

Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs

Darryll Olsen¹

*Pacific Northwest Utilities Conference Committee
One Main Place, 101 S.W. Main
Portland, Oregon 97204-3216*

Jack Richards

*Battelle Human Affairs Research Centers
Seattle, Washington 98105*

R. Douglas Scott

*Social and Economic Sciences Research Center
Washington State University
Pullman, Washington 99164*

ABSTRACT: In the Pacific Northwest, large public agency expenditures are being devoted to the protection, mitigation, and enhancement of salmon and steelhead runs in the Columbia River Basin. The goal is to double the size of the runs (5 million fish) by the year 2000. Resource economists and regional planners have generally conceded that much of the importance of the doubling goal stems from an assumption that Pacific Northwest residents—those paying the costs of the mitigation and enhancement effort—place an existence value on improvements to the fishery. This article (1) summarizes the results of an existence valuation study using a state-of-the-art contingent valuation approach, (2) provides a set of initial guidelines to be followed in conducting existence valuation studies, and (3) summarizes the results of a new sport value study for salmon and steelhead fishing in the Pacific Northwest. The study results demonstrate that Pacific Northwest residents do place an existence value on doubling the run. The recommendation is made that existence and sport values be considered in mitigation and enhancement decisions.

KEY WORDS: Columbia River Basin, contingent valuation method, existence value, fisheries economics, recreation values, sport values.

INTRODUCTION

"The problem with economic analyses for fishery mitigation is that they fail to capture all of the economic benefits held by society."—Comment by Pacific Northwest Fisheries Biologist

and Conservation Act of 1980 (16 U.S.C. 837-839), the Northwest Power Planning Council has introduced one of the most comprehensive fishery management programs in the nation (NPPC 1987). The pro-

Under the authority of the Pacific Northwest Electric Power Planning

¹ Dr. Olsen is also a visiting scientist at Battelle Human Affairs Research Centers in Seattle, Washington.

gram establishes new public expenditure levels to "protect, mitigate, and enhance" salmon and steelhead fish runs in the Columbia River Basin, with the goal of doubling the size of the runs by the year 2000. Both the provisions of the Act and the Council's directives are based on the premise that fisheries mitigation and enhancement will promote social well-being and coincide with public preferences for increased fishery stocks, as expressed through congressional mandate and the collective voice of various interest groups.

Although the Act clearly calls for equitable consideration of fishery resources—in conjunction with the costs of operating the hydroelectric power system—public policy makers would be negligent if they failed to review formally mitigation benefits and costs. In calculating fishery benefits, resource economists have relied on market and nonmarket valuation techniques to capture the economic value of the fishery recognized by society. But resource economists and regional planners have generally conceded that much of the importance granted to fishery mitigation under the Council's program stems from the tacit assumption that Pacific Northwest residents—those who will pay the bulk of the expense for the mitigation and enhancement effort—place an existence value on improvements to the fishery. However, the level of this existence value, as it relates to improving and increasing the size of the salmon and steelhead runs, has been unknown.

To measure the marginal existence value of doubling the size of the Columbia River Basin fish runs, a contingent valuation method (CVM) study was conducted during 1989. The CVM approach employs a survey format to directly solicit from subjects their willingness-to-pay for resources or changes in resource abundance. Key study features included a comprehensive review of the critical literature on existence value theory, empirical assessments, and CVM technology; an extensive review of the study design by independent reviewers; and a thorough pretesting of the survey instrument used within the study (Olsen et al. 1989).

Along with the existence value component of the study, a sport value module for resource users was also incorporated. The sport value module was included because the study sought to measure the total value of the resource held by all actors (Smith 1987; Freeman, in press)—information needed by resource decision makers. There has also been a need to update the sport values currently being used in economic analyses, and to provide a regional context for salmon and steelhead fishing values.

Both theoretical and methodological features of the existence and sport value modules are described below. This technical review is followed by an interpretation of the major study findings and by an initial discussion of proposed guidelines for preparing existence value studies.

EXISTENCE VALUE CONCEPTS AND METHODOLOGY

An analytical process for conducting an existence value study—or pursuing a more conventional application of the CVM—traverses four fundamental steps that (1) define the theoretical and definitional context; (2) identify the institutional setting and proper welfare measures; (3) design the survey instrument, integrating state-of-the-art CVM technology; and (4) analyze and interpret the data. Reviewed in greater detail, this analytical process serves as a guide to highlight the many procedures and methodological decisions made during the existence value study presented here.

Theoretical and Definitional Context of Existence Value

The Concept of Existence Value. Existence value represents the benefit that individuals gain from the knowledge that doubling the Columbia River Basin salmon and steelhead runs would provide the runs with greater ecological stability and diversity. The runs are perceived as being preserved in a more favorable state, even though an individual does not intend to directly use the fishery resource in the future. Existence value essentially consists of an in-

trinsic or inherent value that individuals attach to the fishery resource.

