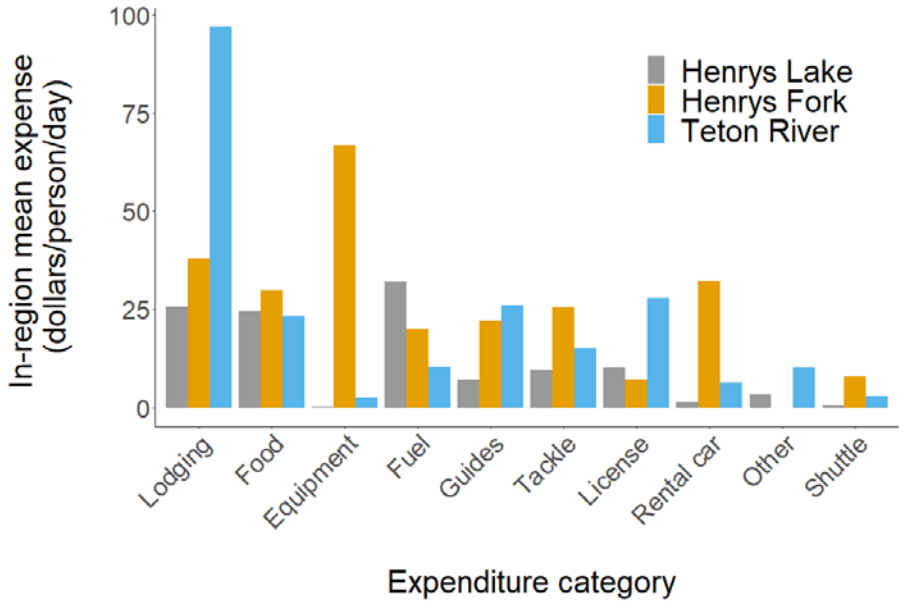

Figure 9. Mean in-region daily expense by category for each water body. The category label “equipment” is an abbreviation for “equipment rental.” Fishing tackle purchases are included in the “tackle” category.

Regional economic contribution

Of the $41.2 million spent by anglers in the region, we consider the $32.6 million spent by nonresidents as “new money,” which generates secondary effects in the economy that are estimated by application of the IMPLAN retail margins and multipliers (Table 2). Margined expenditures totaled $17.4 million, 60% of which was provided by anglers on the Henrys Fork. These expenditures added a value of $17.0 million to the regional economy and supported 317 jobs (Table 9).

Table 9. Application of retail margins and economic multipliers to in-region nonresident expenditures.

	Henrys Lake	Henrys Fork	Teton River	TOTALS
Expenditures, adjusted for retail margin (millions)	$2.17	$10.5	$4.72	$17.4
Base output (millions)	$3.61	$18.0	$7.94	$29.6
Base value added (millions)	$2.13	$10.7	$4.16	$17.0
Base jobs	40	198	79	317

To provide some context for these values, we include IMPLAN results from Taylor and Alward for IMPLAN Sector 11 (agriculture), Sector 71 (general recreation and entertainment), and the entire regional economy (Table 10). While IMPLAN Sector 11 appears to include fishing and hunting, this refers only to commercial (e.g., aquaculture) and not recreational activity, even if the latter employs a commercial outfitting or guide service (Taylor and Alward, personal communication). Recreational fishing is included in IMPLAN Sector 71 (General entertainment and recreation). The row "Regional exports" in Table 10 represents the fraction of total revenues that represent new money into the economy and is analogous to the margined, nonresident expenditures shown in Table 9. That is, nonresident spending by anglers in the region is equivalent to an "export," in this case the fishing experience. The subsequent rows of Table 9 are analogous to those in Table 10. We assume that the values in Table 9 are implicitly part of, and not additions to, the values in Table 10 that represent the current economy. For example, nonresident angling on the study waters accounts for around 11% of economic value added by the recreation/entertainment sector ($17.0 million out of $156 million) and 0.20% of that of the whole economy. Similarly nonresident angling accounts for 11% of the jobs in the recreation/entertainment sector and 0.25% of those in the entire economy. By comparison, agriculture accounts for 3.6% of total value added by regional exports and 4.4% of total jobs in the region.

Table 10. IMPLAN output for agriculture and recreation/entertainment sectors and the regional economy as a whole.

	IMPLAN Sector 11: Agriculture (ag, forestry, fishing hunting)	IMPLAN Sector 71: General recreation and entertainment (arts, entertainment, recreation)	Sum of all IMPLAN sectors: entire regional economy
Regional exports (millions)	$510	$156	$12,300
Base output (millions)	$811	$282	$16,500
Base value added (millions)	$305	$156	$8,400
Base Jobs	5,580	2,890	128,000

Additional value to anglers

We found no significant difference across water bodies in the slope or median value of logistic regression curves that describe the probability of taking the fishing trip as a function of additional daily cost (Likelihood Ratio Test, $\chi_4^2 = 8.7, P = 0.068, df = 416$). This indicates no significant difference in consumer surplus across water bodies. However, we found a significant difference in consumer surplus between residents and nonresidents (Likelihood Ratio Test, $\chi_1^2 = 21.2, P < 0.001, df = 416$). Consumer surplus was $68/day for residents (95% CI [47,99]) and $214/day for nonresidents (95% CI [154,318]; Figure 10).

When extrapolated to all anglers in the population, total consumer surplus ranged from $4.8 million for Henrys Lake to $34.0 million for Henrys Fork (Table 11). The total consumer surplus for all water bodies is around $48 million. Consumer surplus is a very large fraction of, and in some cases even a little higher than current spending. The total consumer surplus is 83% of what anglers already spend, i.e., anglers are willing to pay almost twice as much for their angling as they currently do (Table 12).

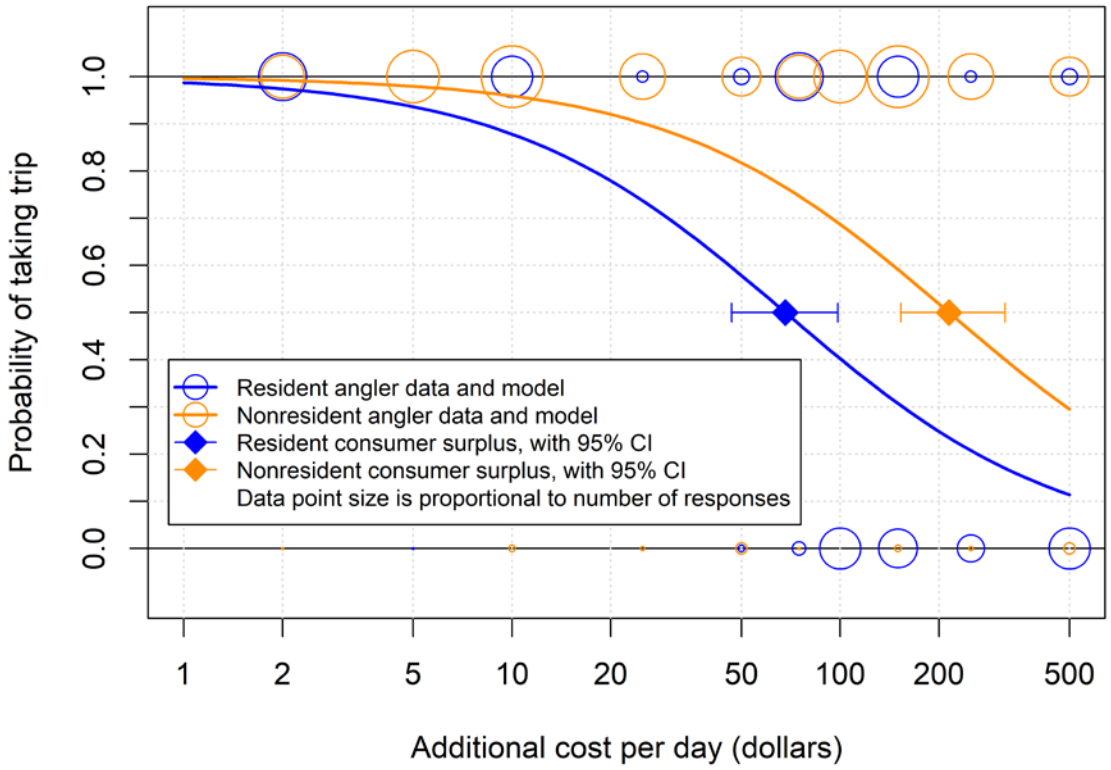

Figure 10. Average willingness to pay for the current fishing experience.

Table 11. Consumer surplus by water body and residency, in millions.

	Residents	Nonresidents	TOTAL
Henrys Lake	$1.7	$3.1	$4.8
Henrys Fork	$4.5	$29.5	$34.0
Teton River	$2.0	$7.2	$9.2
TOTAL	$8.2	$39.8	$48.0

Table 12. Consumer surplus as a percent of actual spending.

	Residents	Nonresidents	TOTAL
Henrys Lake	80.0%	51.6%	59.3%
Henrys Fork	68.5%	104.8%	98.0%
Teton River	106.1%	55.9%	62.3%
TOTAL	77.6%	84.7%	83.4%

The hypothetical scenarios of doubling an angler's catch rate, and of increasing the size of fish caught by 25%, both had a statistically significant effect on angler effort across all three water bodies (Tables 13 and 14). Doubling catch rate would increase mean annual angler effort between 2.6 days (Teton River nonresidents) and 5.6 days (Henrys Fork combined resident/nonresident). Increasing the size of fish caught by 25% would increase mean angler effort between 1.8 days (Henrys Lake resident) and 5.0 days (Henrys Fork combined resident/nonresident). Adding three more access points had a statistically significant effect on the number of days that resident Teton River anglers would fish that reach (mean increase of 3.2 days) but did not have a statistically significant effect on anglers on the other water bodies. Cutting the amount of river use in half had a statistically significant effect on the number of days Teton River resident and nonresident anglers would fish but would have no effect on effort on the other two water bodies. Decreasing the amount of use by half as many people would increase total Teton River resident effort by 24% CI [9, 40] and total Teton River nonresident effort by 33% CI [9, 60]. The question regarding changes in effort with improvements to access site facilities was asked only to Teton River anglers, and the results indicated that improving access site facilities would have no effect on Teton River angler use.

Trend analysis of Henrys Lake creel data showed that the fishery gradually shifted from a harvest-oriented fishery to largely catch-and-release fishery throughout the 1970s and 1980s. This analysis suggests that the "modern" Henrys Lake fishery, with harvest rates consistently below 33%, began in 1991. Using data from 1991-2019, we found a statistically significant, power-function relationship between catch rate and total angler effort (F-test, $F_{1,12} = 8.5, P = 0.013$, Figure 11). This model indicated that observed angler effort increases by around 40% (95% CI [9,80]) for a doubling of catch rate. Averaged over both resident and nonresident survey

respondents, total effort on Henrys Lake would increase by a self-reported 57% in response to a hypothetical doubling of catch rate. This self-reported behavioral response is close to the observed response and well within the statistical confidence interval. Catch rate in 2016, when the survey instrument was distributed, was 0.36 fish/hour but increased to 1.09 fish/hour in 2019. This produced an observed increase in effort from 75,000 angler hours in 2016 to 227,500 angler hours in 2019, close to model predictions (Figure 11).

Table 13. Mean change in days fished per year per angler with conditional management options. The sample size for each response is given in parentheses.

	Catch doubled	25% larger fish	Three more access points	Half as many people	Improved access site facilities
Henrys Lake resident	4.5 (*n=53*)	1.8 (*n=57*)	-0.7 (*n=60*)	1.1 (*n=36*)	NA
Henrys Lake nonresident	4.9 (*n=72*)	3.9 (*n=75*)	2.5 (*n=73*)	2.1 (*n=40*)	NA
Henrys Fork combined*	5.6 (*n=180*)	5 (*n=184*)	0.8 (*n=179*)	3.7 (*n=13*)	NA
Teton River resident	3.9 (*n=54*)	3.5 (*n=48*)	3.2 (*n=39*)	4.8 (*n=40*)	0.1 (n=44)
Teton River nonresident	2.6 (*n=41*)	2.1 (*n=39*)	-0.2 (*n=37*)	2.1 (*n=39*)	0.2 (n=42)

*The intent was to conduct this analysis by residency, but sample size necessitated combining residents and nonresidents for Henrys Fork.

Table 14. Mean change in effort with 95% CI.

	Catch doubled	25% larger fish	Three more access points	Half as many people	Improved access site facilities
Henrys Lake resident	37% [17, 58]	15% [3, 27]	-6% [-23, 14]	8% [-6, 22]	NA
Henrys Lake nonresident	76% [29, 131]	62% [17, 115]	40% [-6, 96]	31%[-10, 82]	NA
Henrys Fork combined*	47% [22, 74]	41% [21, 62]	7% [-6, 21]	20%[-7, 54]	NA
Teton River resident	21% [8, 34]	19% [6, 33]	15% [4, 27]	24% [9, 40]	0% [-4, 4]
Teton River nonresident	31% [1, 66]	23% [-1, 51]	-3% [-21, 21]	33% [9, 60]	1% [-6, 9]

*The intent was to conduct this analysis by residency, but sample size necessitated combining residents and nonresidents for Henrys Fork.

