North American Journal of Fisheries Management 26:301–307, 2006

DOI: 10.1577/M05–116.1

[Article]

Use of Survey Data to Estimate Economic Value and Regional Economic Effects of Fishery Improvements

JOHN LOOMIS*

Department of Agricultural and Resource Economics, Colorado State University, Fort Collins, Colorado 80523-1172, USA

Abstract.—This paper demonstrates a straightforward, survey-based approach that allows fisheries economists and managers to go beyond acquiring just a snapshot of current economic value and regional economic effects to estimate how angler use, benefits, and regional effects (e.g., tourism jobs) would increase with increases in the number or size of fish caught. This is performed by linking responses from intended visitation questions to contingent valuation and input–output models. In a case study of the Snake River in Idaho and Wyoming, I determined that for a 100% increase in angler catch, angler use would increase by 64.5% and would create a corresponding increase in annual economic value and jobs. A similar relationship was found for increases in the size of fish caught.

Fishery managers often rely upon two types of economic analysis to demonstrate the economic significance of fishery resources and the associated aquatic habitats: (1) regional economic analyses that provide estimates of local income and jobs from recreational angler spending and (2) analysis of the economic value of recreational fishing to the anglers themselves. The majority of past recreational fishing studies have primarily been snapshots of what the current habitat and fishing quality provide (Nowell and Kerkvliet 2000; Bohnsack et al. 2002; Kerkvliet et al. 2002).

However, for these types of analysis to be of greater use to fishery managers in negotiating increased flows with water resource managers and hydropower operators and better riparian protection with public land managers, the fishery managers must be able to quantify how the regional economic effects and economic values change with improved flows or habitat protection. This can be challenging based on existing studies, because many studies provide little information on how angler use, and hence regional economic effects and economic values, change with improved fishing conditions. Most past studies have usually focused only on how the economic values per angler trip would increase with increased catch or size of fish (Johnson et al. 1995; Dalton et al. 1998) without evaluating how the number of angler trips would change. Although quantification of how the value per trip would change is an important element, so is the change in trips, since this drives both the annual valuation and regional economic effects analyses. This need has only begun to be addressed in recent research by Hicks (2002), Criddle et al. (2003), and Gentner (2004). Criddle et al. (2003) used a stated-preference choice experiment that allowed for valuation and that could link changes in the probability of taking a trip as a function of trip characteristics to a regional economic model. Implementation of the choice experimental design with seven varying marine fishing trip characteristics required nine versions of the survey. The method of Criddle et al. (2003) is a sophisticated approach for evaluating the effect of multiple fishing trip attributes and has much to offer if the analyst has a sufficient sample size to allow for multiple versions of the survey.

This paper illustrates a simpler stated-preference survey approach that involves the use of just two stated-preference intended behavior or contingent visitation questions that can be used to drive regional economic models and economic valuation methods to quantify how benefits change with improved fishing conditions. The remainder of the paper describes the contingent visitation questions and their link to regional economic and valuation models and provides a case study for the upper Snake River, including the Henry's Fork, the South Fork of the Snake River (hereafter, South Fork), and the main stem downstream of Jackson Lake, Wyoming.

Study Area

The upper boundary of the study area exists in the headwaters of the Snake River in Jackson Hole, Wyoming, extends to the confluence of Henry's Fork, and includes Henry's Fork. There are three main study sections: (1) 75 mi of the Snake River from Grand Teton National Park through Jackson Hole to the top of Palisade Reservoir; (2) 66 mi of the South Fork from

* E-mail: jloomis@lamar.colostate.edu

Received June 22, 2005; accepted October 25, 2005
Published online March 21, 2006

below Palisade Dam to the confluence with Henry's Fork; and (3) the 117 mi of Henry's Fork. Discussions with Trout Unlimited, Henry's Fork Foundation, the U.S. Bureau of Reclamation (USBR), the Idaho Department of Fish and Game (IDFG), and the Bureau of Land Management (BLM) suggested that these three major stretches of river could be adequately represented by (1) four segments for Henry's Fork (i.e., Henry's Lake and three sections down to the confluence with the South Fork); (2) three segments of the Snake River from Grand Teton National Park through Jackson Hole, the lower whitewater stretch above Alpine, Wyoming, and the Flat Creek tributary to the Snake River; and (3) four segments of the South Fork from the outlet of Palisades Dam to the confluence of the South Fork with Henry's Fork.