The concept of existence value advanced here is grounded in both the classic literature and more recent writings. The primary works that have brought existence value to prominence are those of Krutilla (1967) and Krutilla and Fisher (1985). Krutilla states (1967:781): "There are many persons who obtain satisfaction from the mere knowledge that part of the wilderness of North America remains, even though they would be appalled by the prospect of being exposed to it." Krutilla and Fisher (1985: 124) elaborate that existence value forms "the value some individuals place on the knowledge of the mere existence of gifts of nature, even though they feel certain they will never have or choose an opportunity to experience them in situ." This conceptual interpretation is further stressed by Walsh (1986:85): "Existence value is the willingness-to-pay for the individual satisfaction that a recreational or natural resource is protected . . . [it represents] a stock of knowledge or psychic capital."

Although the motives for and derivatives and legitimacy of existence value have been keenly explored (Brookshire et al. 1986), recent literature on the subject suggests that "the concept of existence value should be broadened back to something more closely resembling the original notion of existence value put forth by Krutilla . . . [the] value from knowing this natural environment exists" (Loomis 1988:23). This recommendation is characteristic of the use of the concept by Mitchell and Carson (1989), whereby they assert that nonuse value is a relatively pure expression of existence value. Although the authors recognize—as do others—variations or derivatives of existence value, they place nonuse values primarily in the existence category. The need for a consistent definition for existence value has also been voiced by Smith (1987).

Within the CVM survey instrument, the concept of existence value was explained to respondents as the value (satisfaction) obtained from the knowledge that doubling the Columbia River Basin fish runs would provide greater ecological stability and more species diversity. But to avoid an implied value cue, it was further stated that

some people do hold an existence value, whereas others do not.

Existence Value and the Regional Context. An important study component is the recognition of the interdependence of mitigation and enhancement measures, such as water budget and spill to assist downstream migration patterns, that affect regional fishery production and hydroelectric project operations. A doubling of the fish runs is definitely a regional management action that depends on the cooperation of all of the hydroelectric projects on the Columbia and Snake rivers.

The study population was limited to Pacific Northwest households (Washington, Oregon, Idaho, and western Montana), reflecting the assumption that Pacific Northwest residents are the primary recipients of the benefits and costs provided by the fishery and electric power system. This assumption further holds that the values derived represent a dominant portion of the total national value that could be described as existence value.

Identifying Existence Value—Resource Nonusers. A primary focus of the study was to estimate the existence value of resource nonusers. Resource nonusers were defined as individuals who have not been involved in the commercial fishing industry and who have not participated in the sport fishery during the past 5 years. The survey instrument determined whether any member of the respondent's household participated in the sport fishery during the past 5 years.

It is assumed that resource nonusers—those who have not participated in the commercial or sport fishery and do not plan to do so—retain an almost "pure" form of existence value; that is, resource nonusers project a very small to nonidentifiable amount of expected consumer surplus (recreation value) or option value in their total willingness-to-pay to preserve the resource or know that the resource would be altered to a more desirable condition. The survey instrument included a question to determine whether respondents would likely participate in the sport fishery during the following 5 years. Those who responded either "no" or "uncertain" to this question are considered to have a zero probability of future use (or are considered

to com
as zero

Institu
Welfar

The Pr
Plann
ignite
water
prope
be us
cial, I
tyrig
(rate
held
right
tain
sell i
to ei
surp
sures
to-ac
Exce
ory
are
and
tice,
bia l
divi
don
fixe
pen
tior
aler

Wil
surv
tive
we
dej
vol
wi
wf
us
19
19
va
sp
Pe
je
re
re
sf
et

to comprehend their future use probability as zero).

Institutional Setting and Welfare Measure

The Property Right. The Northwest Power Planning and Conservation Act has designated the Columbia River—fishery and water resources—as reflecting a mixed property right. Columbia River water must be used for fisheries protection (commercial, Indian, and sport fishermen's property rights) and for electric power generation (rate payers' property rights). Collectively held goods usually possess mixed property rights—the requirement of purchase to obtain the good in question or the right to sell it. Therefore, it is theoretically correct to employ both Hicksian compensating surplus willingness-to-pay (WTP) measures and equivalence surplus willingness-to-accept (WTA) compensation measures. Excellent reviews of welfare measure theory and implementation in CVM studies are provided by Desvousges et al. (1983) and Mitchell and Carson (1989). In practice, for a quantity increase of the Columbia River Basin fish runs—in which an individual's utility (satisfaction) is held constant and the quantity increase is fixed—the proper WTP measure is compensating surplus; under the same conditions, the proper WTA measure is equivalence surplus.

Willingness-to-Pay as the Primary Measure. From a purely theoretical perspective, it would be appropriate to give equal weight to either WTP or WTA measures, depending upon the property right involved. However, the literature abounds with considerable apprehension about whether WTA measures can or should be used to estimate benefits (Brookshire et al. 1983; Knetsch and Sinden 1984, 1987; Cox 1986; Coursey et al. 1987; Carson and Navarro 1988), although some counter perspectives have been asserted (Meyer 1979; Power 1988). Many researchers simply reject the WTA measure because of concerns related to market transaction simulation, respondent cognitive dissonance, or respondent failure to "understand" their true entitlement to the resource. Given these

concerns, WTP measures are the primary analysis measures within the study, but WTA measures are estimated for comparative purposes. It is assumed here that WTP and WTA measures of value actually depict two different, and perhaps incomparable, contexts of how people view the resource (Gregory 1986; M. W. Hanemann, unpublished data).

