Estimated Net Economic Benefits to Visitors of Selected Columbia River Fish Hatcheries

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ESTIMATED NET ECONOMIC BENEFITS TO VISITORS OF SELECTED COLUMBIA RIVER FISH HATCHERIES*

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SUMMARY

Statistical demand functions were fitted which related the number of visits to specified Columbia River fish hatcheries to distance, cost of travel, and family income. From these demand functions, net economic values to hatchery visitors can be inferred.

Based upon results from the best fitting demand functions for visitors to Bonneville Hatchery in 1974, net economic values or benefits averaged from $1.19 to $1.25 per visit, resulting in total estimated benefits as high as $264,000 in 1974 for the 211,000 main reason Bonneville visitors. Similarly, total net economic benefits to the 319,000 incidental Bonneville Hatchery visitors in 1974 and 1975 were estimated to have been roughly 185,000, or $0.58 per visitor. Thus, using the more conservative estimates, benefits in 1974 would have been \$1.19 x 211,000 $\doteq$ \$251,000 for main-reason visitors plus \$0.58 x 92,000 $\doteq$ \$53,000 for a total of about \$304,000. Since the cost of labor and facilities for visitors was estimated to be less than \$7,000 per year in 1974, a very high benefit-cost ratio of \$304,000/\$7,000 $\doteq$ 43 to 1 is estimated.

More uncertainty is associated with the estimated net economic values for the other fish hatcheries studied. A higher net economic value per visitor was estimated for the Spring Creek Hatchery. Total benefits of about $48,000 were computed for 4,251 visitors for whom the hatchery was the main reason for their trip. The net benefits to the 9,051 incidental visitors of Spring Creek may have added $5,500 more, giving a total of about $54,000.

In addition, the incidental visitors to Kalama Falls Hatchery were estimated to have received net benefits of roughly $4,300 for 6,190 visitors.

CONTENTS

INTRODUCTION

The operation and maintenance of the 22 federally-funded fish hatcheries on the Columbia River and its tributaries requires expenditures in the neighborhood of $3 million per year. The magnitude of such an expenditure of public funds is, in itself, a partial justification for economic analysis, but further justification might be derived from the argument that it is important to determine in what ways the public benefits from the use of its tax dollars. For this reason, several recent studies (Brown and Hussen; Brown, Larson, Johnston, and Wahle; Brown and Larson) have addressed different facets of hatchery operation and subsequent economic values which might be derived from various production and/or operation alternatives, as well as attempting to strengthen the methodology for valuation and identification of the distribution of benefits.

While the previous research has been primarily concerned with various aspects of fall chinook (*Oncorhynchus tschawytscha*) and coho (*Oncorhynchus kisutch*) salmon production and the resulting public benefits, in recent years several hatcheries have been responsible for another type of benefit to the public. This benefit stems from the provision of visitor facilities for information and education about the salmon resource, particularly at the larger and more accessible hatcheries. The public response to the provision of this service has been remarkable,[1/] indicating that the opportunity to combine education and recreation has a substantial appeal.

Any public use of these facilities indicates that those who undertake a recreational/educational visit to a fish hatchery have anticipations of benefits greater than their costs (in time and money). Thus, in the context of justification of public expenditures, this component of public benefit which the publicly-funded hatcheries provide should be explored.

Therefore, the objectives of this study are two-fold: (1) to estimate the demand for the recreational/educational experience provided by some Columbia

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1/ This public response will be developed in more depth later, but Bonneville Hatchery in 1974 was estimated to have accommodated over 300,000 visitors.

River fish hatcheries, and (2) to estimate the recreational/educational benefits received by visitors to fish hatcheries in the context of outdoor recreation evaluation.

SURVEY DESIGN AND IMPLEMENTATION

A questionnaire was distributed to visitors of fish hatcheries for collecting relevant information for estimation of the recreational demand of hatchery visitors. This questionnaire (see Appendix Table 1) was administered by hatchery personnel at seven different hatcheries (Bonneville, Big Creek, Carson, Gnat Creek, Kalama Falls, Klickitat, and Little White Salmon) in the years 1974 and 1975, with the addition of Spring Creek Hatchery in 1975.

For purposes of this study, the focus will be on the Bonneville, Spring Creek, and Kalama Falls Hatcheries. These hatcheries were chosen for several reasons: they are among the largest and most accessible of the Columbia River hatcheries, and have the most accommodating visitor centers. In addition, during the two years at Bonneville and Kalama Falls and one year at Spring Creek for which visitor data were collected, they had the largest numbers of visitors. Also, only these three hatcheries collected enough questionnaires for analysis.

Bonneville Hatchery is located just west of Bonneville Dam on the Oregon shore of the Columbia River, near the town of Cascade Locks. Operated by the Oregon Department of Fish and Wildlife, it is by far the most widely visited hatchery on the Columbia, due partly to its direct access to Interstate 80 and its proximity (40 miles) to a major metropolitan area. Another potential visitor attraction is Bonneville Dam itself, being the first major hydroelectric power facility constructed on the main-stem Columbia River. Every year families, school groups, and other organizations from the Portland area and elsewhere come to watch the spawning of the fall chinook and coho.

Unfortunately, Army Corps of Engineers construction and renovation efforts hampered data collection during both years at Bonneville Hatchery, as well as potentially reducing the number of visitors. (Improvement of Bonneville Hatchery facilities was undertaken to partially mitigate the loss of spawning grounds caused by the John Day Dam.) The spawning area had to be closed to the public for safety reasons, and poor parking availability, together with dusty and muddy conditions, served to deter visitors.