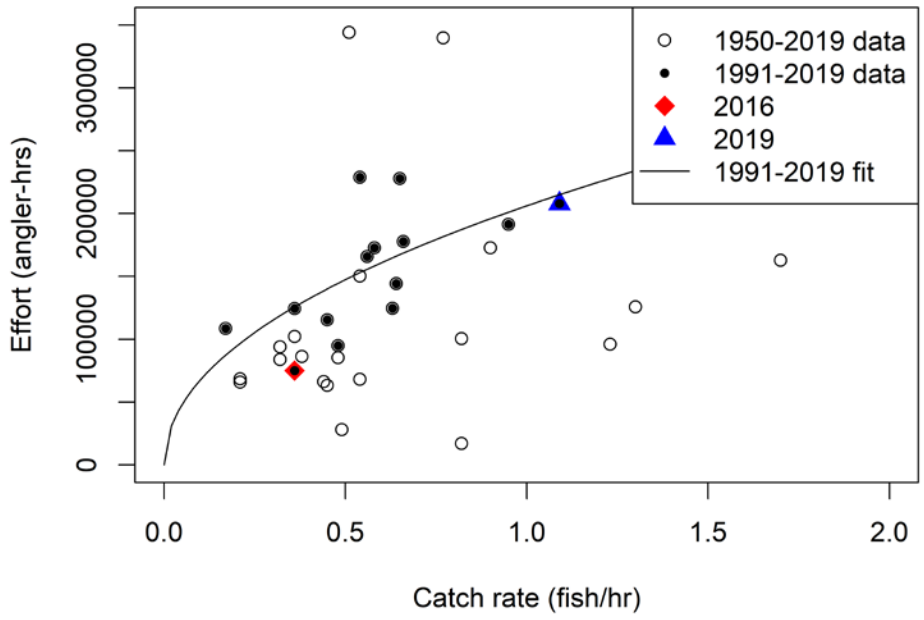

Figure 11. Effort vs catch rate on Henrys Lake. Data were not collected every year, but all data available within each of the two time periods are shown on the graph.

Contribution of part-year residents

Part-year residents comprised 15.2% of the angling population across all water bodies: 19.1% on Henrys Lake, 11.2% on Henrys Fork, and 31.5% on the Teton River (Table 15). Among all lodging options, per-night spending on vacation homes ranked a very close second to private campgrounds and accounted for 24% of the mean nightly cost of lodging (Table 16). Part-year residents accounted for a disproportionate 25% of total angler days because they fished an average of 17.5 days per year, compared with 9.2 days per year for all other anglers. At the mean nonresident spending rate of $382 per angler per day, the additional 8.3 days per year fished by part-year residents accounted for $9.6 million (23%) of the total $41.3 million in nonresident spending.

Table 15. Number of anglers owning vacation homes, by value, and total property taxes paid.

	Home value ($1000)					Number of part-year residents	Total population of anglers	Total property taxes paid
	<100	100-199	200-499	500-999	≥1,000			
Henrys Lake	220	212	252	441	0	1,125	5,898	$4,132,332
Henrys Fork	205	179	128	205	439	1,156	10,322	$7,051,516
Teton River	0	131	60	126	196	513	2,139	$3,104,412
TOTAL	425	522	440	772	635	2,794	18,359	$14,288,260

Table 16. Lodging expenditures per night averaged over all survey respondents.

Lodging option	Average per trip expenditure
Private camp	$8.49
Vacation home	$8.34
Hotel/lodge	$7.26
Cabin rental	$5.85
Public camp	$4.67
TOTAL	$34.61

Median values of vacation homes owned by anglers were in the range of $200-$499 thousand for Henrys Lake anglers, and $500-$999 thousand for Henrys Fork and Teton River anglers. Among vacation homes owned by Henrys Fork and Teton River anglers, 38% of them had values of at least $1 million. Across all home-value categories, property tax for similarly-valued homes was $510 greater in Fremont County than in Teton County (Table 17). Estimated property tax payments made by part-year residents in the angling population totaled $4.1 million for Henrys Lake anglers, $7.1 million by Henrys Fork anglers and $3.1 million by Teton River anglers. However, sampling errors around these estimates are high, ranging from 53% on Henrys Fork to 67% on Henrys Lake (Figure 12). We estimated the total property tax contribution over all water bodies at $14.3 million (95% CI [9.59,19.8]). All of this except that paid on Teton Valley properties on the Wyoming side of the state line would go to the six Idaho counties in our

study region. Publicly available budget information indicates that total property tax revenue for those counties was $64.6 million in 2017.

Table 17. Mean annual property tax, by county and property-value category.

Property value in $	Fremont County	Teton County
<100,000	$1,058	$549
100,000 – 199,999	$1,779	$1,269
200,000 – 499,999	$2,860	$2,351
500,000 – 999,999	$6,356	$5,847
>1,000,000	$11,031	$10,522

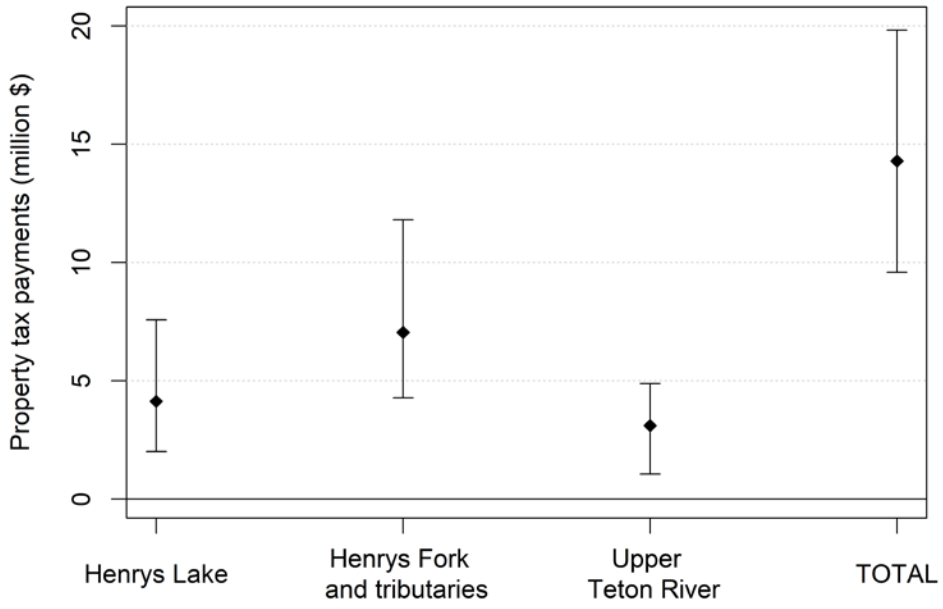

Figure 12. Property tax payments on vacation homes, with 95% confidence intervals.

DISCUSSION

Recreational angling provides a non-trivial contribution to local, state, and national economies. Recreational angling contributes an estimated $125 billion to the national economy and creates over 800,000 jobs nation-wide (Southwick Associates 2019). Partitioned by state,

Idaho recreational angling is estimated to provide $1.12 billion to the national economy, Wyoming recreational angling is estimated to provide $853 million to the national economy, and Montana recreational angling is estimated to provide $706 million to the national economy. While these coarse, large-scale, estimates provide insight into the contribution recreational angling has to the national economy, they do not provide the detail or resolution necessary to be useful for managers and decision makers at the scale of counties or water bodies. We conducted a fine-scale analysis intended to meet this need on three of Idaho's most important fisheries.

Characteristics of the study waters

Strong distinctions among the three study waters provide context for interpretation and application of our results.

Henrys Lake primarily draws anglers from Idaho and northern Utah, although only about 50% live within our seven-county region, comparable to that of the other water bodies. Half of these anglers are employed full-time, and their household income is lower than that of anglers in the other two fisheries. Although 19% of Henrys Lake anglers are part-year residents, the value of homes owned by these part-year residents is lower than that on the other two waters. The majority of Henrys Lake anglers travel by automobile or RV to the lake and camp or stay in their permanent residence or vacation home the night before their fishing trip. Between a higher rate of automobile/RV travel and the dominance of boat angling on Henrys Lake, fuel is the largest expense per angling day. Spending per angling day on Henrys Lake is substantially lower than on the other two water bodies. Because most anglers live within a 6-hour drive of Henrys Lake, they can respond quickly to changes in fishing conditions and apparently do, as reflected both in observed variability in effort from year to year and in their self-reported behavioral changes to

hypothetical increases in catch rate and fish size. Thus, the economic contribution of Henrys Lake will vary from year to year depending on fishing conditions.

At the other extreme of the three water bodies, Teton River anglers travel from around the country, have higher incomes, and are mostly retired. Although the fraction of nonresidents is lowest on the Teton River, the fraction of part-year residents in the Teton River angling population is far greater than on the other two water bodies. As a result, residents and part-year residents account for over 80% of all angling effort on the Teton River, and trips between their permanent or vacation residence to the river were shorter than on the other waters. Even with the conservative method we used to value vacation homes as a lodging option, high vacation-home ownership rate, along with high value of those homes, made lodging the largest daily expense for Teton River anglers. Overall, Teton River anglers spent about the same per day of angling as anglers on the Henrys Fork, but nonresident spending was higher on the Teton River. Self-reported increase in angling effort to hypothetical increases in catch rate of fish size was much smaller among Teton River anglers, and they placed smaller importance on size of fish caught than anglers on the other two water bodies. They did, however, place relatively high importance on catching native Cutthroat Trout.

The Henrys Fork fishery is intermediate in most aspects. Although it shares with the Henrys Lake fishery a large angling constituency in Idaho and northern Utah, it draws anglers from a wider geographic area. On the other hand, although it has a much higher profile nationally than the Teton River, the large majority of Henrys Fork anglers live in the western states and Texas, with relatively large concentrations in California and Montana. A larger fraction of Teton River anglers report permanent residency in the East and Midwest. The fraction of retired anglers on the Henrys Fork was about the same as on the Teton River, but Henrys Fork anglers were, on

the whole, 5-10 years younger than anglers in the other fisheries. Household income, home value, and daily spending among nonresidents on the Henrys Fork were intermediate to the other two waters. Vacation-home ownership among Henrys Fork anglers was the lowest among the three water bodies at 11%, but because of the high value of those homes and the much larger angling population, part-year residents on the Henrys Fork contributed half of the total property taxes paid by part-year residents. Anglers on the Henrys Fork used more diverse travel and lodging options, and their highest daily expense was equipment rental. Although we did not subdivide the equipment rental category, this higher relative expenditure could reflect an anecdotally observed increase in drift boat rentals on the Henrys Fork. Anglers on the Henrys Fork were intermediate in their preference for catching large fish and in their self-reported change in angling effort to hypothetical changes in size and number of fish caught.

Comparison with previous studies

Further distinctions among the fisheries are evident when results of this study are compared with those of the previous two, conducted in 2003 (Grunder et al. 2008) and 2004 (Loomis 2005, 2006). We emphasize that these comparisons are not necessarily direct, because methods, definitions, and reporting differed across the three studies. However, we made every effort to convert all results to measures that were as comparable as possible, given the data resolution. We converted adjusted dollar figures from 2003 and 2004 for inflation to 2017 values for comparison with our 2016-2018 values. We also assumed that the margin of error on estimates made in the other studies, which was seldom, was similar to that in our study.

For the most part, angler effort, demographics, spending characteristics, and economic contribution on Henrys Lake and Henrys Fork did not differ much among the three studies (Tables 18 and 19). We report a larger fraction of nonresidents than Loomis (2005), but our

definition of residency did not include Bingham County (Blackfoot area), whereas the Loomis definition did. All of the effort figures for these two water bodies fell within the estimated margin of statistical error. Our estimates of daily spending on Henrys Lake and Henrys Fork differed somewhat from those reported by the other two studies, but sampling error and differences in methodology could account for most of these differences. Likewise, total spending, consumer surplus, and regional economic contribution differed somewhat, but most estimates were probably within the margin of error.

Table 18. Comparison of angler effort and spending between 2003 (Grunder et al. 2008) and 2016-2018 (this study). Dollar figures from 2003 were adjusted for inflation to 2017 value.

	Effort (angler days)		Spending per angler per day		Total spending (millions)	
	Grunder	This study	Grunder**	This study	Grunder	This study
Henrys Lake	54,489	53,221	$302	$152	$16.5	$8.1
Henrys Fork	140,165	126,293	$298	$278	$41.8	$34.8
Teton River*	8,710	32,114	$105	$251	$0.9	$8.1
TOTAL	191,144	211,628			$59.2	$51.1

*The 2003 figures are for the entire Teton River, whereas this study included only the upper Teton River.
**Spending per angler per day in 2003 was calculated on a county basis. The Henrys Lake spending reported here is the Fremont County average, and the Henrys Fork spending reported is a weighted mean of daily spending in Madison and Fremont counties.

Loomis (2006) reported a larger contribution of angling as an export (nonresident expenditures in the region) to regional jobs, especially relative to reported angler spending per day, but their six-county region differed from ours, and their calculations were based on a 1994 application of IMPLAN. Absent more details, these methodological differences could explain most if not all of the differences, and we conclude that, generally speaking, the Henrys Lake and Henrys Fork fisheries as a whole changed relatively little between the 2003-2004 and 2016-2018.