The WTP measure is advocated as the "proper" measure under the "new property rights approach" discussed by Mitchell and Carson (1989). This approach, yet to receive broad acceptance by resource economists, suggests that under conditions in which collective goods are involved with open access, each change made by society to the state of the resource should be accepted as the new societal status quo (presumably including any resulting externality costs). Under this perspective, both increments to the existing resource level or the avoidance of resource decrements should be analyzed using WTP measures.

Survey Instrument Design and CVM Technology

Survey Application. The CVM survey instrument was implemented through telephone interviews. The Social and Economic Sciences Research Center (SESRC) at Washington State University conducted the survey, relying on the Center's Total Design Method (Dillman 1978; Rossi et al. 1983; Layrakas 1987). The SESRC and the study principal investigators conducted two survey pretests and special training sessions for the survey interviewers before initiating the formal survey. Also, the survey instrument was reviewed by survey research specialists and several resource economists familiar with CVM applications.

The sample population consisted of all Pacific Northwest households with telephones. A probability sample of approximately 700 resource nonusers and 700 resource users (salmon and steelhead fishermen) was selected and interviewed using a dual sampling frame, employing both random digit dialing and directory samples. Survey respondents were screened to identify the person who normally paid the household electric power

bill and to identify resource users and non-users. Also, the head-of-household was identified.

Framing the Simulated Market. Respondents received background information before and during the elicitation process. This information included (1) a statement about the size of the fish runs before industrial development of the Columbia River Basin, (2) a statement about the effort currently being made to double the size of the salmon and steelhead runs, (3) a statement that federal law (Northwest Power Act) requires that those who enjoy the benefits of hydroelectric power must pay for its portion of associated environmental costs, and (4) a statement about the definitional context of existence value—the value derived from the satisfaction of knowing that the runs would be altered to a more stable and diverse condition. An introduction to the payment question defined the contingent market as payment for a guarantee that the fish runs would be doubled in size. Within the CVM literature, a cogent review of the context effects related to market framing is provided by Boyle (1989) and J. C. Bergstrom and J. R. Stoll (unpublished data).

CVM Elicitation Process and Payment Vehicle. To control for the effects of bidding game starting point bias (Boyle et al. 1985; Cummings et al. 1986) and the discrete choice analogue ("yea-saying") of starting point bias (Boyle and Bishop 1988; Mitchell and Carson 1989), a modified open-ended elicitation format was used. First, respondents were queried about their last electric power bill payment (monthly bill) and their estimated average monthly power bill throughout the year. This query served to prompt the respondent to begin thinking about a "market-like" transaction and to introduce the payment vehicle. Second, re-

spondents were asked to identify the maximum amount they would pay above their average monthly (or last) power bill to double the size of the fish runs. Third, the interviewers repeated to the respondents their payment level and indicated to them what percentage of their average (last) monthly power bill this additional amount represented. And fourth, respondents were asked if they would like to change their payment level, and were again requested to state their maximum payment level.

As noted above, the electric power bill served as the payment vehicle. Within the framing information, respondents were told that a portion of their current bills are and will continue to be used by fisheries managers to double the size of the fish runs through mitigation and enhancement actions. Respondents were further told that the electric power bill was the only way to finance the doubling of the runs, to minimize protest bids. However, a second payment vehicle was introduced to respondents who indicated that they did not want to make a payment and suggested that they were either rejecting the electric power bill as a payment vehicle or were concerned about the involvement of the electric power industry. The "second-stage" payment vehicle consisted of a direct solicitation by the respondent's state fishery agency for an annual contribution to be used for doubling the fish runs.

All "no payment" responses were followed with an extensive set of control questions to determine whether a protest bid was being offered or whether the respondent was actually providing a "true" zero-value bid. Adhering to current practice, protest bids were recorded (percentage relative to total sample), but they were not included within analysis.

RESOURCE USER VALUE CONCEPTS AND METHODOLOGY

The resource user and sport value component of the study was composed of two parts: (1) resource user values associated with doubling the size of the Columbia River Basin salmon and steelhead runs, and (2) "regional" sport fishing values for salmon and steelhead derived through a conventional CVM format. Several of the study design features for estimating these

resource user/sport values are identical to the existence value study features discussed above.

Theoretical and Definitional Context

Resource User Value. Resource users were defined as respondents who have partici-



pated in either the 1987 or 1988 salmon and steelhead sport fishing seasons, although participation in the sport fishery during the past 5 years was recorded to differentiate between user and nonuser households. The 2-year "user" time frame was adopted to reduce the likelihood of memory bias, a factor that could affect the accuracy of CVM responses. The resource user probability sample was drawn from the same study population—Pacific Northwest households—as the resource nonusers.

Consistent with the recent literature on CVM measurement theory, the values indicated by respondents are assumed to be an estimate of their "total value." When resource users responded to the CVM question about doubling the size of the runs, they were projecting expected consumer surplus (sport value), option value, and existence value.

The contingent market for resource users was the availability of more fish for ocean and river basin sport catch, as a result of doubling the Columbia River Basin salmon and steelhead runs; no probability function or hypothetical catch increase was proposed. For resource users, their WTP and WTA values were tied to their perception of how doubling the size of the fish runs could affect future fishing quality (use value) and their concerns for fishery stability and diversity.