Most data were collected by a staff member who passed out questionnaires during the course of his/her work day. In addition, during the summer a temporary employee conducted personal interviews with visitors, using the questionnaire as a base. Estimation of total visitors was achieved by multiplying car counts by the average number of people per car, determined from the questionnaires. However, estimation of car counts from mechanical counters was complicated by the construction activity, since the accesses to the hatchery were also used by construction equipment and resident construction workers. In spring, fall, and summer, the daily numbers obtained by car counters were adjusted for this non-visitor traffic by use of a correction factor which took into account fluctuations in construction-related traffic. In winter, when car counters would have been damaged by snow removal equipment, it was necessary to multiply the Army Corps of Engineers' dam visitor counts by a factor which discounted dam visitors who did not visit the hatchery.

Spring Creek Hatchery is located on the Washington side of the Columbia River approximately 3 miles west of the Hood River bridge. Rebuilt and converted to a water reuse system in 1973, it is one of the largest on the Pacific Coast, and is operated by the U.S. Fish and Wildlife Service. Questionnaires were distributed by a hatchery secretary as visitors entered, and were returned either to her or to a deposit box. In addition, a temporary employee was hired to distribute and collect questionnaires and to observe visitation patterns.

Total visitor estimation was more straightforward at Spring Creek Hatchery than at Bonneville. For the period June 16-October 3, a car counter was used, and the resultant count multiplied by a correction factor for hatchery personnel and other non-visitor traffic. At other times, the number of visitors signing the guest register was tripled, as it was determined that approximately one-third of all hatchery visitor parties register. (These correction factors were computed by actually counting the number of cars two or three times per week for several weeks, then comparing the actual car counts with counts from the mechanical counters and the guest register.)

Kalama Falls Hatchery is located on the Kalama River northeast of Kalama, Washington, and is operated by the Washington Department of Fisheries. The hatchery is close to Interstate 5, and is a very popular field trip site for school groups. For the survey, questionnaires were either distributed by hatchery personnel in the course or their duties, or picked up by visitors in the visitor center. Numbers of visitors and visitor groups were counted each day by the hatchery staff.

ESTIMATES OF RECREATIONAL/EDUCATIONAL DEMAND FOR MAIN-REASON VISITORS

Main-reason visitors are defined (for purposes of estimating outdoor recreation demand) as those whose primary purpose of travel is to visit the recreation site, in order to attribute the various costs of travel (in terms of money and time) to the demand for recreation at the site. In contrast, incidental visitors are those for whom the main reason for travel is not to visit the recreation site, and for whom the total costs of travel cannot therefore be attributed to their demand for recreation at that site.

Methodology for Measuring Demand

A well-established methodology, commonly called the "travel cost method", has been developed to handle the demand by main-reason visitors for various types of outdoor recreation.[2/]

Briefly, the travel cost method employs a two-step procedure to estimate the demand for recreation at a particular site. The first step involves estimation of a demand function for the "total recreation experience", which includes (in addition to the recreation experience at the site) travel to and from the site, and anticipation and recollection. The dependent variable in this function is a series of participation rates from the populations of various distance zones surrounding the recreation site. These participation rates are regressed upon various exogenous factors which are thought, *a priori*, to be determinants of the participation rates. The second step involves a transformation of the visitation rate variable for each distance zone to a predicted number of visitors per distance zone, given the existing price structure at the site. With the aid of an

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2/ See, for example, Brown, Nawas, and Stevens, 1973.

assumption that recreationists respond to changes in admission price in the same manner as they respond to changes in travel cost, a number of hypothetical admission price shifts can be used to generate the demand schedule for the recreation experience at the site itself. The consumer surplus which visitors from the different distance zones receive as a result of not having to pay higher prices (which, according to the demand schedule, they would be willing to pay in order to consume diminishing quantities of recreation) is most frequently looked at as the value of recreation at the site.

It was thought that the nature of recreation offered by a visit to a fish hatchery was such that it would be more readily accommodated by the travel cost method than by any other.[3/] This preference for the travel cost method was due partly to the nature of the dependent variable in the demand specification, i.e., quantity of recreation taken. For any given trip to the fish hatchery, the quantity of recreation consumed by a party (or whatever the decision-making unit is) is essentially fixed, in that there is only so much to see at a fish hatchery. There are really no variable on-site costs for a visit to a fish hatchery either, except possibly the opportunity costs of additional time spent, so it can be argued that differences in length of stay at the hatchery between different groups are more reflective of individual styles and paces of consuming recreation than of a decision to recreate more or less, based on variable on-site costs. This aspect of the problem at hand tends to make inapplicable one of the main thrusts of the Edwards et al. specification, i.e., that the recreationist makes a decision to consume more or less, based on two different types of costs, fixed (travel to the site) and variable (on-site costs).

One problem in estimation of the demand relationship which results from the quantity variable being essentially fixed is that one would expect the residuals from Ordinary Least Squares (OLS) estimation to be somewhat autocorrelated. A series of observations on the dependent variable which are identical or nearly identical will tend to introduce some correlation into the residuals calculated by OLS. While OLS gives unbiased parameter estimates when autocorrelation is present, the regression parameter estimates will be inefficient; in addition, their sample variances will usually be underestimated (Johnston, p. 246).

[3/] An example of a different approach is that of Edwards, et al.

Construction of Variables

Information about the income, location of home, distance and time traveled, and other descriptive information about each recreation group, was gathered from the questionnaire. For simplicity in identifying a relevant base population, distance zones were composed of one or more counties in Washington and Oregon. Upon examination of the usable data from the questionnaire, it became clear that 1975 was not a representative year for Bonneville Hatchery for estimating recreational/educational demand and benefits. Visits were adversely affected in 1975 because visitors could not view spawning in 1974, and because of other disagreeable conditions resulting from construction and renovation of the hatchery. Consequently, the analysis of main-reason visitors will treat demand and benefits for Bonneville Hatchery in 1974 and Spring Creek Hatchery in 1975.