Methods

Psychologists (Fishbein and Ajzen 1975) and economists have long relied upon intended behavior as a predictor of what people will do under circumstances different from the current situation (Mitchell and Carson 1989). Intended behavior is the foundation of the contingent valuation method (CVM) for measuring the net willingness to pay (WTP) or consumer surplus. In particular, a dichotomous-choice CVM question asks anglers whether they would pay an increase in trip costs to continue to visit the site. By varying the amount of the increase in trip costs over the sample, a researcher can infer the angler's net WTP over and above current costs.

While CVM has been a commonly used valuation method since the early 1960s, it was not until 1987 that Ward (1987) proposed the use of intended behavior to estimate how boaters would change their trip numbers in response to increased river flows. Layman et al. (1996) were among the first to apply this method to anglers. They asked anglers how their trip numbers would change with alternative proposed fishery management policies and regulations. Ward (1987) argued that asking visitors how their trip numbers would change was less likely to be subject to hypothetical bias, which was a longstanding concern about the use of CVM to ask visitors about their WTP. Using test–retest reliability, Loomis (1993) showed that intended visitation estimates were reliable and constituted a valid indicator of how visitors would react to alternative lake levels. Grijalva et al. (2002) found that rock climbers' intended visitation changes in response to climbing area closures matched aggregate visitation during the following year, when the closures took place.

However, to have greater influence on instream flow negotiations or public land management plans, it would be worthwhile to know more than just how visitation would increase with increases in catch or fish size brought about by increases in instream flow or riparian habitat management. Often, increases in instream flow or streamside buffers involve opportunity costs to irrigators or foregone economical land uses, such as logging or campground construction. Only recently have studies linked the increased angler use associated with improved fishing conditions to both increased tourism jobs and economic values (Hicks 2002; Criddle et al. 2003; Getner 2004). Expressing the improvements in fishery conditions in economic terms (jobs, local county income) and economic values may provide fishery managers with greater leverage in negotiations with water resource and land management agencies. The two types of economic analyses complement each other. Regional analysis focuses on the jobs and income supported by angler spending. In contrast, economic valuation analysis quantifies the benefits (i.e., consumer surplus) that anglers themselves receive. In addition, the U.S. Army Corps of Engineers and USBR also use both types of economic analysis to give a complete picture of the economic consequences of their actions (U.S. Water Resources Council 1983).

Overview of the procedures for linking improved fishing conditions to economic changes.—Figure 1 provides an overview of the linkages from the improved fishing condition scenario to the change in trips. This change in trips, when multiplied by the per-trip angler expenditures, becomes a change in total angler spending. This change is inserted into the regional input–output model to calculate the multiplier effects of angler spending in terms of total (direct, indirect, and induced) regional jobs and income derived from the improvement in fishing conditions. Paralleling the regional economic procedure, the same change in trips is multiplied by the average net WTP calculated from a CVM WTP question, yielding the change in net economic value to the anglers.

Following the components in Figure 1, I describe the specific empirical approach employed in the case study to calculate the gains in angler-days, jobs, and local income as well as the net economic value associated with an increase in catch rate or fish size.

Improved fishing conditions scenario.—Improved fish habitat conditions, such as improved instream flows at critical times of the year or protection of riparian buffers (e.g., shade or filter strips), can improve the fish habitat carrying capacity. That additional capacity can be used either to produce more fish of a given size or increase the size of a given number of fish. Fishery managers are often interested