Regional Sport Value. The regional sport value feature of the study estimated two value components: (1) the value held by users that exceeded the costs of their last fishing experience, with no change or improvement to the catch level; and (2) the value held by users for an incremental change—doubling the number of fish caught—in their catch levels, in excess of the value for present fishing conditions. The former component identified users' average net value for existing catch levels, while the latter expressed a marginal net value for increased sport catch.

Although this study feature relied upon the theory and design constructs of "standard" CVM approaches for measuring recreation values, the geographical scope was unconventional. The respondents' average and net values for their salmon and steelhead fishing experience was aggregated

across different geographical areas, thus representing salmon and steelhead fishing values drawn from a broad "regional" context. The geographical areas were Puget Sound and drainage, the ocean off the Washington or Oregon coasts, Washington or Oregon rivers with coastal drainage, and Columbia River Basin drainage.

This "regional factor" engenders both positive and negative attributes. On the positive side, the values project a regional experience. However, it is not possible to use these regional data to make site-specific estimates of fishing values for a distinct fishing spot within a geographical zone. The values derived for each zone compose an average fishing value given the diverse conditions across each zone.

Institutional Setting and Welfare Measure

Both WTP and WTA measures were used for the resource user value tied to doubling the fishery run size. Only the WTP measure was included for the regional sport value component. A review of the welfare measures applied within the study is provided in the existence value section above.

Survey Instrument Design and CVM Technology

Sample Population. A probability sample of approximately 700 households was interviewed to solicit the regional sport values and the resource user values for doubling the runs. To estimate the ratio of Pacific Northwest households with resource users versus nonusers, the survey instrument contained a question about overall household participation in the fishery.

CVM Format and Contingent Market. For resource users, the CVM format was identical to that of the nonusers' (existence) value format, with the exception of the WTP/WTA framing information. The contingent market for resource users was a payment for the availability of more salmon and steelhead, for the Columbia River and ocean catch, given a doubling of the fish runs along with assurances of ecological stability and diversity.

For the regional sport value component,

the contingent market was payment for (1) a continuation of the existing fishing experience but with additional costs required; and (2) an enhanced fishing experience provided by a doubling of a respondent's stated catch, for example, "one" fish caught for respondents who indicated a "zero" catch during their last trip.

The former payment question requested respondents to state their maximum WTP, above existing costs, for the same catch level. The latter payment question solicited respondents to state their maximum WTP for a marginal improvement in catch—a payment in excess of respondents' WTP for current fishing conditions.

STUDY FINDINGS AND INTERPRETATION

Existence and User Values for Doubling Fish Runs

A random probability sample of 4,028 Pacific Northwest households was contacted during survey implementation. From this sample, 2,907 households provided successful interviews: either they successfully answered a complete nonuser or user interview or they answered a more limited "screening" interview. Screening interviews were conducted to collect accurate nonuse/use ratio data from the probability sample and still fulfill the goal of acquiring approximately 700 nonuser and 700 user questionnaires (users responded to both the doubling-the-runs and "standard" CVM questions). The successful interviews composed a 72% cooperation rate.

Responses from 2,053 individuals indicated that they were resource nonusers; of this group, 21% indicated that a member of their household had participated in the sport salmon or steelhead fishery during the past 5 years. The remaining households (1,622) represent "true" nonuser households. Based on this sample, 56% of the regional households can be classified as resource nonusers and 44% as users.

Over 700 respondents answered a complete nonuser questionnaire. After the removal of difficult-to-understand responses (about 25 questionnaires that the interviewers considered distorted), 695 usable questionnaires remained. The nonusers offered a roughly even split between those willing to make a payment to ensure a doubling of the salmon and steelhead runs versus those not willing to make a payment: 54% responding "yes," and 46% responding "no." By employing a two-stage payment vehicle (as discussed above) and carefully classifying respondent reasons for nonpayment (control questions), it was determined that 204 (29%) cases reflected

"true" zero bids. These respondents indicated that doubling the fish runs held no economic value to them. Through use of the control questions—containing 14 designations for nonpayment—it was further determined that 110 (16%) nonpayment responses comprised protest bids. Respondent reasons for protesting the contingent market reflected a wide range of concerns, such as involvement by the electric power industry in mitigation and enhancement efforts, a lack of confidence that state or federal agencies would take the proper actions to restore the runs, and the perception that all the additional fish would be caught by Indian or commercial fishermen.

The two-stage payment vehicle elicitation format was replicated for resource users, and 482 usable responses were obtained. Approximately 19% of the user nonpayment responses consisted of protest bids. A higher number of users (603) answered the "standard" CVM questions (increased fishing activity expenses) for sport value than the total number of respondents answering the WTP/WTA question for doubling the fish runs. Follow-up responses offered by resource users indicated that a higher response rate for the standard CVM questions was largely due to the perception that they "already pay enough" in licensing fees for fishery management.