Grouping of Observations

In the usual formulation of the travel cost model, all observations from a given distance zone are averaged into a single value for each variable. In this study, there were a large number of observations (recreation groups) for the distance zones which are closer and for those which have large populations, relative to those distance zones which are less populated and/or farther away. To use zone averages in this case would introduce heteroskedastic disturbances into the error term since, by the algebra of expectations, the variance of a distribution of means calculated with k observations is a close approximation of σ^2/k. As k varies from zone to zone, the variance associated with each residual would differ, depending upon how many observations the zone contained.

To avoid this problem, each distance zone was divided into a number of subzones, each of which contained approximately the same number of observations. The observations for a given distance zone were first stratified according to family income class; then each block of about 9 observations comprised a subzone for Bonneville Hatchery (there were 5 observations per subzone for Spring Creek). The Portland metropolitan area had a large number of subzones, whereas more distant zones had fewer (or no) subzones.

It was necessary to calculate the population represented by each subzone. First, the statewide distribution of population by income class was used to estimate the amount of population in each income class for each distance zone. For each distance zone, the number of groups in each income class was also known. The population represented by each recreation group was:

$$POP_{ijk} = \frac{POP_{jk}}{N_{jk}} ,$$

where

POP_{ijk} = the population represented by the i^{th} party of the k^{th} income class in the j^{th} travel zone;

POP_{jk} = the estimated population of the k^{th} income class in the j^{th} travel zone; and

N_{jk} = the number of parties from that same income-distance class.

Once the population represented by each party was estimated, the population represented by each subzone was then simply the sum of the populations represented by the observations in the subzone.

The variables in the model were constructed as follows:

Quantity Variable

In employing the travel cost approach, the quantity of recreation consumed is put on a per-capita basis in order to net out the effects of population differences between various distance subzones. If this were not done, differences in absolute population size between subzones would mar the expected relationship between the cost (price) variable and the quantity variable.

Two different specifications of the dependent quantity variable were used in the analysis. In one case the group or family was considered the recreation unit; thus, each party consumed one unit of recreation per hatchery visit. Standardizing by population, the visitation rate (quantity) variable was:

$$VR_s \equiv \frac{N_s}{POP_s} \times 10^3, \qquad (1)$$

where

VR_s = the visitation rate for the s^{th} subzone;

N_s = the number of groups in the s^{th} subzone (usually 9); and

POP_s = the population represented by the s^{th} subzone.

It might be argued that groups of different sizes are, in effect, taking different quantities of hatchery recreation, since each individual in the group is taking one fixed unit of recreation. That is, a group of five recreationists would take five units of recreation, rather than one. Thus, the dependent variable would have the number of people visiting the hatchery in the numerator of (2) rather than the number of groups. Thus, a second visitation rate variable was defined, corresponding to this line of thinking:

$$VRI_s \equiv \frac{n_s}{POP_s} \times 10^3,$$

where, in this case, n_s is the number of hatchery visitors observed from subzone s. (The visitation rate variables were multiplied by 10^3 for ease of handling small numbers.) This adjustment was accounted for in making the net benefit calculations; however, the β coefficients listed in the regression are correspondingly 10^3 times larger than their actual values on a per capita basis.

One possible disadvantage of the VRI specification is that variations in the dependent variable may be introduced which are unrelated to the theoretical model. If all groups had the same number of people, VRI would be a simple multiple of VR, and its predictive effect in the model would be identical to that of VR. However, as number of people per group varies, corresponding fluctuations in VRI are introduced. It might be thought that differences in number of people per car depend partially on tastes (willingness or unwillingness to be crowded together for the trip to the hatchery) and size of vehicle, rather than on variables which are thought, *a priori*, to be causal; if this were true, some additional variance would be incurred. Nonetheless, as it is a more commonly-found specification in recreation models, it was also used in the analysis.

Travel Cost Variable

From the questionnaire (Appendix Table 1), the type of vehicle driven by the recreation group was obtained. The travel cost variable was then constructed by multiplying the number of miles traveled round trip to the hatchery (also given in the questionnaire) times the average cost per mile of driving that type of vehicle (see Appendix Table 6). The categories of vehicle type that were used were personal car, business car, and rental car. The remaining two categories on type of vehicle (bus and other) were not used because of obvious difficulties in assigning cost, but these and certain types of non-responses comprised only 2 percent of the total recreation groups for Bonneville visitors, and 4 percent of the Spring Creek groups.

Many of the bridges that span the Columbia River are toll bridges, and for many visitors one of the money costs of a trip to the hatchery is payment of the toll. The questionnaire, however, did not include any questions on toll costs until July of the first sampling year, 1974. Also, an examination of the toll costs for visitors to Bonneville from July to December of 1974 showed that only one of the 509 parties paid a toll, so this component of travel cost was excluded for the 1974 visitors to Bonneville. However, it was calculated in the travel costs of the visitors to Spring Creek in 1975.

The travel cost variable also was formulated in two ways, corresponding to the two visitation rate specifications. For the equations in which VR was used, the travel cost used was the total cost of driving, mentioned above. For the equations which had VRI as the dependent variable, the travel cost was divided by the number of people in the party, reflecting each person's share of the total travel cost. In each case, the average travel cost for each zone was then computed as the mean of the travel costs for all observations in that subzone.

The Income Variable

The hatchery visitors were asked to give their before-tax family incomes as falling within one of eight categories, the lowest being "under $2,500" and the highest "$25,000 or more". For analysis, though, a point estimate of family income is needed. For each of the closed intervals between the highest and lowest categories, the midpoint of the interval was chosen as the point estimate, with the implicit assumption of an approximately uniform scattering of incomes within the interval. For the highest and lowest categories, obviously such a method is either impossible (at the upper end) or unreasonable (at the lower end one would not expect a uniform distribution of incomes between $0 and $2,500). Since the income categories on the questionnaire do not coincide with those of published data for which the midpoints are known (Current Population Reports), a rough interpolation was done. Essentially, it was a weighted average of the midpoints of categories which were known (see Appendix Tables 4, 5, and 7).