However, the Teton River fishery has changed substantially over that time. The Teton River was not included in the Loomis study, but based on comparison with the Grunder et al. (2008) study, angling effort on the Teton River has increased by a factor of four, and spending

per day by anglers on the Teton River has more than doubled. As a result, spending and economic value of the Teton River fishery increased from less than 2% of the total in 2003 to 16% in 2018. The population and demographics of Teton County, Idaho changed dramatically between the late 1990s and late 2000s, with most of that occurring between 2003 and 2008 (Baker et al. 2014). This change is readily apparent in our results.

Table 19. Comparison of key angler, trip, and economic statistics between 2004 (Loomis 2005, 2006) and 2016-2018 (this study). Where necessary, statistics from Loomis were converted to equivalent measures used in this study, including dollar figures. We reported separate figures for Henrys Lake (HL) and Henrys Fork (HF) where those were reported by Loomis; otherwise we report combined (HL + HF) figures. The Loomis study did not include Teton River.

	Loomis	This study
HL + HF percent nonresidents	48%	53%
HL effort (angler days)	40,922	53,221
HF effort (angler days)	127,734	126,293
HF percent of effort downstream of Riverside	38%	64%
HL increase in effort, twice catch	77%	57%
HF increase in effort, twice catch	66%	47%
HL increase in effort, 25% larger fish	90%	39%
HF increase in effort, 25% larger fish	62%	41%
HL degree of crowding (10-pt scale)	4.1	3.9
HF degree of crowding (10-pt scale)	5.3	4.5
HL + HF spending per day	$149	$240
HL consumer surplus, per angler day	$106	$93
HF consumer surplus, per angler day	$119	$158
HL + HF fishing export jobs	333	238
HL + HF fishing export value added (millions)	$14.6	$12.8

A few other important differences are apparent in comparison of our results with those of the Loomis study. The largest of these is geographic distribution of angling effort on the Henrys Fork. In 2004, only 38% of angling effort occurred downstream of Riverside Campground, reflecting the traditional emphasis on the Mack's Inn, Box Canyon, and Harriman State Park (Railroad Ranch) reaches, which made the Henrys Fork fishery famous in the first place (Van Kirk and Gamblin 2000). In 2017, the distribution was nearly the opposite; 64% of angling effort

occurred downstream of Riverside. Effort downstream of Ashton increased from 27,120 angler days in 2004 to 36,319 in 2017, a 34% increase. Several factors have probably contributed to this, including decline in fishing experience on the Mack's Inn reach (Van Kirk et al. 2019a), increased availability and popularity of year-round fishing in the lower watershed, and population growth in and around Rexburg, which is much closer to the lower Henrys Fork than to the upper river.

Another difference was in angler responses to questions about their expected change in angling effort to hypothetical management changes. These questions were identical in the two surveys, so comparison is direct. For both Henrys Lake and Henrys Fork, anglers self-reported much smaller increases in angling effort with hypothetical increases in fish size and catch rate in our study than in the 2004 study. The difference between the two studies was largest in response to hypothetical increase in fish size. These differences could indicate that anglers are now more satisfied with the sizes and numbers of fish they catch and thus are less likely to increase the number of days they fish if these change. The lower tendency to increase effort is not likely due to the cost of additional fishing days, because consumer surplus (willingness to pay for additional days of angling) has changed very little.

Economic value

We consider all in-region expenditures as primary economic activity, and estimate that at $41.1 million, with a few caveats. Although in-region expenditures by residents do not constitute new money, we view these as being similar to expenditures of non-base industries. Non-base-industry expenditures "serve the important role of keeping money in the region by way of local purchases" (Watson and Beleiciks 2009). We acknowledge that this approach ignores the possibility that absent angling and other water recreation, residents might recreate elsewhere and

take money out of the region. We likewise have neglected the new-money implications of retired residents whose pensions originate outside the region and of retired nonresidents whose pensions originate within the region.

When limiting economic contribution only to nonresident angling (i.e., treating recreational angling as an export), fishing on the study waters accounts for around 11% of regional economic activity in the general entertainment and recreation sector. The Henrys Fork alone contributes nearly half of that. In our six-county region of economic impact, the majority of exports in this sector are likely to be associated with outdoor recreation, including fishing, hunting, snow sports, and travel through the region to the national parks. Thus, our analysis indicates that fishing in the Henrys Fork watershed is a nontrivial economic contributor among a large number of recreational activities that draw people to the region. However, recreational fishing accounts for about only 0.2% of the total regional export economy. Furthermore, agriculture as a sector contributes about twice as much to the export economy as the entire entertainment/recreation sector and about 4% of the total regional economy, by any of the measures reported in Tables 9 and 10. Thus, agriculture contributes about 20 times more to the regional economy than recreational fishing on the study waters. Even if the additional value to anglers in the form of consumer surplus were converted into economic activity, the value of recreational fishing would still be less than 0.4% of the regional export economy, compared with the roughly 4% for agriculture.

Because the regional economic context is required for meaningful estimates of the contribution of angling, comparison with other water bodies is most easily done using consumer surplus. Our per-day consumer surplus estimates of $68 for residents and $204 for nonresidents (average of $130) are generally within the range of those reported for other recreational fisheries.

Hutt et al. (2013) reported consumer surplus values of $82 and $115 (adjusted for inflation) for trophy crappie fisheries in two Mississippi reservoirs, and Plauger (2018) estimated consumer surplus at $189 per day for a mixed warm-water fishery in an Alabama/Georgia reservoir. These comparisons provide evidence that anglers place roughly the same value on their angling experience regardless of geographic location or fishery type. However, the consumer surplus for nonresidents on our study waters is most likely greater than that in many other fisheries.

It is worth observing that one monetary contribution to the region and state of Idaho that was not included in this analysis is the contribution anglers have to fisheries management, education, and restoration through the purchase of fishing and fishing-related equipment. These purchases provide support to state agencies through the Federal Aid in Sport Fish Restoration Act of 1950 (commonly known as the Dingell-Johnson Act), which created a 3% excise tax on the sale of all fishing and fishing-related equipment. The funds from this tax are distributed to state agencies for fishery management, restoration, aquatic education, clean vessel sanitation devices, and boat safety programs. Roughly $370 million were appropriated between states in 2019 from the Federal Aid in Sport Fish Restoration Act and Idaho received roughly $6.8 million in 2019 (U.S. Fish and Wildlife Service 2019).

Contribution of part-year residents

Our attempt at quantifying the additional economic contribution of part-year residents appears to be one of first such attempts. The first two measures we used—value of vacation homes as a lodging expense and value of additional angling days by part-year residents—indicate that while around 15% of anglers on the study waters are part-year residents, these anglers contribute 24% of daily lodging costs and 23% of total spending by nonresidents. These two measures are insensitive to assumptions about the relative contribution of fishing

opportunity to the reasons for owning a vacation home. The per-night lodging cost is conservative in that it assumes a relatively low maintenance value (1%) and divides that value among all nights spent in the home, regardless of the number of days the angler fished while at the vacation home. It is applied only to the number of days fished and so does not depend on whether the angler fished only a few days per year or every day spent per year in the vacation home.

Total spending due to the additional days on the water spent by part-year residents is also an objective measure that does not depend on the answer to the "chicken or egg" question: did part-year residents in our study fish more days per year because they own a vacation home or did they purchase the vacation home because they fish more?

Our third measure—total property tax payments—is not as robust to assumptions. If fishing were the sole or initial reason that a part-year resident purchased a home in the region, then it is reasonable to assign all property tax payments made on that home to fishing. However, it is likely that many if not most part-year residents have other reasons for maintaining a home in the region. Part-year residents in our study may have a non-angling spouse or other family members who participate in other recreational opportunities. Thus, only some fraction of the total property taxes paid is attributable to fishing. Nonetheless, all of the $14 million in property taxes we report were made by nonresidents who fish, and these taxes represent a contribution to the regional county tax base that would not be counted with standard methods applied to residents and nonresidents only.

A 2003 study assessed the economic contribution of part-year residents in Vermont for the purposes of developing policy to increase the value of Vermont's tourism industry (Economic & Policy Resources, Inc. 2005). As noted above, interpretation of primary spending

figures requires regional economic context, so the dollar figures are not immediately relevant to our study. However, a survey of part-year residents within the Henrys Fork watershed similar to the Vermont study could help develop a better understanding of economic contributions of part-year residents by more thoroughly assessing their expenditure patterns, their reasons for owning a vacation home, and other important information. This would help estimate the contribution of recreational fishing in our region by part-year residents, relative to other activities such as snow sports, hiking, or wildlife viewing.

Management implications

Two of the management-oriented questions we asked were related to catch. Not surprisingly, anglers on Henrys Lake, Henrys Fork, and Teton River indicated they would spend more days fishing if they caught larger fish and more fish. The increase in effort per unit change in catch rate and fish size was greatest among Henrys Lake anglers, and the catch rate data we analyzed indicated that Henrys Lake anglers actually do what they say they will. Because it is primarily hatchery supported, the Henrys Lake fishery is more responsive to fisheries management actions than the other two. The balance between high catch rates and large fish size on Henrys Lake has long been a challenge for managers (Garren et al. 2009). In this study, Henrys Lake anglers placed higher importance on size of fish caught than on numbers of fish caught, and also reported a larger increase in effort for increase in fish size. These results suggest that managers should lean more toward increasing size of fish to maintain or enhance the economic value of the Henrys Lake fishery.

On the other two water bodies, most reaches and tributaries are already managed under catch-and-release or other wild-trout regulations, so there is little room for improvements due to fisheries management changes. Instead, habitat restoration and protection and streamflow

improvements are more likely to have larger effects on fishing quality. Substantial improvement in the native Cutthroat Trout population in the Teton River over the past two decades (Heckel et al. 2020) may have contributed to the large increase in angler effort there since the early 2000s. On the Henrys Fork, water management—in particular management of Island Park Reservoir—will continue to be the most important factor in determining trout populations there (Van Kirk et al. 2019b). The fisheries of the Mack's Inn reach, Box Canyon, and Harriman State Park are the most sensitive to water management, so improved management of Island Park Reservoir may shift some angler effort back toward these upper reaches. On the other hand, with increased use of the lower Henrys Fork, innovative water management strategies such as managed aquifer recharge that improve streamflow and habitat there (Van Kirk et al. 2020) could be important in increasing angler satisfaction and effort there. Because the regional economic contribution of recreational angling is very small compared with that of agriculture—even if the full consumer surplus were converted to spending—economic considerations are not likely to shift water away from agriculture and toward fisheries. However, new approaches to water management that promote sustainability of irrigated lands and benefit both agriculture and fisheries (Van Kirk et al. 2019b) have promise to maintain the current economic contributions of both sectors.

The other three management-oriented questions we asked were related to access, facilities, and crowding. Parking space was the only access site feature important to all three angling populations, and among the other features, the only one that was of above-average importance was concrete boat ramps at Henrys Lake. The number of access points was generally not a major factor in determining angler effort. Only Teton River resident anglers indicated they would fish more if there were more access points on the river. Thus, resources devoted to access

seem most efficiently applied toward enhancing parking at existing sites and maintaining or improving concrete ramps at Henrys Lake.

This study identified crowding as an emerging aspect of fishing experience that will need attention from managers, policy makers and stakeholder groups. Teton River anglers rated crowding at 5.0 on a 10-point scale, and both resident and nonresident anglers reported statistically significant increases in the number of days they would fish if they saw half as many people. Of course this is somewhat of a management paradox—anglers would fish more often if they fished less often, but over 80% of anglers who reported that the river was too crowded cited floating (both angling and non-angling) and not fishing per se as the primary contributor to crowding. In this study (2016 and 2017 data), anglers on Henrys Lake and Henrys Fork as a whole rated degree of crowding as only 3.9 and 4.5 on the 10-point scale and reported no significant change in their angling effort if crowding were reduced. However, a separate study conducted in 2019 identified crowding, and in particular conflict between anglers and non-angling floaters, as an important factor decreasing the quality of the fishing experience on the Henrys Fork in the Mack's Inn area (Van Kirk et al. 2019a).

In 2020, covid-related restrictions on indoor activities and large-group entertainment opportunities appeared to have increased the number of people recreating on waters throughout the region. The Henry's Fork Foundation received more complaints about recreational user conflicts on the river in 2020 than in any recent year, and Idaho Department of Fish and Game received numerous complaints about crowding on the Teton River (Brett High, Idaho Department of Fish and Game, personal communication). Although it is unclear whether increased outdoor recreation in 2020 will become part of the post-covid "new normal," trends over the past few years suggest that crowding is a major issue that threatens to reduce the quality

of the fishing experience and hence economic value of regional fisheries. On the Henrys Fork, the large shift in angling effort from the upper to lower reaches over the past two decades could foretell crowding issues on the lower Henrys Fork. Alleviating that crowding by shifting some angling effort back to the upper Henrys Fork will require reducing conflicts with non-angling recreational floaters there. Another strategy to reduce potential crowding among anglers themselves is to improve fish populations and angling opportunities on waters that currently do not support high-quality fisheries. The potential for such improvement exists on the very lowest reaches of the Teton River and Henrys Fork, in the Rexburg area. On the Teton River, increase in angling effort and per-angler spending in Teton Valley has increased the economic contribution of that fishery to equal that of the long-standing Henrys Lake fishery. Thus, maintaining the quality of fishing on the upper Teton River is much more economically important than it was 15 years ago. Addressing crowding will be critical to maintaining the current quality of angling and its economic contribution on both the Teton River and Henrys Fork.