Nonuser and user WTP and WTA values for doubling the fish runs are presented in Table 1. The average WTP bid for nonusers who stated no probability of future participation in the sport fishery was \$2.21 per month; for nonusers who stated some probability of future participation, \$4.88 per month; and for resource users, \$6.18 per month. These values follow a trend that matches theoretical assumptions. For example, nonuser estimates, those with no probability of future participation, should represent a pure expression of existence

value. Non-
ceived notic
existence va
price (optio
Resource us
value and a
and consum
the value m
groups shc
(The empir
support the

The WT.
stated a W
ble 1. Over
and users
change fo
would be
for WTA/
were rep
that much
observed
several va
relatively
be primar
surround
payment
eral leve
increase
these fac
ket trans

Economi
Columbi
Steelhea

An es
values fo
is displa
values c
multipl
holds,
nonuse
probabi
users w
versus
future
ysis

In to
holds,
dollars
salmon
equiva
rect no
65% to
probab
sport

value. Nonusers who possess some perceived notion of future use should hold existence value and some fraction of option price (option value and consumer surplus). Resource users should possess an existence value and a "full measure" of option value and consumer surplus. Theory suggests that the value magnitude levels across the three groups should follow an upward trend. (The empirical data presented in Table 3 support theoretical expectations.)

The WTA values for respondents who stated a WTP bid are also presented in Table 1. Over 80% of both resource nonusers and users rejected compensation in exchange for knowing that the fish runs would be doubled in size. Also, the ratios for WTA/WTP values—where WTA bids were reported—are relatively low given that much greater differences have been observed in other CVM studies. Although several variables are responsible for this relatively "close" ratio, the outcome may be primarily due to the degree of "realism" surrounding the survey instrument and payment source and to respondents' general level of knowledge about efforts to increase the size of the fish runs. Both of these factors would tend to make the market transaction more authentic.

Economic Value for Doubling the Columbia River Salmon and Steelhead Runs

An estimate of the existence and user values for doubling the size of the fish runs is displayed in Table 2. The average WTP values derived from the CVM survey are multiplied by all Pacific Northwest households, taking into account the resource nonuser and user ratios estimated from the probability sample. Also, ratios for nonusers with some probability of future use versus nonusers with zero probability of future use are incorporated into the analysis.

In total, regional rate payers, or households, are willing to pay \$171 million (1989 dollars) annually for a doubling of the salmon and steelhead runs, or an amount equivalent to \$68.49 per additional fish (direct net value). Resource users contribute 65% to the total value; nonusers with zero probability of future participation in the sport fishery, 25%; and nonusers with some

TABLE 1
Values by nonuser and user groups

Nonuser, no probability of future use	
Mean value:	\$2.21/month = WTP
Median value:	\$1.00/month = WTP
SD:	\$2.98
WTA = 83% say "no sale"	
Mean value:	\$3.39/month = WTA ^a
WTA/WTP ratio =	1.53
Nonuser, with some probability of future use	
Mean value:	\$4.88/month = WTP
Median value:	\$3.00/month = WTP
SD:	\$9.33
WTA = 85% say "no sale"	
Mean value:	\$5.82/month = WTA ^a
WTA/WTP ratio =	1.19
User value	
Mean value:	\$6.18/month = WTP
Median value:	\$3.50/month = WTP
SD:	\$9.92
WTA = 84% say "no sale"	
Mean value:	\$10.25/month = WTA ^a
WTA/WTP ratio =	1.66

^a For those accepting compensation.

probability of future participation, 10%. This "total value" captures resource nonusers' and users' existence value, option value, and expected consumer surplus. Collectively, the resource nonuser and user values reported here are less than many "older" sport value estimates applied within the Columbia River Basin (U.S. Army Corps of Engineers 1989).

Estimated Regional Sport Value

Table 3 provides an estimate of the sport-effort day activity for salmon and steelhead fishing in the Pacific Northwest. When asked about the location of their last fishing trip, salmon anglers replied that 37% fished in the Puget Sound area, 33% off the Washington or Oregon coasts, 6% within a coastal drainage river, and 24% within the Columbia River Basin drainage (includes Buoy 10 area). Steelhead anglers replied that 72% fished within the Columbia River Basin drainage and 28% within a coastal river drainage.

The sport-effort day catch levels reported by anglers who fished off the Washing-



TABLE 2
Estimated existence (nonuser) and user values for doubling the size of the Columbia River Basin fish runs

	Existence (nonuser), no probability of future use	Nonuser, with some probability of future use	User
\$/month	2.21	4.88	6.18
\$/year	26.52	58.56	74.16
Regional households	1,599,360	304,640	1,496,000
Total regional annual value (\$)	42,415,000	17,840,000	110,943,000
Fish/year (doubling goal)	2,500,000 (Marginal)	2,500,000 (Marginal)	2,500,000 (Marginal)
Value/fish (\$)	16.97	7.14	44.38
Net regional benefit (total annual value) = \$68.49/fish ^a			

^a Includes "total value," which is existence value, option value, and consumer's surplus.

TABLE 3
Estimated sport-effort day (SED) and catch levels for salmon and steelhead fishing (for last fishing trip)

	Average days/trip	Average fish/trip	Average fish/SED
Salmon location			
Puget Sound (n = 156)	1.62	1.48	0.91
Washington-Oregon coast (n = 146)	1.75	2.15	1.23
Coastal rivers (n = 32)	1.79	1.59	0.89
Columbia River Basin ^a (n = 103)	2.25	2.44	1.08
Steelhead location			
Coastal rivers (n = 47)	1.72	0.93	0.54
Columbia River Basin (n = 119)	1.95	0.68	0.35

^a Includes fishing in Lower Columbia River and at Buoy 10.

ton or Oregon coasts and within the Columbia River drainage are consistent with the sport-effort catch levels estimated by the Pacific Fishery Management Council (PFMC 1989). For example, the Management Council estimated that the 1988 sport-effort day catch level for anglers off the Washington or Oregon coasts ranged between 1.56 (Washington) and 1.06 (Oregon) and for anglers in the Buoy 10 area (mouth of the Columbia River), 0.94. The estimates provided by the CVM study for the 1987-1988 period are 1.23 for the Washington or Oregon coasts and 1.08 for the Columbia River drainage, including the Buoy 10 area.