The subzone average income was then computed as a weighted average of the incomes of each party in the subzone. The weighting factors were the amount of the subzone population each party represented. This differs from a simple average of the observations only when a subzone is comprised of parties from more than one income class, since groups with identical incomes from a given distance zone represent the same amount of population. Symbolically,

$$INC_s = \frac{\sum_i (INC_{is} \times POP_{is})}{POP_s}$$

where

INC_s is the average family income of families in subzone s;

INC_{is} and POP_{is} are the family income of, and population represented by, the i^{th} party from subzone s; and

POP_s is the total population represented by subzone s.

<u>Travel Time Variable</u>

Although one-way travel time was asked of respondents to the questionnaire, it was felt that this variable was more subject to measurement error than the other explanatory variables. Presumably, a visit to the hatchery is the result of a decision based upon the expected costs and benefits of the visit. It seems reasonable that motorists tend to use distance rather than time as a basis for making cost calculations, so one would expect fairly accurate estimates of distance traveled. Also, the time required to travel to an uncommon destination is probably not as familiar to most motorists as would be travel to a customary destination, such as work.

Since measurement error in the explanatory variable(s) will result in biased and inconsistent parameter estimates (Johnston, pp. 281-282), it is desirable to eliminate or reduce measurement error where it is thought to exist. For this reason, a proxy variable was substituted for the stated time of travel. It consisted of a measured distance from the population-weighted center of each county, by main roads, to the hatchery, divided by 55 miles per hour, the legal speed limit. Although it might be argued that this procedure induces an excessive uniformity to the travel time variable, this, in fact, may not be unreasonable or unrealistic. With today's freeways and highways and volume of traffic, speed of travel tends to be fairly constant at or near the legal speed limit, so time spent traveling is also nearly constant for a given distance. While this procedure undoubtedly does not wholly eliminate the measurement error problem, it should reduce it. In fact, the stated travel time from the questionnaires varied unreasonably from party to party who were from the same origin. Also, use of stated travel time consistently gave "wrong" signs for the explanatory variables. For values of the travel time variable used, see Appendix Tables 8 and 9.

For main-reason visitors to the hatcheries, only recreationists who had come from points within Washington and Oregon were considered. Theoretically, one would not anticipate recreationists to come from great distances and to overcome large costs for the sole purpose of visiting a Columbia River fish hatchery. In fact, in looking at those visitors who had marked an out-of-state residence separately, the mean distance traveled was about the same (48.5 miles) as the distance from the Portland metropolitan area to Bonneville Hatchery, with a maximum distance traveled of 140 miles.

Even if, as it appears, those groups who marked out-of-state residences were visiting in Oregon or Washington when they visited a fish hatchery, the travel cost approach does not adequately handle these recreationists, since their demand needs to be attributed to a base population. It is not realistic to use either the home region's population, because of theoretical considerations, or the population of the distance zone being visited since the recreation group is not legitimately counted as part of that population. Some justification for not treating these groups is that they comprise a minor (less than 6 percent) portion of the total observed visitation.

In conclusion, it should be noted that legitimate criticisms of the travel time variable used in this study can be raised. For one thing, the travel time variable is highly correlated with the travel cost variable (although this would also be true if both variables were measured without error). More serious is the error of measurement in the travel time variable, as used.

Recreational/Educational Demand Estimates

Bonneville Hatchery - 1974

Using data from 920 recreation parties, grouped into 105 subzones, the following function was estimated for main-reason visitors to Bonneville Hatchery in 1974 by OLS, using the group specification of visitation rate and travel cost:

$$\widehat{\ln VR_s} = \underset{(4.59)}{1.78634} - \underset{(-9.39)}{0.50144}TT_s - \underset{(-3.76)}{0.09793}TC_s - \underset{(-2.41)}{2.43152 \times 10^{-9}}INC_s^2 \quad (3)$$

$$+ \underset{(2.18)}{6.57687 \times 10^{-5}}INC_s$$

$$R^2 = 0.236 \qquad D\text{-}W = 0.91408 \qquad n = 105,$$

where

$\ln VR_s$ is the natural logarithm of the average group visitation rate for subzone s;

TT_s is the proxy variable for round trip travel time to the site from subzone s;

TC_s is the average group travel cost (round trip) to the site from subzone s; and

INC_s is the average family income for subzone s.

Student's t-values are in parentheses below regression coefficients.

Although all variables are significant at the 5 percent level (two-tailed test), there is a significant problem with autocorrelation of the residuals, shown by the low value of the Durbin-Watson (D-W) statistic (values near 2.0 indicate freedom from autocorrelation).

Using Durbin's method to correct for autocorrelation (Durbin 1960), the following equation was estimated:

$$\widehat{\ln VR_s} = \underset{(5.69)}{2.11652} - \underset{(-7.08)}{0.41379}TT_s - \underset{(-6.94)}{0.13839}TC_s - \underset{(-2.13)}{2.2563 \times 10^{-9}}INC_s^2 \quad (4)$$

$$+ \underset{(1.95)}{6.8513 \times 10^{-5}}INC_s$$

$$\hat{\rho} = 0.55021 \qquad R^2 = 0.137 \qquad D\text{-}W = 1.6572.$$

The variables are all still significant at the 5 percent or better level, except INC_s, which is significant at the 6 percent level. In fact, travel cost gained a great deal in significance, and the constant term gained slightly, while the other t-values dropped. The D-W statistic indicates freedom from autocorrelation at the 1 percent level. While the R^2 is low, and appeared to drop as a result of correcting the autocorrelation, a more meaningful statistic is the estimated regression variance, $\hat{\sigma}_u^2$, since it measures the dispersion of the residuals about the regression line. This indicator dropped from 0.3681 to 0.2357 as a result of correcting autocorrelation, indicating greater precision of the regression as measured by the regression variance, σ_u^2.