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Appendix A. Statistical Estimators

Teton River mark-recapture estimator

The mark-recapture method used was an open-population, multiple mark-release design, assuming that individuals who leave the population during the study period do not return ("permanent emigration"). Each individual interview of a recreational user was considered a "capture," all unique individuals interviewed prior to a given survey day was the number of "marked" individuals present in the population at that day, and each interview with an individual who had previously been interviewed was a "recapture." All interviewees were asked if they had previously been interviewed. If not, they were assigned a unique identification code ("mark") that could easily be recalled by the individual (a combination of birth year and initials). If so, they were recorded as a "recapture" on the day of the interview. Because we tracked each individual by their unique identification code, we could determine the day on which any recaptured individual was initially marked.

We estimated the population N_j on each sample day j with Chapman's simple least-squares regression model (Seber 2002; pg. 238):

$$\left[\frac{v_i(C_j+1)}{(R_{i,j}+1)}\right] = (N_j) + (\phi)(t_j - t_i) + \varepsilon, \tag{A.1}$$

where

v_i is the number of newly marked individuals released on day i

C_j is the total number of individuals captured on day j

$R_{i,j}$ is the number of individuals initially marked on day i that were recaptured on day j

ϕ is the per-day geometric rate of change in the population

$t_j - t_i$ is the number of days between capture day j and release day i, and

ε is an independent, identically distributed normal random variable with mean 0.

In addition to the standard assumptions for such least-square regression models, the geometric rate of change $\phi = N_{t+1}/N_t$ is assumed to be constant and less than 1, representing the probability that an individual present in the population on day t will be present on day $t + 1$. Standard errors for the regression intercept (N_j) and slope (ϕ) allowed calculation of confidence intervals for N_j and ϕ. The regression was performed for each sample day, starting on the 5th day, so that at least two degrees of freedom were available for estimating the regression parameters. Once (N_j) and its standard error were obtained for each sample day, we estimated stratum and season-total use and confidence intervals. Within-stratum use was calculated as the product of per-day use and total number of days in the stratum. Because probability sampling was used, weighted means were used to estimate parameters within each stratum; weights were the reciprocals of sampling probabilities.

Change in angling effort in response to management changes

To derive the appropriate estimator of change in effort based on survey responses, let:

$E =$ total effort (recreation days)

$E_m =$ new total effort resulting from hypothetical management change

$N =$ (unknown) population of anglers/recreationists

$n =$ (known) sample of anglers/recreationists

$d_i =$ number of days per season individual i fishes/recreates

$c_i =$ change in number of annual recreation days i would make if management changed .

Note that c_i can be any integer, so its distribution cannot easily be transformed to address skewness. Then

$$E = \sum_{i=1}^{N} d_i \tag{A.2}$$

and

$$E_m = \sum_{i=1}^{N} (d_i + c_i) = \left[1 + \frac{\sum_{i=1}^{N} c_i}{E}\right] E = \rho E, \tag{A.3}$$

where ρ is the multiplicative factor by which total effort changes as a result of the hypothetical management action. This factor can be applied to the count-based effort estimate without knowing anything about the individual anglers that were counted on any given day. A little algebra yields

$$\rho = \frac{\frac{1}{N}\sum_{i=1}^{N}(d_i + c_i)}{\frac{1}{N}\sum_{i=1}^{N} d_i}, \tag{A.4}$$

from which statistical theory and calculus show that an unbiased estimator based on the survey responses is

$$\hat{\rho} = \frac{\frac{1}{n}\sum_{i=1}^{n}(d_i + c_i)}{\frac{1}{n}\sum_{i=1}^{n} d_i}. \tag{A.5}$$

Then, given the count-based effort estimate $\hat{E}$, the estimate of new effort expected upon making the hypothetical change in recreational experience is

$$\hat{E}_m = \hat{\rho}\hat{E}. \tag{A.6}$$

The sampling distribution of $\hat{E}_m$ can be estimated using bootstrapping from the sampling distributions of $\hat{\rho}$ and $\hat{E}$. The estimate and sampling distribution of $\hat{\rho}$ can be obtained by fitting the appropriate means to the sample data $d_i + c_i$ and d_i and using bootstrapping for their ratio. Both of these quantities were right-skewed. The survey asked anglers to report the number of

days they had fished the given water body in the past year. For anglers reporting a nonzero response, we can assume this response is equal to the number of days they fished during the year when the count-based effort estimate was made, which is d_i in the above equations. Some survey respondents reported 0, which is a valid response if that angler did not fish the given water body in the past year, and the trip on which they were surveyed was their first trip to that water body in the year of the survey. However, they obviously fished that water body at least one day during the survey year, because they received the survey instrument on that water body. Including 0 values in equation (A.5) will result in a slight overestimate of $\hat{\rho}$. So, for the purposes of this estimate, 0 values for d_i needed to be replaced with a nonzero value. In absence of any other information, we replaced all 0 values with 1. This ensures that $d_i > 0$. However, $d_i + c_i$ could still be zero, since some respondents reported that they would reduce their number of recreation days enough that they would not fish/recreate at all. Thus, the $\log(x + 1)$ transformation was used.

Estimation of part-year resident population

To estimate total property taxes paid by anglers who fished a particular water body, we needed to estimate population of part-year residents. Letting N_i be the number of anglers in the population who owned a vacation home of value in category i, we have

$$N_i = \frac{N_i NE}{NE}, \tag{A.7}$$

where the total population of anglers N and total effort E are as defined above. Using the definition of E given in equation (A.2), equation (A.7) can be rearranged to yield

$$N_i = \frac{N_i}{N} \cdot \frac{E}{\frac{1}{N}\sum_{j=1}^{N} d_j}, \tag{A.8}$$

where d_j is the number of days per year angler j fished. Thus, a sample-based estimate of N_i derived from the survey responses and the count-based effort estimate $\hat{E}$ is

$$\widehat{N}_i = \frac{n_i}{n} \cdot \frac{\hat{E}}{\frac{1}{n}\sum_{j=1}^{n} d_j}. \tag{A.9}$$

Appendix B. Detailed Demographic and Spending Data

Demographic data

Tables B.1 through B.35 provide further information about angler demographics. The table captions refer to the corresponding questions in the survey instrument, e.g. QA1a refers to Question 1 part A in the survey instrument. The abbreviated column names have the following meanings: Min = minimum, Q1 = first quartile, Q3 = third quartile, Max = maximum, and # of Responses = the total number of valid survey responses to that question.

Table B.1. QA1a – Days.fish

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	3	4	4.60	5.5	19	147
Henrys Fork	0	3	5	4.99	6	12	231
Teton River	0	3	4	4.69	6	10	95
Total	0	3	5	4.81	6	19	473

Table B.2. QA1b – Hours.reach

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	3	4	4.60	5.5	19	147
Henrys Fork	0	3	5	4.99	6	12	231
Teton River	0	3	4	4.69	6	10	95
Total	0	3	5	4.81	6	19	473

Table B.3. QA1c - Hours.total

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	3	4	4.60	5.5	19	147
Henrys Fork	0	4	5	5.75	8	16	231
Teton River	0	3	4	4.69	6	10	95
Total	0	3.5	5	5.18	6	19	473

Table B.4. QA2 - Trip.purpose

	Fishing equally important	Fishing was incidental	Fish was primary	No fishing	# of Responses
Henrys Lake	0.11	0	0.89	0	149
Henrys Fork	0.05	0.02	0.93	0	227
Teton River	0.22	0	0.78	0	96
Total	0.1	0.01	0.89	0	472

Table B.5. QA3 - Lodging

	Private camp--ground	Public camp-ground	Hotel/motel /lodge	Other	Private residence	Short term rental	# of Responses
Henrys Lake	0.04	0.23	0.03	0.13	0.43	0.13	149
Henrys Fork	0.03	0.19	0.12	0.13	0.41	0.11	232
Teton River	0.03	0.04	0.1	0.04	0.68	0.1	96
Total	0.04	0.17	0.09	0.11	0.47	0.12	477

Table B.6. QA4 - Travel.time

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	15	30	81.07	105	720	151
Henrys Fork	1	15	30	49.93	60	345	232
Teton River	0	11.5	15	18.74	25	45	88
Total	0	15	30	54.08	60	720	471

Table B.7. QA5 - Travel.distance

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	6	16	53.18	78.5	470	148
Henrys Fork	0	6	20	31.11	45	350	225
Teton River	0.1	6	10	17.00	15.5	197	95
Total	0	6	15	35.22	45	470	468

Table B.8. QA7a - Number.trout

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	5	7	6.64	8.25	10	148
Henrys Fork	1	5	7	6.39	8.5	10	231
Teton River	1	5	6.5	6.38	8	10	94
Total	0	5	7	6.47	8	10	473

Table B.9. QA7b - Larger.trout

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	1	6	8	7.77	10	10	149
Henrys Fork	1	5	8	7.19	10	10	231
Teton River	1	4	6	5.73	8	10	93
Total	1	5	8	7.08	10	10	473

Table B.10. QA7c - Brook

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	4	5	5.78	8	10	148
Henrys Fork	1	1	2	3.39	5	10	230
Teton River	1	2	5	4.75	7	10	92
Total	0	1	5	4.41	7	10	470

Table B.11. QA7d - Brown

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	1	3	3.61	6	10	149
Henrys Fork	1	2	6	5.60	8	10	230
Teton River	0	2	5	5.01	7	10	91
Total	0	1	5	4.86	7	10	470

Table B.12. QA7e - Cutthroat

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	1	5	6	6.07	8	10	149
Henrys Fork	1	1	5	4.65	7	10	229
Teton River	1	5	7	6.90	10	10	93
Total	1	3	6	5.54	8	10	471

Table B.13. QA7f - Hybrid

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	1	5	7	6.91	9	10	149
Henrys Fork	1	1	5	4.65	7	10	229
Teton River	1	4	5	5.29	7	10	93
Total	1	3	5	5.49	8	10	471

Table B.14. QA7g - Rainbow

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	1	5	4.77	7	10	149
Henrys Fork	1	6	8	7.24	10	10	229
Teton River	1	5	6	6.01	8	10	93
Total	0	5	7	6.21	9	10	471

Table B.15. QA7h - Whitefish

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	1	1	2.11	2	10	147
Henrys Fork	1	1	1	2.59	4	10	228
Teton River	0	1	2	2.87	4.25	10	92
Total	0	1	1	2.49	4	10	467

Table B.16. QA7i - Restrooms

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	2	5	5.48	8	10	148
Henrys Fork	1	1	4	4.32	7	10	229
Teton River	0	2	5	4.79	7.25	10	92
Total	0	2	5	4.78	8	10	469

Table B.17. QA7j - Ramp

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	3.75	7	6.24	10	10	148
Henrys Fork	1	1	2	3.75	7	10	228
Teton River	0	1	5	5.13	8	10	93
Total	0	1	5	4.81	8	10	469

Table B.18. QA7k - Parking

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	1	5	8	7.03	10	10	149
Henrys Fork	1	4	6	5.84	8	10	229
Teton River	0	5	7	6.55	8	10	93
Total	0	5	7	6.36	9	10	471

Table B.19. QA7l – Information

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	3	5	5.73	8	10	148
Henrys Fork	1	2	5	5.32	8	10	229
Teton River	1	5	7	6.27	8	10	93
Total	0	3	6	5.64	8	10	470

Table B.20. QA8 - Crowded

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	1	1	2	3.92	7	10	149
Henrys Fork	1	2	4.5	4.63	7	10	230
Teton River	1	3	5	4.66	7	10	94
Total	1	2	4	4.41	7	10	473

Table B.21. QA9 – Crowded.Type

	Boat an-glers	Boat/ non-angler	Boat/ non-angler /other	Boat/ other	Non-angler	Non-angler/ other	Other	Wade	Wade /boat	Wade/ Boat/ non-angler/ other	Wade/ boat/ non-angler	Wade/ boat/ other	Wade/ non-angler	Wade/ non-angler/ other	# of Re-sponses
Henrys Lake	0.37	0	0.02	0.02	0.02	0	0.03	0.22	0.28	0.02	0.03	0.02	0	0	65
Henrys Fork	0.28	0.04	0	0	0.11	0.01	0.06	0.31	0.12	0	0.06	0	0	0.01	139
Teton River	0.13	0.72	0	0	0	0	0.02	0.04	0	0	0.06	0	0.02	0	47
Total	0.27	0.16	0	0	0.06	0	0.04	0.24	0.14	0	0.06	0	0	0.01	251

Table B.22. QD2A - Trips.year

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	1	1.5	3	5.59	7	50	95
Henrys Fork	0	1	2	7.33	5.75	100	134
Teton River	0	1	1	14.25	10	150	51
Total	0	1	2	8.00	6	150	280

Table B.23. QD2B - Mode.travel

	Auto-mobile	Automobile & other	Automobile & plane	Automobile & RV	Other	Plane	RV	RV & Plane	# of Responses
Henrys Lake	0.7	0	0.03	0.04	0.04	0	0.19	0	101
Henrys Fork	0.63	0	0.16	0.05	0.01	0.07	0.07	0.01	153
Teton River	0.83	0	0.06	0	0.02	0.09	0	0	53
Total	0.69	0	0.1	0.04	0.02	0.05	0.09	0.01	307