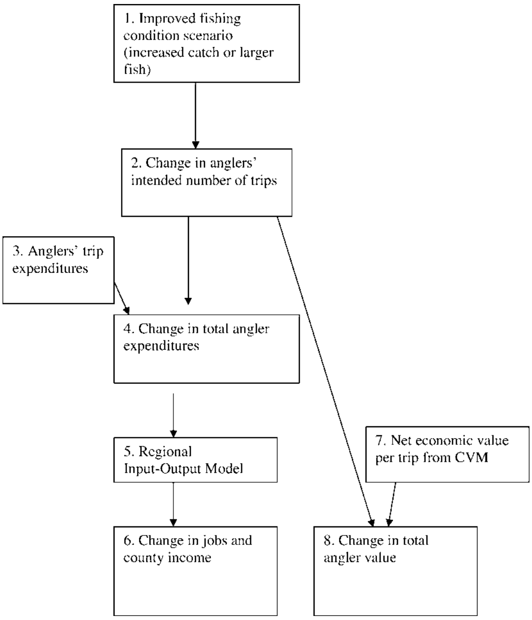

FIGURE 1.—Overview of linkages between a scenario of improved fishing conditions and resulting economic effects.

in which of these two (largely) mutually exclusive options would yield the greatest benefits to anglers.

To provide data to address this issue, I asked the following two questions in the survey of anglers after they reported the targeted fish species, the fishing method used, and the annual number of trips taken in the past 12 months to the site where they received the survey:

(1) Would your decision to visit this river segment change if you had twice the daily catch of your targeted species than you experienced on this trip?
(2) Would your decision to visit this river segment change if the fish you caught were 25% larger (for example, increasing from 12 to 15 in)?

Responses indicating more (fewer) visits to the site were then used to estimate the increase (decrease) in the yearly number of trips; a third possible response was no change in the number of visits.

These intended visitation questions were designed in consultation with fishery biologists from the state fish and game agency, the public land and water resource management agencies, and several local fishing organizations. These two questions allowed anglers to indicate that there would be no change or an increase or decrease in their annual trips to the river in response to the two different changes in fishing conditions. Future surveys might also allow anglers to indicate whether they would change the number of trips to other water bodies if fishing conditions improved at the interview site. This might allow for incorporation of substitution possibilities between the improved water body and other unimproved water bodies. The omission of allowances for angler substitution might result in overstating the overall gain in trips and associated economic effects.

Angler trip expenditures.—The survey elicited angler expenditures in the local area (defined for survey purposes as southeastern Idaho and southwestern Wyoming). The usual categories of variable trip costs included gasoline, food and drink at restaurants, food and drink at grocery stores, supplies, camping fees, hotels, equipment rental, and guide fees. These total group expenditures were divided by the group size to calculate them on a per-angler basis. As is common in regional economic impact studies, angler spending by those residing outside of the local region was viewed as injecting "new" money into the local economy. The presumption is that local residents would continue to spend their money within the economic area even if the recreational fishing opportunities on these rivers were not present (e.g., they might fish at other rivers not included in this study or at reservoirs in the study area or might spend their money on other goods or services within the study area). As Crompton et al. (2001:81) noted, expenditures at a recreation area by those that reside within the impact area involve only the "recycling" of money that already exists there. In particular, they stated that

> Only if the local recreation site had no substitutes in the economic area, and locals would find it worthwhile to travel to another site in another economic region would the locals' spending visiting the local park count as money in the local economic impact area.

However, some believe that it is worthwhile to present the effect of locals' spending on the local economy, as some anglers might fish outside the region if local fishing quality were to deteriorate. Thus, I present the effects of resident and nonresident angler spending separately.

Regional input–output models.—The input–output model used to measure the impact of recreational expenditures in southeastern Idaho was originally developed by M. Henry Robison at the University of Idaho, Moscow. This model uses traditional input–output methodology from IMPLAN software (Minnesota IMPLAN Group 1997) and is "ground-truthed" with recent county data applicable to the six-county region by Don Reading of Ben Johnson Associates (see Loomis 2005 for more details). The input–output model for southwest Wyoming also utilized IMPLAN county data profiles, but the IMPLAN county-level employment data were adjusted with the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System data at the one-digit Standard Industrial Code level for the year 2000. Total value added and total industry output data were scaled proportionally with employment changes in the model. The IMPLAN's commodity regional purchase coefficients were adjusted to better reflect typical spending patterns between locals and non-locals (Minnesota IMPLAN Group 1997). Based on these two input–output models and the relationship with non-local angler use, the increase in local jobs and county income with improved fishing conditions was calculated.