Using the individual specification of visitation rate and travel cost, the resultant equation was:

$$\widehat{\ln VRI_s} = \underset{(6.48)}{2.75784} - \underset{(-7.64)}{0.42682TT_s} - \underset{(-3.07)}{0.27586TCI_s} - \underset{(-2.03)}{2.15676 \times 10^{-9}INC_s^2} \quad (5)$$
$$+ \underset{(1.84)}{5.94081INC_s}$$
$$R^2 = 0.311 \qquad D\text{-}W = 1.30127 \qquad n = 105,$$

where ln VRI and TCI are the individual specifications of visitation rate and travel cost, respectively, and other variables are as previously defined.

Autocorrelation is still evident in (5), although it is not as serious as in (3). Once again using Durbin's method, the resultant corrected equation is:

$$\widehat{\ln VRI_s} = \underset{(7.23)}{3.15143} - \underset{(-5.76)}{0.37064TT_s} - \underset{(-5.00)}{0.40092TCI_s} - \underset{(-1.65)}{1.9938 \times 10^{-9}INC_s^2} \quad (6)$$
$$+ \underset{(1.41)}{5.3610 \times 10^{-5}INC_s}$$
$$\hat{\rho} = 0.37825 \qquad R^2 = 0.222 \qquad D\text{-}W = 1.944175.$$

The corrected equation (6) has a slightly higher R^2 than equation (4), as well as a better D-W statistic, but the t-values in (4) appear to be larger overall, especially those for income and income squared. Both equations yield substantially the same parameter estimates (with the possible exception of travel cost and the constant term), since the estimates for the individual versus the group specification coefficients are within one standard error of each other. (The estimated coefficient of TC is approximately 3 times smaller than that of TCI, which is to be expected if they are estimates of the same β since, on the average, TC is about 4 times as large as TCI.)

The same variables were also fitted in a linear functional specification, and the fit was fairly good. For the VR and TC group variables, the results were:

$$\widehat{VR}_s = \underset{(6.30)}{1.72967} - \underset{(-4.61)}{0.17801TT_s} - \underset{(-2.89)}{0.05312TC_s} - \underset{(-2.95)}{2.10440 \times 10^{-9}INC_s^2} \tag{7}$$

$$+ \underset{(2.92)}{6.21409 \times 10^{-5}INC_s}$$

$R^2 = 0.331$ D-W = 0.56987 n = 105

and, correcting (7) for autocorrelation,

$$\widehat{VR}_s = \underset{(6.17)}{1.44789} - \underset{(-2.98)}{0.10401TT_s} - \underset{(-3.12)}{0.03387TC_s} - \underset{(-1.97)}{1.2422 \times 10^{-9}INC_s^2} \tag{8}$$

$$+ \underset{(1.76)}{3.8067 \times 10^{-5}INC_s}$$

$\hat{\rho} = 0.73900$ $R^2 = 0.337$ D-W = 1.903123.

The results for VRI and TCI in a linear functional form were:

$$\widehat{VRI}_s = \underset{(4.94)}{5.85862} - \underset{(-4.80)}{0.74735TT_s} - \underset{(-2.12)}{0.53046TCI_s} - \underset{(-3.04)}{9.02472 \times 10^{-9}INC_s^2} \tag{9}$$

$$+ \underset{(3.16)}{2.84632 \times 10^{-4}INC_s}$$

$R^2 = 0.331$ D-W = 0.58155 n = 105

and, correcting for autocorrelation,

$$\widehat{VRI}_s = 6.19709 - 0.44994TT_s - 0.65217TCI_s - 6.6167 \times 10^{-9}INC_s^2 \qquad (10)$$
$$(6.15) \quad (-3.07) \quad (-4.44) \quad (-2.52)$$

$$+ 2.1101 \times 10^{-4}INC_s$$
$$(2.32)$$

$$\hat{\rho} = 0.71769 \qquad R^2 = 0.339 \qquad D\text{-}W = 1.856758.$$

The linear functional forms of (10) and (8) emphasize the similarity of the group specification (VR, TC) of the model, compared to the individual (VRI, TCI) specification. First, all the coefficients in (10) are 4.3 to 5.5 times larger than those in (8) (with the exception of travel cost), which is to be expected since the mean of VRI is 4.2 times larger than that of VR. The coefficient of TCI is 19.25($\doteq 4.31^2$) times that of TC, since TCI is also deflated by number of people per group. Such a pattern is not so evident with the exponential specification, because $\overline{\ln VRI} = 1.2220$ and $\overline{\ln VR} = -0.2417$; one is clearly not some obvious multiple of the other, because the natural logs were taken. In every case, after correcting for autocorrelation, the t-value of travel cost increased, while the t's for the other β's declined, as expected. In addition, in every case the residual mean square was lower in the corrected equations, giving more accurate predictions as measured by σ_u^2. The larger $\hat{\rho}$ was, the greater the increase in precision achieved by correcting for the autocorrelation.

Given the much better goodness of fit to the Bonneville data, the linear demand functions are preferred over the exponential functions. Also, the equations corrected for autocorrelation should provide more accurate estimates. However, there is little basis for choosing between the group versus individual model specification, since Equations (8) and (10) give very similar results.