Current sport-effort day catch level estimates for Idaho (1987-1988) are congruent with the study estimates for the Columbia River Basin. The Idaho Department of Fish and Game (IDFG 1989) estimated a

statewide average catch level (Snake, Clearwater, and Salmon rivers) of 0.32 fish per sport-effort day; angler reports from the study establish the catch level at 0.35 fish per sport-effort day. Both the IDFG and study estimates reflect an increase in catch levels that coincides with improvements to the upper river steelhead runs (Pratt and Chapman 1989). Also, the 0.35 study estimate has been directly discussed with fishery agency officials, and it is considered to be reasonable (Al Van Vooren, personal communication).

Tables 4 and 5 display average and marginal net value estimates for salmon and steelhead fishing on a value per trip, value per sport-effort day, and value per fish basis. Average net values for salmon fishing off the Washington or Oregon coasts and within the Columbia River Basin (including Buoy 10 area) are \$41.61 per fish and

Estimatec

Salmon I
Puget
Washi
Coasta
Colum
Steelhea
Coasta
Colum

Note: Ave
^a Includes

Est

Salmor
Puge
Wash
Coas
Colu
Steelhu
Coas
Colu

^a Includes

\$45.68 per
fishing—are
values—t
catch—of
fish, respe
reported 1
CVM stud
mates from
sored by 1
and Wild.
Oregon S
Brown 19
Oregon C
from abou
pending 1
Steelhe
bia River
value of 1



TABLE 4
Estimated sport values (average net value) for existing fishing experience, without change (for last fishing trip)

	Average fish/trip	Average fish/SED	Average net value/trip (\$)	Average net value/SED (\$)	Average net value/fish (\$)
Salmon location					
Puget Sound	1.48	0.91	75.88	46.66	51.27
Washington-Oregon coast	2.15	1.23	89.47	51.59	41.61
Coastal rivers	1.59	0.89	58.39	32.68	36.72
Columbia River Basin ^a	2.44	1.08	111.46	49.33	45.68
Steelhead location					
Coastal rivers	0.93	0.54	59.58	34.59	64.06
Columbia River Basin	0.68	0.35	90.08	46.36	132.47

Note: Average fish per trip is based on multiple-day fishing at the site.

^a Includes fishing in Lower Columbia River and at Buoy 10.

TABLE 5
Estimated sport values—average and marginal net values (for last fishing trip)

	Average net value/trip (\$)	Marginal 2(X) fish net value/trip (\$)	Average net value/fish (\$)	Marginal 2(X) fish net value/fish (\$)
Salmon location				
Puget Sound	75.88	26.89	51.27	18.17
Washington-Oregon coast	89.47	54.31	41.61	25.26
Coastal rivers	58.39	23.55	36.72	14.81
Columbia River Basin ^a	111.46	45.07	45.68	18.47
Steelhead location				
Coastal rivers	59.58	23.21	64.06	24.96
Columbia River Basin	90.08	37.29	132.47	54.84

^a Includes fishing in Lower Columbia River and at Buoy 10.

\$45.68 per fish, respectively. For the same fishing areas, anglers reported marginal net values—based on a doubling of their catch—of \$25.26 per fish and \$18.47 per fish, respectively. The average net value reported by the ocean fishermen in the CVM study is consistent with value estimates from a recent travel cost study sponsored by the Oregon Department of Fish and Wildlife (ODFW) and conducted by Oregon State University (Abdullah 1989; Brown 1990). The ODFW estimates for the Oregon Coast sport salmon fishery range from about \$40.00 to \$60.00 per fish, depending upon the coastal site.

Steelhead anglers fishing in the Columbia River Basin reported an average net value of \$132.47 per fish and a marginal

net value of \$54.84 per fish (marginal value estimate based on a doubling of catch). A smaller sample of steelhead anglers fishing at different coastal river sites reported an average net value of \$64.06 per fish and a marginal net value of \$24.96 per fish.

Comparison of Use and Regional Sport Values

For Columbia River steelhead, there is an important similarity between the user value estimates for doubling the size of the Columbia River Basin fish runs and the regional sport value estimate for a marginal increase in catch. The user value for doubling the runs (\$44.38 per fish) and the marginal steelhead sport value (\$54.84) are



approximately equal. This observation is consistent with the hypothesis that users should offer roughly equivalent values for either a doubling of the runs or marginal increases in fish catch. This observation also supports the concept that much of the value users (and perhaps nonusers) assign to a doubling the runs stems from potential increases to upper river stocks.