Net economic value per trip from CVM.—The CVM was used to estimate the net WTP for a trip. The specific CVM valuation question, which was asked after the anglers reported their expenditures, was

> As you know, the costs of travel such as gasoline often increase. If the total cost of this most recent trip had been $XX higher, would you have made this trip to the river segments visited? Yes/No.

The $XX is the dollar amount the respondent was asked to pay. It varied from US$2 to $950. The range was selected such that I expected that everyone would agree to pay $2 more and that no one or very few people would pay the additional $950 per trip. The premise of rising gasoline prices was quite credible, as the price of gas had risen from about $1.50 per gallon to over $2.00 per gallon during the springtime.

This dichotomous-choice question was analyzed with a logistic regression model, since the dependent variable was coded 1 if the respondent stated "yes" and 0 if the respondent stated "no." For purposes of estimating river-specific values, I estimated a simple logit model with only the dollar amount (bid) as the independent variable to conserve degrees of freedom, since some river specific samples were fairly small. The change in total angler value was calculated by multiplying the change in all angler trips times the net WTP per trip.

Results

Survey Distribution and Response Rate

An average of 9 d was spent sampling at each of the 11 river segments, yielding 99 total sampling days. Sampling days were distributed proportionately between weekdays and weekends. The sampling season was from May to September 2004. Students from Idaho State University, Pocatello, handed out mail-back survey packages. These packages included a cover letter and postage-paid return envelope. Names and addresses were collected so that reminder postcards and second mailings of surveys could be sent to non-respondents.

The interviewers made 1,330 on-site contacts. Interviewers handed out a total of 1,272 surveys; 58 people refused to take a survey. This represents less than a 5% on-site refusal rate. Of the 1,272 surveys that were handed out, 34 were undeliverable when follow-up mailings were performed, and thus follow-up contacts via reminder postcards and second surveys could not be delivered. In total, I received 787 returned surveys by the cut-off date in October 2004. The overall response rate was 63.6% of the deliverable surveys. This is a reasonably good response rate given the length of the survey and the fact that many people that received the survey were on vacation. It is comparable to a similar survey response rate of 65%, which I obtained previously (Loomis 2005) on the Snake River in Jackson Hole based on a similar procedure. With over 700 surveys returned, the margin of error on most responses was ±3.5–3.8% (Babbie 1992).

To calculate current angler-days in Table 1 from the survey sample, three expansions were necessary. First, the number of anglers contacted plus the number of vehicles remaining when the interviewer left (times the average number of anglers per vehicle from the survey for that site) were summed. This number provided an estimate of use at that site on a typical weekday or weekend, depending on what type of day was sampled. This estimate was generalized to the adjacent unsampled weekdays or weekend in that week. This

TABLE 1.—Anglers' surveyed responses to a doubling of current catch rate or a 25% increase in the size of fish caught. Anglers in three reaches of the Snake River, Idaho and Wyoming, were asked how many angling trips they had taken in the previous 12 months and how the number would change in response to the two scenarios.

		100% increase in catch		25% increase in fish size	
Reach	Current angler-days	Angler-days	% Change	Angler-days	% Change
Henry's Fork	168,656	284,470	68.7	284,991	69.0
South Fork	196,199	312,866	59.5	310,479	58.2
Wyoming	95,563	159,889	67.3	170,168	78.1
Total for sampled sites	460,418	757,224	64.5	765,638	66.3

TABLE 2.—Contingent valuation logit regression results and mean willingness to pay (WTP) for various reaches of Henry's and South forks, Idaho, and the Snake River, Wyoming; $P < 0.10$*, $P < 0.05$**, $P < 0.01$***.