Spring Creek Hatchery - 1975

Using 148 observations, grouped into 30 subzones, the following exponential function was estimated by OLS for the individual specification of the travel cost model:

$$\widehat{\ln VRI_s} = 1.8773 + 4.1613 \times 10^{-5}INC_s - 0.52455TT_s - 0.14193TCI_s \qquad (11)$$
$$(4.02) \quad (1.64) \quad (-5.06) \quad (-3.01)$$

$$R^2 = 0.245 \qquad D\text{-}W = 0.88233 \qquad n = 30.$$

Correcting once again for autocorrelation:

$$\widehat{\ln VRI_s} = 1.52453 + 4.0992 \times 10^{-5} INC_s - 0.48015 TT_s - 0.11199 TCI_s \qquad (12)$$

$$(3.13) \qquad (2.08) \qquad\qquad (-6.18) \qquad (-2.61)$$

$$\hat{\rho} = 0.51212 \qquad R^2 = 0.203 \qquad D\text{-}W = 1.62989.$$

In contrast, the same functional form was fitted to the group specification of the model, with the following results:

$$\widehat{\ln VR_s} = 6.0118 \times 10^{-5} INC_s - 0.39663 TT_s - 0.05909 TC_s \qquad (13)$$

$$(3.15) \qquad\qquad (-3.41) \qquad (-3.23)$$

$$R^2 = 0.284 \qquad D\text{-}W = 0.99035 \qquad n = 30.$$

The variable INC_s^2 did not have any significant effect in either model, and was therefore eliminated. Interestingly, the constant term was significant for the individual specification, but not for the group specification. Also, $e^{\hat{\alpha}} \doteq 4.59$ ($\hat{\alpha} = 1.52453$), which is only slightly greater than the ratio of $\overline{VRI}$ to $\overline{VR}$ ($\overline{VRI} : \overline{VR} = 6.07 : 1.51 = 4.02$). If VRI were a constant multiple (k) of VR throughout the sample, then the estimated equation for ln VRI would have an additional term equal to ln k. After correcting Equation (13) for autocorrelation:

$$\widehat{\ln VR_s} = 3.8931 \times 10^{-5} INC_s - 0.33256 TT_s - 0.025356 TC_s \qquad (14)$$

$$(2.18) \qquad\qquad (-4.54) \qquad (-2.51)$$

$$\hat{\rho} = 0.93448 \qquad R^2 = 0.209 \qquad D\text{-}W = 1.81660.$$

The linear forms of the model specifications did not fit the data very well, either because there were fewer data points or because of the restrictiveness of linearity on the relationship between travel cost and visitation rate.

Care must be taken with the interpretation of "goodness of fit," as measured by R^2, when transformations of the dependent variable are involved in the estimation. The R^2 values listed have been adjusted for the transformation(s) done on the dependent variable; a detailed discussion is given in Larson (1978).

ESTIMATES OF RECREATIONAL/EDUCATIONAL DEMAND FOR INCIDENTAL VISITORS

Methodology for Measuring Demand

Since these recreationists have stated that their visit to the hatchery is incidental, the travel cost method of identifying a base population which each visitor represents is not really applicable. A particular visit is no longer a function of origin of travel but, rather, is dependent upon the recreationist's decision at some point in his travels to visit the hatchery. If we could pinpoint this point, we could measure its distance from the hatchery and use the travel cost methodology, but obvious difficulties preclude this. Hence, we must obtain by some other means the visitor's willingness to pay.

One method might be to ask the recreationist directly what he would be willing to pay to visit the hatchery. A disadvantage of this method is that biases could be incurred in either direction, depending upon the visitor's interpretation of the question.[4/] However, if we were able to chart in a cumulative frequency table the number of visitors who would be willing to pay various admission charges, we would have the points with which to plot the site demand curve and determine value. Based upon stated willingness to pay, it seems reasonable to infer a benefit per visitor-day for those recreationists interviewed.

On the questionnaire distributed to visitors at Columbia River hatcheries, Question No. 8 asked the respondent what he would have been willing to pay had there been an admission charge, stressing that the answer would be used only for purposes of analysis. If we can accept the idea that the respondents fully understood the intent of the question, and no bias was incurred (that is, their actual reactions to admission charges would be exactly what they stated), then we have the elements of the site demand curve.

The responses to the question, "If there had been a charge for visiting this hatchery, how much would you have been willing to pay per person?" were put into a cumulative frequency distribution. This gave nine price-number of visitors combinations which formed the demand schedule for the recreational experience at

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4/ An empirical examination of this point is given in Meyer (1975).

the site. Only the responses of the individuals filling out the questionnaire were used; i.e., no inferences were made about the willingness to pay of the other members of the recreation group. These points were regressed to determine the functional form of the demand schedule. Thus, by using this so-called "direct method", the site demand curve is obtained in one step, as contrasted with the estimation of a visitation rate curve and subsequent transformation to a site demand curve employed by the indirect travel cost method. The advantage of the travel cost method, of course, is freedom from the weak (and necessary) assumption that responses to a hypothetical question reflect actual behavior patterns. Nevertheless, the assumption may not be so unreasonable if the respondent could be made fully aware of the question - primarily, that it would not affect existing price schemes or ownership. (Appendix Table 10 lists the cumulative frequencies of visitors to each hatchery, given their stated willingnesses to pay various hypothetical per-person admission charges.)

Recreational/Educational Demand Estimates

Bonneville Hatchery - 1974 and 1975

The incidental visitors to Bonneville Hatchery were combined into one model covering both years. This was done because differences in quality between the two years should have had minimum impact on incidental visitors. For the 825 incidental visitors during the two years, the following site-demand curve was estimated from the nine cumulative price-number of visitors points:

$$\widehat{\ln NV_i} = \underset{(58.91)}{6.9422503} - \underset{(-23.70)}{2.1628000} ADM_i \qquad (15)$$

$$R^2 = 0.988 \qquad D\text{-}W = 1.96654 \qquad n = 9,$$

where $\ln NV_i$ is the natural logarithm of number of visitors, and ADM_i is the admission price hypothetically charged. Student's t-values are given in parentheses below the regression parameters.

Spring Creek Hatchery - 1975

For 387 incidental visitors to Spring Creek in 1975, the following site-demand curve was estimated:

$$\widehat{\ln NV_i} = 5.9140053 - 1.5578ADM_i \quad (16)$$
$$(46.52) \qquad (-15.82)$$

$$R^2 = 0.972 \qquad D\text{-}W = 2.33490 \qquad n = 9,$$

where the variables are defined as above.