Table B.24. QD2C - Lodging.all

	Private camp-ground	Public campground	Private & public campground	Hotel	Private residence	Short term rental	# of Responses
Henrys Lake	0.05	0.31	0	0.05	0.45	0.14	98
Henrys Fork	0.09	0.25	0.01	0.18	0.32	0.14	142
Teton River	0.04	0.04	0	0.18	0.56	0.19	57
Total	0.07	0.23	0	0.14	0.41	0.15	297

Table B.25. QD3 - Gender

	Female	Male	# of Responses
Henrys Lake	0.11	0.89	143
Henrys Fork	0.12	0.88	215
Teton River	0.2	0.8	87
Total	0.13	0.87	445

Table B.26. - QD4.Age

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	22	47	58	56.13	67	84	145
Henrys Fork	17	33.75	46	46.83	60	85	212
Teton River	22	40	52	50.95	65	82	85
Total	17	37.25	52	50.67	65	85	442

Table B.27. QD5A1 - Employed

	No	Yes	# of Responses
Henrys Lake	0.46	0.54	143
Henrys Fork	0.3	0.7	213
Teton River	0.25	0.75	87
Total	0.34	0.66	443

Table B.28. QD5A2 - Employment

	Full time	Part time	Retired	Unemployed	# of Responses
Henrys Lake	0.49	0.05	0.45	0.01	141
Henrys Fork	0.64	0.07	0.24	0.05	213
Teton River	0.59	0.16	0.24	0	86
Total	0.58	0.08	0.31	0.02	440

Table B.29. QD5B -Time.off

	No	Yes	# of Responses
Henrys Lake	0.16	0.84	77
Henrys Fork	0.22	0.78	152
Teton River	0.28	0.72	67
Total	0.22	0.78	296

Table B.30. QD5C - Weeks.vacation

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	0	1	3	3.355263	4	30	76
Henrys Fork	0	0	3	3.544218	4.25	22	147
Teton River	0	0	3	3.830769	4	52	65
Total	0	0	3	3.559028	4	52	288

Table B.31. QD6 - education

	Bachelor's degree	Some college	Graduate or professional degree	High school graduate or equivalent	Less than high school	# of Responses
Henrys Lake	0.3	0.28	0.25	0.16	0.01	142
Henrys Fork	0.37	0.26	0.32	0.04	0	213
Teton River	0.47	0.11	0.38	0.03	0	87
Total	0.37	0.24	0.31	0.08	0	442

Table B.32. QD7 - Household.size

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	1	2	2	2.78	3	8	143
Henrys Fork	1	2	2	2.82	4	7	212
Teton River	1	2	2	2.69	4	7	78
Total	1	2	2	2.78	4	8	433

Table B.33. QD8 - Household.income.k

	Min	Q1	Median	Mean	Q3	Max	# of responses
Henrys Lake	10	70	90	98.45	112.5	300	139
Henrys Fork	10	50	90	114.02	137.5	300	204
Teton River	10	85	112.5	152.65	250	300	84
Total	10	70	90	116.55	137.5	300	427

Table B.34. QD9A - Home.value.k

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	50	150	350	271.52	350	750	79
Henrys Fork	50	150	350	364.38	350	1000	73
Teton River	150	350	350	488.04	750	1000	46
Total	50	150	350	356.06	350	1000	198

Table B.35. QD9b - Months.year

	Min	Q1	Median	Mean	Q3	Max	# of Responses
Henrys Lake	1	6	12	9.09	12	12	79
Henrys Fork	0	4	12	8.77	12	12	70
Teton River	0	4.5	10	8.32	12	12	47
Total	0	5	12	8.79	12	12	196

Expenditure Data

Tables B.36 through B.38 provide the per-person-day expenditures from the survey data. Tables B.39 through B.44 provide Expenditure Summary Statistics for each water body and resident class. The abbreviated column names have the following meanings: Min = minimum,

Q1 = first quartile, Q3 = third quartile, Max = maximum, and # Responses = the total number of survey responses.

Table B.36. Per-person-day expenditures for Henrys Lake anglers.

Expenditure Category	Nonresident expenditures in region	Nonresident expenditures outside Region	Resident expenditures in region	Resident expenditures outside region
Gas and oil	$36.29	$19.83	$27.27	$2.32
Restaurant food	$14.57	$9.67	$4.45	$1.53
Store food	$16.04	$18.36	$9.73	$0.87
Fishing supplies	$10.20	$18.94	$7.79	$0.01
Motel/hotel	$9.13	$2.04	$0.48	$0
Public camping	$11.42	$0.32	$2.03	$0
Private camping	$11.20	$0.55	$0.42	$0
Short-term rental	$2.18	$0.02	$2.98	$0
Equipment rental	$0.01	$0.02	$0	$0
Guide fees	$8.58	$5.31	$5.08	$0
Fishing license	$13.89	$1.46	$5.55	$2.27
Vehicle shuttle	$0.90	$1.90	$0.02	$0
Rental car	$0.54	$0.01	$2.20	$0
Other	$0.47	$0	$6.78	$0
Vacation home upkeep	$7.48	$0	$0.67	$0
Total per person-day	$143.22	$78.41	$75.47	$6.99

Table B.37. Per-person-day expenditures for Henrys Fork anglers.

Expenditure Category	Nonresident expenditures in region	Nonresident expenditures outside Region	Resident expenditures in region	Resident expenditures outside region
Gas and oil	$21.21	$6.35	$21.21	$6.35
Restaurant food	$22.69	$3.78	$22.69	$3.78
Store food	$16.13	$3.25	$16.13	$3.25
Fishing supplies	$26.51	$20.58	$26.51	$20.58
Motel/hotel	$5.30	$2.79	$5.30	$2.79
Public camping	$7.94	$0.42	$7.94	$0.42
Private camping	$28.54	$7.99	$28.54	$7.99
Short-term rental	$0.71	$0.29	$0.71	$0.29
Equipment rental	$101.90	$11.25	$101.90	$11.25
Guide fees	$25.08	$6.27	$25.08	$6.27
Fishing license	$8.80	$0.33	$8.80	$0.33
Vehicle shuttle	$13.26	$3.53	$13.26	$3.53
Rental car	$55.57	$13.54	$55.57	$13.54
Other	$0	$0	$0	$0
Vacation home upkeep	$6.61	$0	$6.61	$0
Total per person-day	$340.34	$80.37	$340.34	$80.37

Table B.38. Per-person-day expenditures for Teton River anglers.

Expenditure Category	Nonresident expenditures in region	Nonresident expenditures outside Region	Resident expenditures in region	Resident expenditures outside region
Gas and oil	$12.70	$6.29	$8.33	$0
Restaurant food	$20.76	$14.29	$3.91	$0
Store food	$14.57	$1.43	$8.42	$0
Fishing supplies	$18.67	$0.57	$11.12	$0
Motel/hotel	$49.58	$7.14	$0	$0
Public camping	$0	$0	$0	$0
Private camping	$1.14	$0	$0	$0
Short-term rental	$41.63	$0	$0	$0
Equipment rental	$4.21	$0	$1.03	$0
Guide fees	$55.93	$0	$0	$0
Fishing license	$37.23	$1.74	$19.76	$0
Vehicle shuttle	$4.36	$0	$1.72	$0
Rental car	$13.61	$0	$0	$0
Other	$21.43	$44.29	$0	$0
Vacation home upkeep	$100.12	$0	$5.99	$0
Total per person-day	$393.29	$75.74	$60.44	$0

Table B.39. Resident expenditure summary statistics for Henrys Lake. "In.XXX" is money spent on the particular category in the region, and "Out.XXX" is money spent out of the region.

	Min	Q1	Median	Mean	Q3	Max	# Responses
In.Fuel	$0	$7.5	$24	$27.27	$40	$130	59
In.Restaurant	$0	$0	$0	$4.45	$4.17	$50	59
In.Grocery	$0	$0	$5	$9.73	$11	$75	59
In.Tackle	$0	$0	$3	$7.79	$12.5	$50	59
In.Hotel	$0	$0	$0	$0.48	$0	$20	59
In.Camp.public	$0	$0	$0	$2.03	$0	$55	59
In.Camp.private	$0	$0	$0	$0.42	$0	$25	59
In.Short.rental	$0	$0	$0	$2.98	$0	$175	59
In.Equipment.rental	$0	$0	$0	$0	$0	$0	59
In.Guide	$0	$0	$0	$5.08	$3.33	$35	59
In.License	$0	$0	$0	$5.55	$6.69	$50	59
In.Shuttle	$0	$0	$0	$0.02	$0	$1.33	59
In.Rental.car	$0	$0	$0	$2.20	$0	$100	59
In.Other	$0	$0	$0	$6.78	$0	$400	59
In.vacation.home.lodging	$0	$0	$0	$0.67	$0	$19.44	59
In.Total	$1.88	$20	$57	$75.47	$99.17	$495	59
Out.Fuel	$0	$0	$0	$2.32	$0	$50	59
Out.Restaurant	$0	$0	$0	$1.53	$0	$50	59
Out.Grocery	$0	$0	$0	$0.87	$0	$40	59
Out.Tackle	$0	$0	$0	$0.01	$0	$0.31	59
Out.Hotel	$0	$0	$0	$0	$0	$0	59
Out.Camp.public	$0	$0	$0	$0	$0	$0	59
Out.Camp.private	$0	$0	$0	$0	$0	$0	59
Out.Short.rental	$0	$0	$0	$0	$0	$0	59
Out.Equipment.rental	$0	$0	$0	$0	$0	$0	59
Out.Guide	$0	$0	$0	$0	$0	$0	59
Out.License	$0	$0	$0	$2.27	$0	$99	59
Out.Shuttle	$0	$0	$0	$0	$0	$0	59
Out.Rental.car	$0	$0	$0	$0	$0	$0	59
Out.Other	$0	$0	$0	$0	$0	$0	59
Out.Total	$0	$0	$0	$6.99	$0	$219	59

Table B.40. Nonresident expenditure summary statistics for Henrys Lake. "In.XXX" is money spent on the particular category in the region, and "Out.XXX" is money spent out of the region.

	Min	Q1	Median	Mean	Q3	Max	# Responses
In.Fuel	$0	$3.75	$20	$36.29	$40	$300	74
In.Restaurant	$0	$0	$0	$14.57	$19.75	$125	74
In.Grocery	$0	$0	$0	$16.04	$9.58	$250	74
In.Tackle	$0	$0	$0	$10.20	$10	$165	74
In.Hotel	$0	$0	$0	$9.13	$0	$200	74
In.Camp.public	$0	$0	$0	$11.42	$0	$500	74
In.Camp.private	$0	$0	$0	$11.20	$0	$300	74
In.Short.rental	$0	$0	$0	$2.18	$0	$100	74
In.Equipment.rental	$0	$0	$0	$0.01	$0	$1	74
In.Guide	$0	$0	$0	$8.58	$5.94	$100	74
In.License	$0	$0	$0	$13.89	$4.98	$115	74
In.Shuttle	$0	$0	$0	$0.90	$0	$66.67	74
In.Rental.car	$0	$0	$0	$0.54	$0	$40	74
In.Other	$0	$0	$0	$0.47	$0	$20	74
In.vacation.home.lodging	$0	$0	$0	$7.48	$0	$116.67	77
In.Total	$0	$49.25	$88.19	$143.22	$146.13	$1,216.67	74
Out.Fuel	$0	$0	$0	$19.83	$20	$300	74
Out.Restaurant	$0	$0	$0	$9.67	$0	$200	74
Out.Grocery	$0	$0	$0	$18.36	$0	$450	74
Out.Tackle	$0	$0	$0	$18.94	$0	$700	74
Out.Hotel	$0	$0	$0	$2.04	$0	$100	74
Out.Camp.public	$0	$0	$0	$0.32	$0	$22.50	74
Out.Camp.private	$0	$0	$0	$0.55	$0	$40	74
Out.Short.rental	$0	$0	$0	$0.02	$0	$1.14	74
Out.Equipment.rental	$0	$0	$0	$0.02	$0	$1.29	74
Out.Guide	$0	$0	$0	$5.31	$0	$200	74
Out.License	$0	$0	$0	$1.46	$0	$32.67	74
Out.Shuttle	$0	$0	$0	$1.90	$0	$140	74
Out.Rental.car	$0	$0	$0	$0.01	$0	$0.43	74
Out.Other	$0	$0	$0	$0	$0	$0	74
Out.Total	$0	$0	$0	$78.41	$43.25	$1,300	74

Table B.41. Resident expenditure summary statistics for Henrys Fork. "In.XXX" is money spent on the particular category in the region, and "Out.XXX" is money spent out of the region.