Interpreting Existence and User Values

Given the parameters of the CVM study, Pacific Northwest households have established existence and use values for doubling the size of the Columbia River Basin salmon and steelhead runs. When combined, these values mark a point of caution or threshold that can be used to assess the overall economic value society places on

proposed fishery mitigation and enhancement projects. For example, if the cost per incremental fish in a proposed mitigation or enhancement project is substantially greater than the combined existence and user value average for doubling the runs (\$68.49 per fish), then the project should be reconsidered in light of other alternatives. Most projects should be screened on an individual basis, taking into account cumulative effects where possible.

The existence and user value threshold provides a clear economic boundary for resource decisions. Prudent resource managers will not exceed this economic threshold. By more fully evaluating project decisions through adoption of a societal economic threshold, resource managers will be more likely to meet the doubling goal objective by the year 2000—dollars will be effectively spent.

GUIDELINES FOR CONDUCTING EXISTENCE VALUATION STUDIES

Since the early 1980's, resource economists have attempted to quantify the existence or nonuse values (or preservation values depending upon the preferred nomenclature) previously discussed within the theoretical literature. A representative overview of the applied studies can be found in Rowe et al. (1980), Brookshire et al. (1983), Schulze and Brookshire (1983), Kneese (1984), Walsh et al. (1984), Mitchell and Carson (1985), and Edwards (1988). Underlying much of this research has been a recognition that existence or nonuse values should be taken into account when economic analyses are conducted to evaluate the merits of various resource projects.

It is likely that greater attention will be placed on existence and nonuse values in the future as resource managers confront the need to assess ever more diverse societal preferences for resource allocation. Therefore, it is important to establish some fundamental guidelines for when and how existence and nonuse values can be applied. The points offered below serve to "initiate" this task, reflecting the authors' experience in conducting an existence value study.

1. The "general concept" of existence value is adequate for evaluating re-

source decisions. The concept of existence value of Krutilla (1967) and Krutilla and Fisher (1985) should not be transformed into impotent theoretical definitions and distinctions, impossible to apply to resource allocation decisions. Existence value as the value an individual (or society) places on the knowledge that a resource exists in a certain state is theoretically sound and can be measured for assessment within the resource decision making arena.

2. The existence value contingent market should be tied to a well-defined policy action. Avoid "open-ended" contingent value markets. The contingent value market and its framing should be matched to relevant policy questions that resource managers can act upon once values are obtained.
3. Public understanding or knowledge about a resource, even if only general in nature, should be a prerequisite to conducting an existence valuation study. Obscure resources are poor candidates for existence valuation.
4. It is unrealistic to expect individuals to place a meaningful existence value upon an ecologically or geographically "fragmented" resource. The

and enhance-
if the cost per
ed mitigation
substantially
existence and
ling the runs
project should
other alterna-
e screened on
to account cu-
ble.
ue threshold
ndary for re-
source man-
omic thresh-
ting project
of a societal
re managers
he doubling
000—dollars

IES
cept of ex-
(1967) and
should not
otent theo-
listinctions,
source allo-
value as the
iety) places
resource ex-
eoretically
red for as-
source deci-

ngent mar-
ell-defined
en-ended"
. The con-
ts framing
vant policy
nagers can
btained.
nowledge
ly general
quisite to
valuation
are poor
uation.
ividuals
nce value
eographi-
rce. The

ry 1991

temptation to isolate a "portion" of a resource—either biologically or geographically—for existence valuation should be resisted. This partitioning invites problems related to part/whole bias and requires individuals to develop a cognitive distinction that cannot be adequately invoked through CVM research methods.

As more applied existence value work is conducted, additional guidelines should be added to the above list. The use of existence valuation and formal guidelines for implementation should be brought into agency resource decision making on a standard basis.

ACKNOWLEDGMENTS

Several individuals provided important comments and recommendations on the methodology employed in this study. We thank Shep Buchanan, Bonneville Power Administration; Chris Carter, Oregon Department of Fish and Wildlife; Ken Corum, Northwest Power Planning Council; Stan Detering, Bonneville Power Administration; Myrick Freeman, Resources for the Future, Washington, D.C.; John Loomis, University of California, Davis; John Tarnai, Washington State University; Phil Wandschneider, Washington State University; Tom White, North Pacific Division, Army Corps of Engineers; and Ed Woodruff, North Pacific Division, Army Corps of Engineers.

REFERENCES

Abdullah, N. M. R. 1989. Estimation of average and incremental net values of Oregon sport-caught salmon: An aggregated travel cost approach. Doctoral dissertation. Corvallis: Oregon State University, Department of Agricultural and Resource Economics.

Boyle, K. J. 1989. Commodity specification and the framing of contingent valuation questions. *Land Economics* 65(1):57-63.

———, and R. C. Bishop. 1988. Welfare measurements using contingent valuation: A comparison of techniques. *American Journal of Agricultural Economics* 70(1):20-28.

———, ———, and M. P. Welsh. 1985. Starting point bias in contingent valuation bidding games. *Land Economics* 61(2):188-194.

Brookshire, D. S., L. Eubanks, and A. Randall. 1983. Estimating option prices and existence values for wildlife resources. *Land Economics* 59(1):1-15.

———, ———, and C. F. Sorg. 1986. Existence values and normative economics: Implications for valuing water resources. *Water Resources Research* 22(11):1509-1518.

Brown, W. 1990. Estimation of net economic values for Oregon sport-caught salmon and steelhead. Final report to Oregon Department of Fish and Wildlife (R/PPA-30), Portland.