Kalama Falls Hatchery - 1974 and 1975

Data were insufficient to estimate a demand function for main-reason visitors to the hatchery; however, there were 58 incidental visitors for whom a direct-question site demand curve could be estimated. For these visitors, the best estimate of site demand was:

$$\widehat{\ln NV_i} = 3.9338362 - 1.2773576ADM_i \quad (17)$$
$$(20.46) \qquad (-8.58)$$

$$R^2 = 0.913 \qquad D\text{-}W = 2.59487 \qquad n = 9,$$

where the variables are as previously defined.

A Comparison: Main-Reason Visitors to Bonneville Hatchery Estimated with the Direct Question Technique

Due to the potential uncertainty which could be introduced into the parameter estimates by the direct questioning method, it was thought advisable to provide a rough check of the method by estimating the site demand and resultant value for the main-reason visitors to Bonneville, for whom a travel cost type of demand curve had already been estimated. There would be no reason to expect comparability of the demand and value estimates between the main-reason visitors and the incidental visitors; however, the logic was that if the predicted values for the main-reason visitors, using the direct method, were inordinately high, then perhaps the direct method was overstating the demand and value for all incidental visitors. If, on the other hand, the predicted values by the direct method for main-reason visitors were low, a justification could be made for keeping the incidental values as high as they are.

For the 910 main-reason visitors who indicated a willingness to pay an admission charge, the following site-demand curve was estimated:

$$\widehat{\ln NV_i} = 6.3442594 - 2.4730627ADM_i \quad (18)$$
$$(11.85) \qquad (-5.96)$$

$$R^2 = 0.836 \qquad D\text{-}W = 2.05802 \qquad n = 9,$$

where the variables are as previously defined.

ESTIMATED NET BENEFITS RECEIVED BY VISITORS TO COLUMBIA RIVER FISH HATCHERIES

Main-Reason Visitors

The Site Demand Curve

Once we have estimated the participation rate equation by the travel cost method, which gives the demand schedule that hatchery visitors are observed to follow, it is necessary to transform the dependent variable to be able to estimate the number of visitors expected from each subzone, given the particular characteristics (income, average travel cost, and travel time) of that subzone. Multiplying the predicted visitation rate for each subzone by its population accomplishes this. At this point, the previously mentioned assumption that recreationists visiting the hatchery react to a change in admission price in the same manner as they would to an equal change in travel cost is utilized. Holding all other exogenous variables constant, values of the travel cost variable are increased, to represent a hypothetical admission charge, and the predicted number of visitors to the hatchery given that hypothetical admission charge is calculated from the transformed visitation rate equation. By repeating this process for a number of different travel cost values, the demand curve for the recreation site (in this case, the hatchery) is generated. The negative sign on the coefficient of travel cost implies that, as the hypothetical admission charge increases, eventually the number of people predicted to visit will be (or approach) zero for each subzone. The site demand curve for the linear functional form, with the four variables used in this analysis, can be shown, in general, to be:[5/]

$$NV_i = NV_o + (\hat{\beta}_1 \sum_s POP_s)\ ADM_i, \quad (19)$$

[5/] The derivations of these site demand curves are given in Larson (1978).

where

ADM_i is the i^{th} hypothetical admission charge;

NV_i is the predicted number of visitors to the hatchery at that admission;

NV_o is the predicted number of visitors at zero admission price (existing average travel cost for each zone);

$\hat{\beta}_1$ is the estimated coefficient for travel cost; and

$\sum_s POP_s$ is the total number of people in all travel zones.

The form of the site demand curve corresponding to the exponential specification is:

$$\widehat{NV_i} = \widehat{NV_o} \cdot e^{\hat{\beta}_1 \, ADM_i} , \qquad (20)$$

where all variables are defined as above.

Consumer Surplus

The concept of consumer surplus is frequently used as a measure of the net economic benefits to consumers (in this case, hatchery visitors). Briefly put, it approximates the savings consumers realize by not having to pay higher prices for diminishing quantities of a commodity (hatchery, recreation/education) which, according to their demand curve, they would be willing to do. Graphically, it is represented by the area bounded by the demand curve, the price line, and the y-axis; in our case, the relevant curve is the site demand curve and, since admission is not currently charged for entrance, the whole area under the site demand curve represents consumer surplus.[6/]

The consumer surplus calculation can be reduced to the following formula for the exponential case:[7/]

6/ The concept of surplus and its interpretation have occupied a controversial place in economic theory (a detailed discussion is given in Currie, Murphy, and Schmitz, 1971). Although it is useful as a potential tool, it does have limitations, including the fact that it assumes no interdependence among consumption goods, aggregates over consumers (so it gives no information about income distribution), and ignores the income effects of a price increase. Nonetheless, it is a frequently used concept in the literature as a measure of net benefits and, subject to caution because of the above limitations, it shall be used here.

7/ Again, details are given in Larson (1978).

$$\text{Consumer Surplus} = \widehat{NV}_o / -\hat{\beta}_1, \tag{21}$$

and the formula for the linear case is:

$$\text{Consumer Surplus} = \widehat{NV}_o^2 / 2.0\ (-\hat{\beta}_1)(\sum POP_s). \tag{22}$$

The variables in Equations (21) and (22) are as previously defined.

Incidental Visitors

As was mentioned earlier, the "direct" questioning method allows one to estimate in one step the site demand curve by using responses to the question ". . . how much would you have been willing to pay?" Since there is no admission charge for any of the hatcheries being discussed, the whole area under the site demand curve represents consumer surplus and net benefits to the hatchery visitors.