	Min	Q1	Median	Mean	Q3	Max	# Responses
In.Fuel	$0	$5	$12.50	$19.31	$30	$100	79
In.Restaurant	$0	$0	$0	$9.73	$10	$200	79
In.Grocery	$0	$0	$5	$7.81	$10	$125	79
In.Tackle	$0	$0	$5	$24.61	$18.33	$800	79
In.Hotel	$0	$0	$0	$0.75	$0	$20	79
In.Camp.public	$0	$0	$0	$0	$0	$0	79
In.Camp.private	$0	$0	$0	$1.90	$0	$150	79
In.Short.rental	$0	$0	$0	$0.22	$0	$17.50	79
In.Equipment.rental	$0	$0	$0	$9.81	$0	$500	79
In.Guide	$0	$0	$0	$13.14	$22.50	$106	79
In.License	$0	$0	$0	$4.75	$6.67	$35	79
In.Shuttle	$0	$0	$0	$0.66	$0	$30	79
In.Rental.car	$0	$0	$0	$0.71	$0	$25	79
In.Other	$0	$0	$0	$0	$0	$0	79
In.vacation.home.lodging	$0	$0	$0	$0.46	$0	$37.04	80
In.Total	$0	$28.67	$50	$93.87	$85.83	$912	79
Out.Fuel	$0	$0	$0	$0.78	$0	$30	79
Out.Restaurant	$0	$0	$0	$0.25	$0	$10	79
Out.Grocery	$0	$0	$0	$0.60	$0	$25	79
Out.Tackle	$0	$0	$0	$0.98	$0	$40	79
Out.Hotel	$0	$0	$0	$0	$0	$0	79
Out.Camp.public	$0	$0	$0	$0	$0	$0	79
Out.Camp.private	$0	$0	$0	$6.39	$0	$500	79
Out.Short.rental	$0	$0	$0	$1.27	$0	$100	79
Out.Equipment.rental	$0	$0	$0	$3.80	$0	$300	79
Out.Guide	$0	$0	$0	$1.30	$0	$60	79
Out.License	$0	$0	$0	$0.16	$0	$12.50	79
Out.Shuttle	$0	$0	$0	$0	$0	$0	79
Out.Rental.car	$0	$0	$0	$0.03	$0	$2.50	79
Out.Other	$0	$0	$0	$0	$0	$0	79
Out.Total	$0	$0	$0	$15.56	$0	$945	79

Table B.42. Nonresident expenditure summary statistics for Henrys Fork. "In.XXX" is money spent on the particular category in the region, and "Out.XXX" is money spent out of the region.

	Min	Q1	Median	Mean	Q3	Max	# Responses
In.Fuel	$0	$2.13	$10	$21.21	$25	$200	120
In.Restaurant	$0	$0	$15	$22.69	$35	$120	120
In.Grocery	$0	$0	$5	$16.13	$13.75	$250	120
In.Tackle	$0	$0	$10	$26.51	$27	$250	120
In.Hotel	$0	$0	$0	$5.30	$0	$200	120
In.Camp.public	$0	$0	$0	$7.94	$0	$350	120
In.Camp.private	$0	$0	$0	$28.54	$0	$700	120
In.Short.rental	$0	$0	$0	$0.71	$0	$75	120
In.Equipment.rental	$0	$0	$0	$101.90	$0	$4,000	120
In.Guide	$0	$0	$9.50	$25.08	$33.75	$200	120
In.License	$0	$0	$0	$8.80	$0	$120	120
In.Shuttle	$0	$0	$0	$13.26	$0	$300	120
In.Rental.car	$0	$0	$0	$55.57	$0	$3,000	120
In.Other	$0	$0	$0	$0	$0	$0	120
In.vacation.home.lodging	$0	$0	$0	$6.61	$0	$125	122
In.Total	$0	$59.50	$158.75	$340.34	$352.25	$4,260	120
Out.Fuel	$0	$0	$0	$6.35	$0	$120	120
Out.Restaurant	$0	$0	$0	$3.78	$0	$100	120
Out.Grocery	$0	$0	$0	$3.25	$0	$125	120
Out.Tackle	$0	$0	$0	$20.58	$0	$1,200	120
Out.Hotel	$0	$0	$0	$2.79	$0	$250	120
Out.Camp.public	$0	$0	$0	$0.42	$0	$50	120
Out.Camp.private	$0	$0	$0	$7.99	$0	$300	120
Out.Short.rental	$0	$0	$0	$0.29	$0	$35	120
Out.Equipment.rental	$0	$0	$0	$11.25	$0	$600	120
Out.Guide	$0	$0	$0	$6.27	$0	$575	120
Out.License	$0	$0	$0	$0.33	$0	$27	120
Out.Shuttle	$0	$0	$0	$3.53	$0	$260	120
Out.Rental.car	$0	$0	$0	$13.54	$0	$1,500	120
Out.Other	$0	$0	$0	$0	$0	$0	120
Out.Total	$0	$0	$0	$80.37	$3.75	$2,000	120

Table B.43. Resident expenditure summary statistics for Teton River. "In.XXX" is money spent on the particular category in the region, and "Out.XXX" is money spent out of the region.

	Min	Q1	Median	Mean	Q3	Max	# Responses
In.Fuel	$0	$2.25	$5	$8.33	$10	$50	39
In.Restaurant	$0	$0	$0	$3.91	$0	$40	39
In.Grocery	$0	$0	$4	$8.42	$13.75	$75	39
In.Tackle	$0	$0	$3	$11.12	$10	$150	39
In.Hotel	$0	$0	$0	$0	$0	$0	39
In.Camp.public	$0	$0	$0	$0	$0	$0	39
In.Camp.private	$0	$0	$0	$0	$0	$0	39
In.Short.rental	$0	$0	$0	$0	$0	$0	39
In.Equipment.rental	$0	$0	$0	$1.03	$0	$40	39
In.Guide	$0	$0	$0	$0	$0	$0	39
In.License	$0	$0	$0	$19.76	$15	$200	39
In.Shuttle	$0	$0	$0	$1.72	$0	$25	39
In.Rental.car	$0	$0	$0	$0	$0	$0	39
In.Other	$0	$0	$0	$0	$0	$0	39
In.Second.home.lodging	$0	$0	$0	$5.99	$6.46	$41.67	40
In.Total	$0	$17.33	$40	$60.44	$61.25	$311.67	39
Out.Fuel	$0	$0	$0	$0	$0	$0	39
Out.Restaurant	$0	$0	$0	$0	$0	$0	39
Out.Grocery	$0	$0	$0	$0	$0	$0	39
Out.Tackle	$0	$0	$0	$0	$0	$0	39
Out.Hotel	$0	$0	$0	$0	$0	$0	39
Out.Camp.public	$0	$0	$0	$0	$0	$0	39
Out.Camp.private	$0	$0	$0	$0	$0	$0	39
Out.Short.rental	$0	$0	$0	$0	$0	$0	39
Out.Equipment.rental	$0	$0	$0	$0	$0	$0	39
Out.Guide	$0	$0	$0	$0	$0	$0	39
Out.License	$0	$0	$0	$0	$0	$0	39
Out.Shuttle	$0	$0	$0	$0	$0	$0	39
Out.Rental.car	$0	$0	$0	$0	$0	$0	39
Out.Other	$0	$0	$0	$0	$0	$0	39
Out.Total	$0	$0	$0	$0	$0	$0	39

Table B.44. Nonresident expenditure summary statistics for Teton River. "In.XXX" is money spent on the particular category in the region, and "Out.XXX" is money spent out of the region.

	Min	Q1	Median	Mean	Q3	Max	# Responses
In.Fuel	$0	$0	$5	$12.70	$11	$100	35
In.Restaurant	$0	$0	$8.33	$20.76	$23.13	$125	35
In.Grocery	$0	$0	$10	$14.57	$18.33	$100	35
In.Tackle	$0	$0	$7.50	$18.67	$27.50	$200	35
In.Hotel	$0	$0	$0	$49.58	$35.42	$600	35
In.Camp.public	$0	$0	$0	$0	$0	$0	35
In.Camp.private	$0	$0	$0	$1.14	$0	$40	35
In.Short.rental	$0	$0	$0	$41.63	$20	$350	35
In.Equipment.rental	$0	$0	$0	$4.21	$0	$100	35
In.Guide	$0	$0	$0	$55.93	$0	$700	35
In.License	$0	$1.88	$11	$37.23	$42.50	$250	35
In.Shuttle	$0	$0	$0	$4.36	$0	$30	35
In.Rental.car	$0	$0	$0	$13.61	$0	$150	35
In.Other	$0	$0	$0	$21.43	$0	$500	35
In.Second.home.lodging	$0	$0	$0	$100.12	$0	$3,500	38
In.Total	$11.67	$106.04	$179	$393.29	$357.13	$4,510	36
Out.Fuel	$0	$0	$0	$6.29	$0	$200	35
Out.Restaurant	$0	$0	$0	$14.29	$0	$200	35
Out.Grocery	$0	$0	$0	$1.43	$0	$50	35
Out.Tackle	$0	$0	$0	$0.57	$0	$20	35
Out.Hotel	$0	$0	$0	$7.14	$0	$250	35
Out.Camp.public	$0	$0	$0	$0	$0	$0	35
Out.Camp.private	$0	$0	$0	$0	$0	$0	35
Out.Short.rental	$0	$0	$0	$0	$0	$0	35
Out.Equipment.rental	$0	$0	$0	$0	$0	$0	35
Out.Guide	$0	$0	$0	$0	$0	$0	35
Out.License	$0	$0	$0	$1.74	$0	$50	35
Out.Shuttle	$0	$0	$0	$0	$0	$0	35
Out.Rental.car	$0	$0	$0	$0	$0	$0	35
Out.Other	$0	$0	$0	$44.29	$0	$1,500	35
Out.Total	$0	$0	$0	$75.74	$0	$1,500	35

Appendix C. Survey Instrument

A representative survey instrument for each water body is attached here, in the booklet-style layout used to produce the paper instruments. Individual survey instruments for a given water body differed only in the random dollar value that appeared in the question used to estimate consumer surplus.

Fishing Survey
Weber State University
3807 University Circle
Ogden, UT. 84408-3807

Economic Value of Recreational Fishing on the Teton River, Henry's Fork, and South Fork of the Snake River

Photo credit: Darren Clark

Thank you for agreeing to take this survey. We anticipate it will take you about 15 minutes to complete. The information you provide will be a valuable contribution to a multi-year, region-wide assessment of the economic value of recreational fishing on the Teton River, Henry's Fork (including Henry's Lake), and South Fork Snake River. This assessment is being conducted collaboratively by Friends of the Teton River, the Henry's Fork Foundation, Idaho Department of Fish and Game, and Weber State University. The aggregate results of this study will be provided to natural-resource managers, elected officials, and other decision-makers to help them understand the economic effects of different options for managing fish, water and other resources in the upper Snake River region. We already know from previous studies that recreational fishing supports a large sector of our regional economy, but those studies are now over 10 years old, and we are thus in need of an updated economic valuation of the region's major trout fisheries. We greatly appreciate your contribution to this effort.

Section A: Describe Your Fishing Trip Today

In this section, we'd like you to think about your fishing trip on the day you received this survey or the link to the online survey, including your lodging the night before your day of fishing. Even though you will most likely complete the survey sometime after this day of fishing, we refer to this day as "today," for ease in phrasing and reading the questions.

Question 1.

a. How many days in the past 12 months did you fish Henry's Lake?
_____ days

b. How much time did you spend fishing Henry's Lake today?
_____hours

Question 2.

Which one of the following best describes your fishing today? (check one)

- ☐ Fishing was the primary purpose of today's trip.
- ☐ Fishing was one of many equally important reasons for today's trip. (For example, you planned a day trip from Ashton to West Yellowstone and back that included two hours of fishing on Henry's Lake in the morning, and then lunch and shopping in West Yellowstone in the afternoon.)
- ☐ Fishing was just an incidental stop on a trip taken for other purposes. (For example, you planned a day trip from Ashton to West Yellowstone to go shopping and have lunch, but the shopping took less time than intended, the wind was calm, and you happened to have your rod in the car, so you stopped and fished Henry's Lake for an hour on the way home.)

Question 3.

Where did you stay last night? (check only one)

- ☐ Hotel/motel/lodge
- ☐ Public campground or camping area
- ☐ Private campground
- ☐ Cabin or home that you rented on a short-term basis (less than 6 months)
- ☐ Other private residence
- ☐ Other

Thank you again for participating in this survey.

The information you provided will be a valuable contribution to a multi-year, region-wide assessment of the economic value of recreational fishing on the Teton River, Henry's Fork (including Henry's Lake), and South Fork Snake River.

To Return Your Survey:

1. Tape the booklet closed along the edges
2. Drop it in the mail

The back cover of this survey contains the mailing information as well as postage.

Question 4.
What was the **one-way travel *time*** from where you stayed last night to where you fished today? _____ hours _____minutes

Question 5.
What was the **one-way travel *distance*** from where you stayed last night to where you fished today? _____ miles

Question 6.
Including yourself, how many people were in your fishing group today (not counting a guide, if you hired one)? _____

Question 7.
On a 1-10 scale, rate the importance of each of the following to your fishing experience today (1 = not at all important, 10 = very important).

a. Opportunities to catch a large number of trout_____
b. Opportunities to catch trophy-sized trout_____
c. Opportunities to catch brook trout_____
d. Opportunities to catch brown trout_____
e. Opportunities to catch cutthroat trout_____
f. Opportunities to catch cutthroat-rainbow hybrid trout_____
g. Opportunities to catch rainbow trout_____
h. Opportunities to catch mountain whitefish_____
i. Availability of public restrooms at lake access point(s)_____
j. Concrete boat ramp at lake access point(s)_____
k. Adequate parking space and facilities at lake access point(s)____
l. Information posted at lake access point(s) (for example: fishing regulations, water conditions, map) _____

Question 8.
On a 1-10 scale, how crowded did you think Henry's Lake was today? (1= not at all crowded, 10 = very crowded) _____

Question 9.
If you thought the lake was crowded today, please indicate what sort of lake uses contributed to the crowding. Check all that apply.