Carson, R., and P. Navarro. 1988. Fundamental issues in natural resource damage assessments. *Natural Resources Journal* 28(4):815-836.

Coursey, D. L., J. L. Hovis, and W. D. Schulze. 1987. The disparity between willingness-to-accept and willingness-to-pay measures of value. *Quarterly Journal of Economics* 102(3):679-690.

Cox, L. A., Jr. 1986. Theory of regulatory benefits assessment: Econometric and expressed preferences approaches. Pages 85-159 in J. D. Bentkover, V. T. Cocello, and J. Mumpower, editors. *Benefits assessment: The state of the art*. Boston: D. Reidel Publishing Company.

Cummings, R. G., D. S. Brookshire, W. D. Schulze, et al. 1986. *Valuing environmental goods: An assessment of the contingent valuation method*. Totowa, NJ: Rowman & Allanheld.

Desvousges, W. H., V. K. Smith, and M. P. McGiven. 1983. A comparison of alternative approaches for estimating recreation and related benefits of water quality improvements. Washington, DC: U.S. Environmental Protection Agency (68-01-5838).

Dillman, D. A. 1978. *Mail and telephone surveys: The total design method*. New York: John Wiley & Sons.

Edwards, S. F. 1988. Option prices for groundwater protection. *Journal of Environmental Economics and Management* 15(4):475-487.

Freeman, A. M., III. In press. *Nomuse values in natural resources damage assessments*. Washington, DC: Resources for the Future.

Gregory, R. 1986. Interpreting measures of economic loss: Evidence from contingent valuation and experimental studies. *Journal of Environmental Economics and Management* 13(4):325-337.

Idaho Department of Fish and Game (IDFG). 1989. Salmon and steelhead investigations. Boise: Idaho Department of Fish and Game (Project No. F-73-R-11).

- Kneese, A. V. 1984. *Measuring the benefits of clean air and water*. Washington, DC: Resources for the Future.
- Knetsch, J. L., and J. A. Sinden. 1984. Willingness-to-pay and compensation demanded: Experimental evidence of an unexpected disparity in measures of value. *Quarterly Journal of Economics* 99(3):508-521.
- , and ———. 1987. The persistence of evaluation disparities. *Quarterly Journal of Economics* 102(3):691-695.
- Krutilla, J. V. 1967. Conservation reconsidered. *American Economics Review* 57(4):777-786.
- , and A. C. Fisher. 1985. *The economics of natural environments: Studies in the valuation of commodity and amenity resources*. Washington, DC: Resources for the Future.
- Lavrakas, P. J. 1987. *Telephone survey methods: Sampling, selection, and supervision*. Beverly Hills, CA: Sage Publications.
- Loomis, J. 1988. Broadening the concept and measurement of existence value. *Northeastern Journal of Agricultural and Resource Economics* 17(1):23-29.
- Meyer, P. A. 1979. Publically vested values for fish and wildlife: Criteria in economic welfare and interface with the law. *Land Economics* 55(2):223-235.
- Mitchell, R. C., and R. T. Carson. 1985. An experiment in determining willingness-to-pay for national water quality improvements. Report prepared for the U.S. Environmental Protection Agency, Washington, DC.
- , and ———. 1989. *Using surveys to value public goods: The contingent valuation method*. Washington, DC: Resources for the Future.
- Northwest Power Planning Council (NPPC). 1987. Columbia River Basin fish and wildlife program. Portland, OR: Northwest Power Planning Council.
- Olsen, D., J. Richards, and R. D. Scott. 1989. Study design report: Existence and resource user value estimates for doubling the size of the Columbia River Basin salmon and steelhead runs. Seattle, WA: North Pacific Division, U.S. Army Corps of Engineers, Battelle Human Affairs Research Centers (CRT-73).
- Pacific Fishery Management Council (PFMC). 1989. Review of 1988 ocean salmon fisheries. Portland, OR: Pacific Fishery Management Council (CRT-73).
- Power, T. M. 1988. *The economic pursuit of quality*. Armonk, NY: M. E. Sharpe.
- Pratt, K., and D. Chapman. 1989. Progress toward the run doubling goal of the northwest power planning council. Final report to Pacific Northwest Utilities Conference Committee.
- Rossi, P. H., J. D. Wright, and A. B. Anderson. 1983. *Handbook of survey research*. New York: Academic Press.
- Rowe, R. D., R. C. D'Arge, and D. S. Brookshire. 1980. An experiment on the economic value of visibility. *Journal of Environmental Economics and Management* 7(1):1-19.
- Schulze, W. D., and D. S. Brookshire. 1983. The economic benefits of preserving visibility in the national parklands of the southwest. *Natural Resources Journal* 23(1):149-173.
- Smith, V. K. 1987. Nonuse values in benefit-cost analysis. *Southern Economic Journal* 54(1):19-26.
- U.S. Army Corps of Engineers. 1989. Galloway preliminary feasibility report. Portland, OR: U.S. Army Corps of Engineers.
- Walsh, R. G. 1986. *Recreation economic decisions: Comparing benefits and costs*. State College, PA: Venture Publishing.
- , J. B. Loomis, and R. A. Gillman. 1984. Valuing option, existence, and bequest demands for wilderness. *Land Economics* 60(1):14-28.