Site	Constant	*t*-value	Bid coefficient (*t*-value)	McFadden's R^2	Mean net WTP/angler-day
Henry's Fork					
Reach 1	2.44	4.37***	−0.003442 (−3.369***)	0.21	$82.62
Reach 2	1.824	4.46***	−0.001598 (−1.728*)	0.032	$104.90
Reach 3	1.838	3.31888	−0.000349 (−2.976)**	0.183	$79.08
Reach 4	1.574	3.03**	−0.003139 (−2.47)**	0.150	$65.50
South Fork					
Reach 1	1.436	2.63***	−0.003766 (−2.456***)	0.15	$62.74
Reach 2	1.600	3.41***	−0.003373 (−2.728)***	0.139	$95.83
Reaches 3–4	1.862	1.66*	−0.02169 (−1.79)*	0.453	$36.07
Wyoming					
Jackson Hole	2.0169	3.57***	−0.003358 (−2.60)***	0.16	$104.68
Whitewater	3.305	2.554***	−0.0048 (2.33)**	0.315	$62.59
Flat Creek	2.95	2.48***	−0.47853[a] (−2.089)**	0.074	$149.29

[a] Log of bid amount.

process was repeated until I had estimated angler use for the sampling season (May–September). Finally, the survey data were used to convert the number of anglers to annual angler-days by multiplying by the average annual number of trips anglers took and the average number of angler-days per trip. The resulting estimates were compared to angler estimates developed by IDFG based on a mail survey of licensed anglers. My combined angler-day estimate for the Henry's and South forks was 364,855, while IDFG's (unpublished) estimate was 378,701, less than a 5% difference.

Response to Intended Visitation Behavior Questions

Table 1 reports how anglers indicated they would change the number of trips, and hence angler-days, if catch doubled or fish size increased by 25%. Averaged over all three main stretches of the Snake River, a 100% change in catch would result in a 64.5% change in angler use. Alternatively, if the size of fish caught increased by 25%, angler use would increase by an overall average of 66.3%—a slightly higher increase due to the Wyoming anglers' response that they would substantially increase their number of angler-days if they caught larger fish. Further investigation of the determinants of changes in anglers' intended visitation behavior is possible by estimating an equation that relates their change in trips to current catch, other trip characteristics, and demographics. This was not the main focus of this paper, however.

Contingent Valuation Estimates of WTP by River

The logit model results are presented in Table 2 along with the mean WTP. The logit models performed well; the bid coefficient was negative, indicating that the higher the dollar amount the visitors were asked to pay, the less likely they were to pay. This result corresponds with common sense and economic theory. The coefficients were significant at the 10% level or higher, and most of the McFadden's R^2 values indicated a respectable goodness of fit. The mean WTP per trip was calculated as the constant divided by the bid coefficient (Haab and McConnell 2002). The result was divided by the number of anglers in the group and the number of days per trip to yield a value per angler-day.

Angler Expenditures and Input–Output Model Results

Visitors to Henry's Fork spent an average of $98 per angler-day in the study area, while visitors to the South Fork spent an average of about $116 per angler-day. Anglers fishing the Snake River near Jackson spent about $51 per angler-day in the local area. These data on angler expenditures in southeastern Idaho and southwestern Wyoming were combined with the two input–output models to capture multiplier effects, and the total (direct, indirect, and induced) changes in jobs and income (wages, profits, rents) to the economies of these two areas were calculated. The results are reported in Table 3 based on non-local- and local-angler spending in the impact area.

If conditions improved such that non-local anglers could catch twice as many fish, the increased angler trips and spending would support an additional 585 jobs near Henry's Fork, 203 jobs near the South Fork, and 180 jobs near the Wyoming stretch of the Snake River. Alternatively, a 25% increase in the size of fish caught would result in a very similar increase in jobs near Henry's Fork (587 jobs) and the South Fork (199 jobs) but a slightly larger increase in jobs near the Wyoming stretch (209 jobs). Either of these fishery improvements results in substantial increases in employment (and local county income) and is likely to be persuasive in policy discussions. It should be noted that the simultaneous improvement in all three fisheries may not yield additive results because of the

TABLE 3.—Current and potential jobs and income related to nonlocal and local anglers fishing on the Snake River in southeastern Idaho and southwestern Wyoming under two improved fishing scenarios.

Reach	Current		100% increase in catch		25% larger fish	
	Jobs	Income (millions)	Jobs	Income (millions)	Jobs	Income (millions)
Nonlocal anglers						
Henry's Fork	851	$29	1,436	$49	1,438	$49
South Fork	341	$12	544	$19	540	$19
Southwestern Wyoming	268	$5.5	448	$9.5	477	$9.7
Local anglers						
Henry's Fork	922	$31	1,555	$53	1,558	$53
South Fork	146	$5	233	$8	231	$8
Southwestern Wyoming	81	$2	135	$3	143	$3

angler substitution possibilities between improved rivers.