☐ wade/bank anglers ☐ non-fishing floaters
☐ boat anglers ☐ other (specify) _____

Section B: Describe Your Fishing-Related Expenditures Today

In this and subsequent sections, we define the upper Snake River region as:

Bonneville, Clark, Fremont, Madison, Jefferson and Teton counties, Idaho
Teton County, Wyoming

As in Section A, we'd like you to think about your fishing trip on the day you received this survey ("today"), including lodging the night before your fishing day ("where you stayed last night").

Question 1.
Please indicate the amount of money you spent on your fishing day, including lodging the night before the fishing day, both within and outside of the upper Snake River region, as we defined it above.

Expense	Amount ($) spent **in** upper Snake region	Amount ($) spent **outside** the upper Snake region
Gas and oil for vehicle and/or boat		
Food/drink in restaurants		
Food/drink in grocery store		
Fishing tackle and related supplies, clothing, etc.		
Motel/hotel/lodge		
Camping on public land		
Camping at private area		
Short-term cabin/home rental		

Question 5.

a. Are you employed?
   - ☐ NO → Are you retired? ___Yes ___No (If you are retired, or not employed, skip to question 6.)
   - ☐ YES → (check one) ___Work full-time ___Work part-time

b. Do you take time off from work to go fishing? ___Yes ___No

c. How many weeks paid vacation do you receive each year? ____ wks

Question 6.
What is your highest level of formal education? (check one)
- ☐ Less than high school
- ☐ High-school graduate or equivalent
- ☐ Some college
- ☐ Bachelor's degree
- ☐ Graduate or professional degree beyond bachelor's

Question 7.
How many members are in your household? _____

Question 8.
What was your approximate household income last year from all sources (before taxes)? (check one)
- ☐ less than $20,000
- ☐ $20,000 – $39,999
- ☐ $40,000 - $59,999
- ☐ $60,000 - $79,999
- ☐ $80,000 - $99,999
- ☐ $100,000 - $124,999
- ☐ $125,000 - $149,999
- ☐ $150,000 - $199,999
- ☐ $200,000 - $299,999
- ☐ $300,000 or more

Question 9.
If you own a home in the upper Snake River region, as we defined it above:

a. What is the approximate value of that home? (check one)
   - ☐ less than $100,000
   - ☐ $100,000 – $199,999
   - ☐ $200,000 - $499,999
   - ☐ $500,000 - $999,999
   - ☐ $1 million or more

b. How many months per year do you live in this residence?
   _____months

Section D: Please Tell Us About Yourself

Question 1.
Please list the ZIP code of your permanent residence: _____

Question 2.
If this ZIP code is NOT in the upper Snake River region, as we defined it above, please answer the following questions. If your permanent residence is in the upper Snake River region, please skip to question 3.

a. How many trips per year do you make between your permanent residence and the upper Snake River region for the primary purpose of fishing? _____ trips

b. What modes of travel do you use between your permanent residence and the upper Snake River region? Check all that apply:
- ☐ Automobile
- ☐ Recreational vehicle (RV)
- ☐ Airplane
- ☐ Other

c. On the trip to the upper Snake River region on which you received this survey what type of overnight accommodations did you use? Check all that apply.
- ☐ Hotel/motel/lodge
- ☐ Public campground or camping area
- ☐ Private campground
- ☐ Cabin/home you rented on a short-term basis (< 6 months)
- ☐ Other private residence

Question 3.
Are you: ☐ Male ☐ Female

Question 4.
Age: _____ years

Expense	Amount ($) spent **in** upper Snake region	Amount ($) spent **outside** the upper Snake region
Equipment rental		
Guide fee		
Fishing license		
Vehicle shuttle		
Rental car		
Other (please list)		

Question 2.
Including yourself, how many people in your group shared these expenses with you today? _____

Question 3.
As you know, some of the costs of going fishing for the day can change.

a. If the total cost of your fishing trip today had been $25.00 higher, would you have made this trip to the Henry's Lake today? (circle one) YES NO

b. If you answered "NO" to the above question, would you have fished today somewhere else within the upper Snake region, as we defined it above? (circle one) YES NO

Section C: How Would Potential Changes to the Fishery Affect Your Fishing?

Question 1.
Would your decision to fish Henry's Lake change if you could catch twice as many of your targeted fish species as you caught today? (check one and fill in number of days, as appropriate)

- ☐ YES: I would fish Henry's Lake MORE often: estimated number of **added** days per year___
- ☐ YES: I would fish Henry's Lake LESS often: estimated number of **fewer** days per year_____
- ☐ NO: I would not change the number of days I fish Henry's Lake.

Question 2.
Would your decision to fish Henry's Lake change if the fish you caught were 25% larger than the ones you caught today? (check one and fill in number of days, as appropriate)

- ☐ YES: I would fish Henry's Lake MORE often: estimated number of **added** days per year___
- ☐ YES: I would fish Henry's Lake LESS often: estimated number of **fewer** days per year_____
- ☐ NO: I would not change the number of days I fish Henry's Lake.

Question 3.
Would your decision to fish Henry's Lake change if three more public access points were added to this river reach? (check one and fill in number of days, as appropriate)

- ☐ YES: I would fish Henry's Lake MORE often: estimated number of **added** days per year___
- ☐ YES: I would fish Henry's Lake LESS often: estimated number of **fewer** days per year_____
- ☐ NO: I would not change the number of days I fish Henry's Lake.

Question 4.
Would your decision to fish Henry's Lake change if you saw half as many other lake users than you saw today? (check one and fill in number of days, as appropriate)

- ☐ YES: I would fish Henry's Lake MORE often: estimated number of added days per year___
- ☐ YES: I would fish Henry's Lake LESS often: estimated number of fewer days per year_____
- ☐ NO: I would not change the number of days I fish Henry's Lake.

Fishing Survey
Weber State University
3807 University Circle
Ogden, UT. 84408-3807

Economic Value of Recreational Fishing on the Teton River, Henry's Fork, and South Fork of the Snake River

Photo credit: Darren Clark

Thank you for agreeing to take this survey. We anticipate it will take you about 15 minutes to complete. The information you provide will be a valuable contribution to a multi-year, region-wide assessment of the economic value of recreational fishing on the Teton River, Henry's Fork (including Henry's Lake), and South Fork Snake River. This assessment is being conducted collaboratively by Friends of the Teton River, the Henry's Fork Foundation, Idaho Department of Fish and Game, and Weber State University. The aggregate results of this study will be provided to natural-resource managers, elected officials, and other decision-makers to help them understand the economic effects of different options for managing fish, water and other resources in the upper Snake River region. We already know from previous studies that recreational fishing supports a large sector of our regional economy, but those studies are now over 10 years old, and we are thus in need of an updated economic valuation of the region's major trout fisheries. We greatly appreciate your contribution to this effort.

Section A: Describe Your Fishing Trip Today

In this section, we'd like you to think about your fishing trip on the day you received this survey or the link to the online survey, including your lodging the night before your day of fishing. Even though you will most likely complete the survey sometime after this day of fishing, we refer to this day as "today," for ease in phrasing and reading the questions.

For the purposes of this survey, we divide the Henry's Fork into eight river reaches:

- Upper Henry's Fork: Upstream of Island Park Reservoir, including Henry's Lake Outlet
- Box Canyon to upper Harriman State Park boundary ("Log Jam")
- Upper Harriman State Park boundary to Riverside Campground
- Riverside Campground to Ashton Reservoir (Highway 20 bridge)
- Ashton Dam to Chester Dam
- Chester Dam to St. Anthony Railroad Bridge
- St. Anthony Railroad Bridge to Warm Slough Access
- Tributaries: Buffalo, Warm, and Fall rivers

Question 1.

a. How many days in the past 12 months did you fish the river reach where you received this survey? _____ days

b. How much time did you spend fishing this river reach today? _____hours

c. If you visited more than one reach of the Henry's Fork or its tributaries today, how much time did you spend fishing all of these reaches today? _____hours

Question 2.

Which one of the following best describes your fishing today? (check one)

☐ Fishing was the primary purpose of today's trip.

☐ Fishing was one of many equally important reasons for today's trip. (i.e, you planned a day trip from Ashton to Rexburg and back that included shopping, a dentist appointment, and two hours of fishing on the Henry's Fork at St. Anthony on the way home.)

Thank you again for participating in this survey.

The information you provided will be a valuable contribution to a multi-year, region-wide assessment of the economic value of recreational fishing on the Teton River, Henry's Fork (including Henry's Lake), and South Fork Snake River.

To Return Your Survey:

1. Tape the booklet closed along the edges
2. Drop it in the mail

The back cover of this survey contains the mailing information as well as postage.

Question 5.

a. Are you employed?

☐ NO → Are you retired? ___Yes ___No (If you are retired, or not employed, skip to question 6.)

☐ YES → (check one) ___Work full-time ___Work part-time

b. Do you take time off from work to go fishing? ___Yes ___No

c. How many weeks paid vacation do you receive each year? _____ wks

Question 6.

What is your highest level of formal education? (check one)

☐ Less than high school
☐ High-school graduate or equivalent
☐ Some college
☐ Bachelor's degree
☐ Graduate or professional degree beyond bachelor's

Question 7.

How many members are in your household? _____

Question 8.

What was your approximate household income last year from all sources (before taxes)? (check one)

☐ less than $20,000
☐ $20,000 – $39,999
☐ $40,000 - $59,999
☐ $60,000 - $79,999
☐ $80,000 - $99,999
☐ $100,000 - $124,999
☐ $125,000 - $149,999
☐ $150,000 - $199,999
☐ $200,000 - $299,999
☐ $300,000 or more

Question 9.

If you own a home in the upper Snake River region, as we defined it above:

a. What is the approximate value of that home? (check one)

☐ less than $100,000
☐ $100,000 – $199,999
☐ $200,000 - $499,999
☐ $500,000 - $999,999
☐ $1 million or more

b. How many months per year do you live in this residence? _____months

☐ Fishing was just an incidental stop on a trip taken for other purposes. (For example, you planned a day trip from Ashton to Rexburg to go shopping, but the shopping took less time than intended, insects were hatching, and you happened to have your rod in the car, so you stopped and fished for an hour on the way home.)

Question 3.

Where did you stay last night? (check only one)

☐ Hotel/motel/lodge
☐ Public campground or camping area
☐ Private campground
☐ Cabin or home that you rented on a short-term basis (less than 6 months)
☐ Other private residence
☐ Other

Question 4.

What was the **one-way travel *time*** from where you stayed last night to where you fished today? _____ hours _____minutes

Question 5.

What was the **one-way travel *distance*** from where you stayed last night to where you fished today? _____ miles

Question 6.

Including yourself, how many people were in your fishing group today (not counting a guide, if you hired one)? _____

Question 7.

On a 1-10 scale, rate the importance of each of the following to your fishing experience today (1 = not at all important, 10 = very important).

a. Opportunities to catch a large number of trout_____
b. Opportunities to catch trophy-sized trout_____
c. Opportunities to catch brook trout_____
d. Opportunities to catch brown trout_____
e. Opportunities to catch cutthroat trout_____
f. Opportunities to catch cutthroat-rainbow hybrid trout_____

g. Opportunities to catch rainbow trout_____
h. Opportunities to catch mountain whitefish_____
i. Availability of public restrooms at river access point(s)_____
j. Concrete boat ramp at river access point(s)_____
k. Adequate parking space and facilities at river access point(s)_____
l. Information posted at river access point(s) (for example: fishing regulations, river conditions, map, float times) _____

Question 8.
On a 1-10 scale, how crowded did you think the river was today? (1= not at all crowded, 10 = very crowded) _____

Question 9.
If you thought the river reach you fished today was crowded, please indicate what sort of river uses contributed to the crowding. Check all that apply.

- ☐ wade/bank anglers
- ☐ boat anglers
- ☐ non-fishing floaters
- ☐ other (specify) _____

Section D: Please Tell Us About Yourself

Question 1.
Please list the ZIP code of your permanent residence: _____

Question 2.
If this ZIP code is NOT in the upper Snake River region, as we defined it above, please answer the following questions. If your permanent residence is in the upper Snake River region, please skip to question 3.

a. How many trips per year do you make between your permanent residence and the upper Snake River region for the primary purpose of fishing? _____ trips

b. What modes of travel do you use between your permanent residence and the upper Snake River region? Check all that apply:
   - ☐ Automobile
   - ☐ Recreational vehicle (RV)
   - ☐ Airplane
   - ☐ Other

c. On the trip to the upper Snake River region on which you received this survey what type of overnight accommodations did you use? Check all that apply.
   - ☐ Hotel/motel/lodge
   - ☐ Public campground or camping area
   - ☐ Private campground
   - ☐ Cabin/home you rented on a short-term basis (< 6 months)
   - ☐ Other private residence

Question 3.
Are you: ☐ Male ☐ Female

Question 4.
Age: _____ years

Question 4.
Would your decision to fish this river reach change if you saw half as many other river users than you saw on this reach today? (check one and fill in number of days, as appropriate)

- ☐ YES: I would fish this reach MORE often: estimated number of added days per year___
- ☐ YES: I would fish this reach LESS often: estimated number of fewer days per year____
- ☐ NO: I would not change the number of days I fish this river reach.