These regional economic effects also work in reverse for deterioration in fishing conditions, which not only cause direct reductions in tourism jobs but also create multiplier reductions throughout the local economy.

Recognizing that a doubling of catch is equal to a 100% increase in catch, each 10% gain in catch rate would increase employment opportunities by 97 jobs annually based on a linear interpolation of the 100% change. The linear interpolation of anglers' response to a small change in fishery improvement from a large change causes one to understate the magnitude of the angler response. Specifically, if there is a diminishing marginal effect of improvements (as economic theory would suggest and as past studies have shown: Loomis and Cooper 1990), then the first small increment (say 10%) is likely to have a larger effect than the second 10% and certainly will have a larger effect than a 100% change. Future surveys might consider the use of smaller and more realistic increments to avoid this problem.

Net Economic Value of Increased Fishing Quality

Use of the net economic values per angler-day from the contingent valuation method analyses and the number of angler-days yields the results in Table 4. As can be seen, the net economic value rises substantially with a doubling of catch or with the catch of fish that are 25% larger. With a 100% increase in catch, each 10% gain in catch rate would increase net economic value by about $1 million annually on the Henry's and South forks based on a linear interpolation (as noted above, this may understate the extent of benefits for a small change).

Management Implications

The results in Table 3 (gain in local jobs and income) and in Table 4 (gain in economic value of fishing) both indicate very similar increases for a doubling of fish catch or a 25% increase in fish size. Thus, managers may be able to determine which option is most economically efficient by comparing the costs of attaining each of the two alternative fishery improvements. Given the very similar economic values and economic activity, whichever fishery improvement (25% size increase or doubling of catch) is least expensive to obtain would be the most economically efficient. Of course, there may be other non-economic decision factors, such as risk or uncertainty, as well as biological and ecological objectives involved in choosing between these two fishery improvements.

Conclusions

This paper has demonstrated how the use of a relatively straightforward determination of angler intended visitation contingent upon improved fishing scenarios can be linked to regional economic and valuation models to quantify the economic effects of improving a fishery. This allows fishery managers to go beyond just a snapshot of the current economic value and impacts associated with current fishing conditions. Rather, a manager using these techniques and results can demonstrate the economic benefits to

TABLE 4.—Current and potential net economic value related to fishing on the Snake River in southeastern Idaho and southwestern Wyoming under two improved fishing scenarios.

Reach	Value per trip	Current value (millions)	Value for 100% increase (millions)	Value for 25% increase in fish size (millions)
Henry's Fork	$89.84	$15.1	$25.6	$25.6
South Fork	$74.96	$14.7	$23.4	$23.3
Southwestern Wyoming	$100.29	$9.6	$16.0	$17.0

anglers and the regional economy of increasing instream flow or restoring riparian habitat.

In this case study of the upper Snake River in Wyoming and Idaho, anglers would increase their number of trips by a sizeable but plausible amount in response to either a doubling of the catch rate or a 25% increase in the size of fish caught. Averaged across the three river segments, a 100% increase in angler catch would precipitate a 64.5% increase in angler use and a corresponding increase in the annual economic value of fishing and county jobs and income attributed to fishing. A similar magnitude of increase in economic value, local jobs, and local income is found for increases in the size of fish caught.

Acknowledgments

The initiation of the study and critical guidance in study design and data collection came from Steve Trafton, Henry's Fork Foundation executive director, and Scott Yates of Trout Unlimited. Funding for the data collection was provided by the Hewlett Foundation grant to the Henry's Fork Foundation. Vicki Kellerman and Chris Jansen Lute of the USBR provided important direction, detailed comments, and financial support for the economic analysis portion of this project. Valuable study design and survey input was provided Jim Fredricks and Bill Schrader of IDFG and Monica Zimmerman of the BLM's Idaho Falls Field Office. Special thanks to Lynne Koontz, who ran her input–output model of Teton County to calculate local regional economic effects in Wyoming, and Don Reading of Ben Johnson Associates for calculating regional economic effects for southeastern Idaho. Suggestions of three anonymous reviewers improved the clarity and accuracy of the interpretation of these results. Any errors or omissions are the responsibility of the author.

References

Babbie, E. 1992. The practice of social research, 6th edition. Wadsworth Publishing, Belmont, California.

Bohnsack, B., R. Ditton, J. Stoll, R. Chen, R. Novak, and L. Smutko. 2002. The economic impacts of the recreational bluefin tuna fishery in Hatteras, North Carolina. North American Journal of Fisheries Management 22:165–176.

Criddle, K. R., M. Herrmann, T. S. Lee, and C. Hamel. 2003. Participation decisions, angler welfare, and the regional economic impact of sportfishing. Marine Resource Economics 18(4):291–312.

Crompton, J., S. Lee, and T. Shuster. 2001. A guide for undertaking economic impact studies: the Springfest examples. Journal of Travel Research 40:79–87.

Dalton, R., C. Bastian, J. Jacobs, and T. Wesche. 1998. Estimating the economic value of improved trout fishing on Wyoming streams. North American Journal of Fisheries Management 18:786–797.

Fishbein, M., and I. Ajzen. 1975. Belief, attitudes, intention, and behavior: an introduction to theory and research. Addison-Wesley, Reading, Massachusetts.

Gentner, B. 2004. Examining target species substitution in the face of changing recreational fisheries policies. *in* Y. Matsuda and T. Yamamoto, editors. Proceedings of the 12th Biennial Conference of the International Institute of Fisheries Economics and Trade (IIFET). IIFET, Corvallis, Oregon.

Grijalva, T., R. Berrens, A. Bohara, and W. Shaw. 2002. Testing the validity of contingent behavior trip responses. American Journal of Agricultural Economics 84(2):401–414.

Haab, T., and K. McConnell. 2002. Valuing environmental and natural resources: the econometrics of nonmarket valuation. Edward Elgar, North Hampton, Massachusetts.

Hicks, R. 2002. Stated-preference methods for environmental management: recreational summer flounder angling in the northeastern United States. National Marine Fisheries Service, Report for Requisition NFFKS-18, Silver Spring, Maryland.

Johnson, D., R. Behnke, D. Harpman, and R. Walsh. 1995. Economic benefits and costs of stocking catchable rainbow trout: a synthesis of economic analysis in Colorado. North American Journal of Fisheries Management 15:26–32.

Kerkvliet, J., D. Nowell, and S. Lowe. 2002. The economic value of the Greater Yellowstone's blue-ribbon fishery. North American Journal of Fisheries Management 22:418–424.

Layman, C., J. Boyce, and K. Criddle. 1996. Economic valuation of the Chinook salmon sport fishery of the Gulkana River, Alaska under current and alternative management plans. Land Economics 72(1):113–128.

Loomis, J. 1993. An investigation into the reliability of intended visitation behavior. Environmental and Resource Economics 3:183–191.

Loomis, J. 2005. The economic values of recreational fishing and boating to visitors and communities along the upper Snake River. Department of Agricultural and Resource Economics, Colorado State University, Fort Collins.

Loomis, J., and J. Cooper. 1990. Comparison of environmental quality–induced demand shifts using time series and cross-section data. Western Journal of Agricultural Economics 15(1):83–90.

Minnesota IMPLAN Group. 1997. IMPLAN Professional: social accounting and impact analysis software. Minnesota IMPLAN Group, Stillwater, Minnesota.

Mitchell, R., and R. Carson. 1989. Using surveys to value public goods: the contingent valuation method. Resources for the Future, Washington, D.C.

Nowell, C., and J. Kerkvliet. 2000. The economic value of the Henry's Fork fishery. Intermountain Journal of Sciences 6(3):285–292.

U.S. Water Resources Council. 1983. Economic and environmental principles for water and related land resource implementation studies. U.S. Government Printing Office, Washington, D.C.

Ward, F. 1987. Economics of water allocation to instream flow uses in a fully appropriated river basin. Water Resources Research 23(3):381–392.