Section B: Describe Your Fishing-Related Expenditures Today

In this and subsequent sections, we define the upper Snake River region as:

- Bonneville, Clark, Fremont, Madison, Jefferson and Teton counties, Idaho
- Teton County, Wyoming

As in Section A, we'd like you to think about your fishing trip on the day you received this survey ("today"), including lodging the night before your fishing day ("where you stayed last night").

Question 1.
Please indicate the amount of money you spent on your fishing day, including lodging the night before the fishing day, both within and outside of the upper Snake River region, as we defined it above.

Expense	Amount ($) spent **in** upper Snake region	Amount ($) spent **outside** the upper Snake region
Gas and oil for vehicle and/or boat		
Food/drink in restaurants		
Food/drink in grocery store		
Fishing tackle and related supplies, clothing, etc.		
Motel/hotel/lodge		
Camping on public land		
Camping at private area		
Short-term cabin/home rental		

Expense	Amount ($) spent **in** upper Snake region	Amount ($) spent **outside** the upper Snake region
Equipment rental		
Guide fee		
Fishing license		
Vehicle shuttle		
Rental car		
Other (please list)		

Question 2.
Including yourself, how many people in your group shared these expenses with you today? _____

Question 3.
As you know, some of the costs of going fishing for the day can change.

a. If the total cost of your fishing trip today had been $250.00 higher, would you have made this trip to the Henry's Fork today? (circle one) YES NO

b. If you answered "NO" to the above question, would you have fished today somewhere else within the upper Snake region, as we defined it above? (circle one) YES NO

Section C: How Would Potential Changes to the Fishery Affect Your Fishing?

Question 1.
Would your decision to fish this river reach change if you could catch twice as many of your targeted fish species as you caught today? (check one and fill in number of days, as appropriate)

☐ YES: I would fish this reach MORE often: estimated number of **added** days per year___
☐ YES: I would fish this reach LESS often: estimated number of **fewer** days per year____
☐ NO: I would not change the number of days I fish this river reach.

Question 2.
Would your decision to fish this river reach change if the fish you caught were 25% larger than the ones you caught today? (check one and fill in number of days, as appropriate)

☐ YES: I would fish this reach MORE often: estimated number of **added** days per year___
☐ YES: I would fish this reach LESS often: estimated number of **fewer** days per year____
☐ NO: I would not change the number of days I fish this river reach.

Question 3.
Would your decision to fish this river reach change if three more public access points were added to this river reach? (check one and fill in number of days, as appropriate)

☐ YES: I would fish this reach MORE often: estimated number of **added** days per year___
☐ YES: I would fish this reach LESS often: estimated number of **fewer** days per year____
☐ NO: I would not change the number of days I fish this river reach.

Fishing Survey
Weber State University
3807 University Circle
Ogden, UT. 84408-3807

Economic Value of Recreational Use of the Upper Teton River

Photo credit: Darren Clark

Thank you for agreeing to take this survey. We anticipate it will take you about 15 minutes to complete. The information you provide will be a valuable contribution to a multi-year, region-wide assessment of the economic value of recreational fishing on the Teton River, Henry's Fork (including Henry's Lake), and South Fork Snake River. In addition to fishing, We are also including non-angling recreation on the upper Teton River in this particular version of the survey. This assessment is being conducted collaboratively by Friends of the Teton River, the Henry's Fork Foundation, Idaho Department of Fish and Game, and Weber State University. The aggregate results of this study will be provided to natural-resource managers, elected officials, and other decision-makers to help them understand the economic effects of different options for managing fish, water and other resources in the upper Snake River region. We already know from previous studies that recreational fishing and boating supports a large sector of our regional economy, but those studies are now over 10 years old, and we are thus in need of an updated economic valuation of the region's major trout fisheries. We greatly appreciate your contribution to this effort.

Section A: Describe Your River Recreation Today

In this section, we'd like you to think about your recreational experience on the day you received this survey or the link to the online survey, including your lodging the night before your day of recreation on the Teton River. Even though you will most likely complete the survey sometime after this day of river recreation, we refer to this day as "today," for ease in phrasing and reading the questions. For the purposes of this particular survey, consider only your recreational experience on the Teton River upstream of Harrop's Bridge (Highway 33), which we refer to as the "upper Teton River." We consider river recreation as any recreational activity for which you specifically visited the upper Teton River. Examples are fishing, floating, kayaking/canoeing, picnicking, bird-watching, and swimming.

Question 1.

a. How many days in the past 12 months did you visit the upper Teton River for recreation? _____ days

b. How much time did you spend on the upper Teton River today? _____hours

Question 2.

Which one of the following best describes your river recreation today? (check one)

- ☐ Fishing was the primary purpose of today's trip.
- ☐ Fishing was one of many equally important reasons for today's trip. (For example, you floated from Bates Bridge to Rainey with your family, had a picnic along the river, and did some fishing while you stopped for lunch.
- ☐ My river recreation today did not include any fishing.

Question 3.

Where did you stay last night? (check only one)

- ☐ Hotel/motel/lodge
- ☐ Public campground or camping area
- ☐ Private campground
- ☐ Cabin or home that you rented on a short-term basis (less than 6 months)

Thank you again for participating in this survey.

The information you provided will be a valuable contribution to a multi-year, region-wide assessment of the economic value of recreational use of the upper Teton River.

To Return Your Survey:

1. Tape the booklet closed along the edges
2. Drop it in the mail

The back cover of this survey contains the mailing information as well as postage.

Question 5.

a. Are you employed?

☐ NO → Are you retired? ___Yes ___No (If you are retired, or not employed, skip to question 6.)

☐ YES → (check one) ___Work full-time ___Work part-time

b. Do you take time off from work to pursue river recreation (on any river)? ___Yes ___No

c. How many weeks paid vacation do you receive each year? ____ wks

Question 6.

What is your highest level of formal education? (check one)

☐ Less than high school
☐ High-school graduate or equivalent
☐ Some college
☐ Bachelor's degree
☐ Graduate or professional degree beyond bachelor's

Question 7.

How many members are in your household? _____

Question 8.

What was your approximate household income last year from all sources (before taxes)? (check one)

☐ less than $20,000
☐ $20,000 – $39,999
☐ $40,000 - $59,999
☐ $60,000 - $79,999
☐ $80,000 - $99,999
☐ $100,000 - $124,999
☐ $125,000 - $149,999
☐ $150,000 - $199,999
☐ $200,000 - $299,999
☐ $300,000 or more

Question 9.

If you own a home in the upper Snake River region, as we defined it above:

a. What is the approximate value of that home? (check one)

☐ less than $100,000
☐ $100,000 – $199,999
☐ $200,000 - $499,999
☐ $500,000 - $999,999
☐ $1 million or more

b. How many months per year do you live in this residence?

☐ Other private residence
☐ Other

Question 4.

What was the **one-way travel *time*** from where you stayed last night to where you accessed the upper Teton River today? _____ hours _____minutes

Question 5.

What was the **one-way travel *distance*** from where you stayed last night to where you accessed the upper Teton River today? _____ miles

Question 6.

Including yourself, how many people were in your group today (not counting a guide, if you hired one)? _____

If you fished today, answer question 7 and then skip to question 9. If your river recreation today did not include any fishing, skip to question 8.

Question 7.

On a 1-10 scale, rate the importance of each of the following to your fishing experience today (1 = not at all important, 10 = very important).

a. Opportunities to catch a large number of trout_____
b. Opportunities to catch trophy-sized trout_____
c. Opportunities to catch brook trout_____
d. Opportunities to catch brown trout_____
e. Opportunities to catch cutthroat trout_____
f. Opportunities to catch cutthroat-rainbow hybrid trout_____
g. Opportunities to catch rainbow trout_____
h. Opportunities to catch mountain whitefish_____
i. Availability of public restrooms at river access point(s)_____
j. Concrete boat ramp at river access point(s)_____
k. Adequate parking space and facilities at river access point(s)____
l. Information posted at river access point(s) (for example: fishing regulations, river conditions, map, float times) _____

Question 8.
On a 1-10 scale, rate the importance of each of the following to your recreational experience today (1 = not at all important, 10 = very important).

a. Solitude_____
b. Opportunities to watch wildlife_____
c. Quality time with friends and family_____
d. Availability of public restrooms at river access point(s)_____
e. Concrete boat ramp at river access point(s)_____
f. Adequate parking space and facilities at river access point(s)_____
g. Information posted at river access point(s) (for example: fishing regulations, river conditions, map, float times) _____

Question 9.
On a 1-10 scale, how crowded did you think the river was today? (1= not at all crowded, 10 = very crowded) _____

Question 10.
If you thought the river reach you fished today was crowded, please indicate what sort of river uses contributed to the crowding. Check all that apply.

☐ wade/bank anglers
☐ boat anglers
☐ non-fishing floaters
☐ other (specify) _____

Section D: Please Tell Us About Yourself

Question 1.
Please list the ZIP code of your permanent residence: _____

Question 2.
If this ZIP code is NOT in the upper Snake River region, as we defined it above, please answer the following questions. If your permanent residence is in the upper Snake River region, please skip to question 3.

a. How many trips per year do you make between your permanent residence and the upper Snake River region for the primary purpose of recreating on the upper Teton River?
_____ trips

b. What modes of travel do you use between your permanent residence and the upper Snake River region? Check all that apply:
☐ Automobile
☐ Recreational vehicle (RV)
☐ Airplane
☐ Other

c. On the trip to the upper Snake River region on which you received this survey what type of overnight accommodations did you use? Check all that apply.
☐ Hotel/motel/lodge
☐ Public campground or camping area
☐ Private campground
☐ Cabin/home you rented on a short-term basis (< 6 months)
☐ Other private residence

Question 3.
Are you: ☐ Male ☐ Female

Question 4.
Age: _____ years

☐ YES: I would visit the upper Teton River LESS often: estimated number of **fewer** days per year____

☐ NO: I would not change the number of days I visit the upper Teton River.

Question 4.
Would your decision to recreate on the upper Teton River change if facilities (parking, restrooms, boat ramps) were improved at existing access sites? (check one and fill in number of days, as appropriate)

☐ YES: I would visit the upper Teton River MORE often: estimated number of **added** days per year___

☐ YES: I would visit the upper Teton River LESS often: estimated number of **fewer** days per year____

☐ NO: I would not change the number of days I visit the upper Teton River.

Question 5.
Would your decision to visit the upper Teton River change if you saw half as many other river users than you saw on this reach today? (check one and fill in number of days, as appropriate)

YES: I would visit the upper Teton River MORE often: estimated number of **added** days per year___

YES: I would visit the upper Teton River LESS often: estimated number of **fewer** days per year____

NO: I would not change the number of days I visit the upper Teton River.

Section B: Describe Your Recreation-Related Expenditures Today

In this and subsequent sections, we define the upper Snake River region as:

- Bonneville, Clark, Fremont, Madison, Jefferson and Teton counties, Idaho
- Teton County, Wyoming

As in Section A, we'd like you to think about your river recreation on the day you received this survey ("today"), including lodging the night before your day of river recreation ("where you stayed last night").

Question 1.
Please indicate the amount of money you spent on your day of river recreation, including lodging the night before your day of recreation, both within and outside of the upper Snake River region, as we defined it above.

Expense	Amount ($) spent **in** upper Snake region	Amount ($) spent **outside** the upper Snake region
Gas and oil for vehicle and/or boat		
Food/drink in restaurants		
Food/drink in grocery store		
Fishing tackle and related supplies, clothing, etc.		
Motel/hotel/lodge		
Camping on public land		
Camping at private area		
Short-term cabin/home rental		

Expense	Amount ($) spent **in** upper Snake region	Amount ($) spent **outside** the upper Snake region
Equipment rental		
Guide fee		
Fishing license		
Vehicle shuttle		
Rental car		
Other (please list)		

Question 2.
Including yourself, how many people in your group shared these expenses with you today? _____

Question 3.
As you know, some of the costs of recreation can change.

a. If the total cost of your river recreation today had been $5.00 higher, would you have made this trip to the upper Teton River today? (circle one) YES NO

b. If you answered "NO" to the above question, would you have spent the day recreating on another river somewhere else within the upper Snake region, as we defined it above? (circle one) YES NO

Section C: How Would Potential Changes to Management of the River Affect Your Recreational Use?

If you fished, answer all five questions. If you did not fish, skip questions 1 and 2 and answer only questions 3, 4 and 5.

Question 1.
Would your decision to fish this river reach change if you could catch twice as many of your targeted fish species as you caught today? (check one and fill in number of days, as appropriate)

☐ YES: I would fish this reach MORE often: estimated number of **added** days per year___
☐ YES: I would fish this reach LESS often: estimated number of **fewer** days per year____
☐ NO: I would not change the number of days I fish this river reach.

Question 2.
Would your decision to fish this river reach change if the fish you caught were 25% larger than the ones you caught today? (check one and fill in number of days, as appropriate)

☐ YES: I would fish this reach MORE often: estimated number of **added** days per year___
☐ YES: I would fish this reach LESS often: estimated number of **fewer** days per year____
☐ NO: I would not change the number of days I fish this river reach.

Question 3.
Would your decision to recreate on the upper Teton River change if three more public access points were added? (check one and fill in number of days, as appropriate)

☐ YES: I would visit the upper Teton River MORE often: estimated number of **added** days per year___