Equations (15) through (17) represent the site demand curves of incidental visitors to each hatchery (Bonneville, Spring Creek, and Kalama Falls), and equation (18) denotes the site demand curve derived for Bonneville main-reason visitors by the direct method. These four equations were integrated from 0 to ∞ to determine the consumer surplus, or net benefits, to consumers. For Equations (15) through (18), each of which were of the form

$$\widehat{NV}_i = e^{\hat{\alpha} + \hat{\beta}_1 ADM_i},$$

the consumer surplus calculation conveniently reduced to

$$\text{Consumer Surplus (exponential)} = \widehat{NV}_o / -\beta_1.$$

Extrapolating a Value to Society of Hatchery Visitor Benefits

The recreationists whose information was used in the analysis represent a small fraction of the total visitation of Columbia River hatcheries. While it is useful to know what the average benefit per visitor day is, since public funds are used to construct and maintain the hatchery facilities, it is also helpful to know what the total value to society is of such expenditures. A rough idea of what this total value is can be estimated by simply extrapolating the sample benefits to the entire population of hatchery visitors. This involves, of course, the necessary assumption that the sample was representative of the population.

For Bonneville Hatchery in 1974, there was a total of approximately 303,000 visitors, from whom 1,472 questionnaires were obtained. Of these questionnaires, 1,025, or 69.63 percent, were filled out by main-reason parties. From this, we can calculate that approximately .6963 (303,000) $\doteq$ 211,000 visitors were main-reason, and 303,000 - 211,000 $\doteq$ 92,000 were incidental. The 919 questionnaires which were complete enough to use in the regression estimates represented 3,770 people; thus, we can calculate an "extrapolation factor" of 211,000 ÷ 3,770 = 56.0272. The value obtained by consumer surplus for the sample, multiplied by this factor, approximates the total benefits received by all main-reason visitors to Bonneville Hatchery in 1974.

Of the 311,000 visitors to Bonneville in 1975, only 155 ÷ 571 = 27.15 percent of the visitors were main-reason visitors. The remaining 72.85 percent, or about 227,000 visitors, were incidental visitors.[8/] For the two years 1974 and 1975, there were a total of 92,000 + 227,000 $\doteq$ 319,000 incidental visitors. Our sample of incidental visitors consisted of 825 responses. Thus, the calculated extrapolation factor for the incidental visitors was 319,000 ÷ 825 $\doteq$ 386.667.

For Spring Creek Hatchery, the main-reason visitors comprised 194 ÷ 607 $\doteq$ 31.96 percent of the 13,302 total visitors, or 4,251 visitors. The sample information from the 148 questionnaires used in the regression estimates represented 518 visitors, so the extrapolation factor would be 4,251 ÷ 518 $\doteq$ 8.2066. There were 387 usable incidental visit questionnaires responses, which gives an extrapolation factor of (13,302 - 4,251) ÷ 387 $\doteq$ 23.388.

For Kalama Falls Hatchery, 64 out of 96 questionnaires collected were from incidental visitors; the total number of incidental visitors was approximately 0.667 (9,281) $\doteq$ 6,190. The number of usable questionnaires was 58; the extrapolation factor for Kalama Falls incidental visitors was then 6,190 ÷ 58 $\doteq$ 106.724.

8/ This reversal of the main reason-incidental visitor ratio was attributed to the construction activity at the dam during this period, which made conditions inconvenient for many visitors. It was dusty in the summer and muddy in the winter, and visitors had a long walk to the hatchery from the temporary parking lots. Apparently many people who visited in 1974 did not return in 1975 because of these factors. Since the total number of visitors was the same in both years, presumably had there been no construction, the visitation in 1975 would have been much heavier.

(Appendix Table 11 presents visitor counts at the hatcheries by month and year, and the total number of questionnaires collected.)

Computed Net Benefits

Bonneville - Main-Reason

For Bonneville Hatchery in 1974, the linear group specification yielded total benefits of $251,067 for the 211,000 total main-reason visitors, or approximately $1.19 per visit. By contrast, the linear individual specification resulted in total benefits of $264,247 for the same number of visitors, or $1.25 per visit.

The curvilinear (exponential) specifications, both group and individual, resulted in larger benefits to main-reason visitors. The total benefits, using the group specification, were $371,152, while those for the individual specification were $576,725. That works out to $1.76 and $2.73 per visitor, respectively. It is likely that the higher estimates of consumer surplus, or net benefits, yielded by the exponential functions are due, at least in part, to the fact that they approach the vertical axis asymptotically, whereas the linear functions intersect the axis at finite values. There is considerable area in the upper tails of the exponential functions which the linear forms do not have.[9/] It is perhaps more reasonable to assume that there is some finite admission charge which will deter visitation - especially so since, with the large number of visitors, when the sample is extrapolated to the population of visitors the exponential curves predict that some visitors would be willing to pay extremely high admission charges. Also, in light of the better fit of the linear forms, it would seem that the value estimates for Bonneville Hatchery are more closely approximated by the linear functions.

Spring Creek - Main-Reason

The estimated net economic benefits per visitor for Spring Creek were much higher than those for Bonneville. Why this is so is not exactly clear, but it seems likely that the population distribution of subzones around the hatchery, as well as the relative frequencies of visitation from those subzones, was a

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9/ The reader interested in more detail can consult Larson (1978) for graphs showing the relationship between the linear and exponential function forms, as well as between the group and individual specifications.

major contributing factor. Bonneville Hatchery draws primarily from the Portland metropolitan area, which is the nearest major source of visitors; Spring Creek Hatchery also draws heavily from the Portland area, but also has extensive visitation from local communities in Hood River, Skamania, Wasco, and Klickitat Counties. The exponential demand functions estimated for Spring Creek had smaller coefficients for travel cost than did their counterparts for Bonneville, indicating a steeper curve between travel cost and visitation (hence, a steeper curve between admission and number of visits). This, combined with the heavy local visitation, would seem to have the effect of shifting out the demand curves for the site, relative to those for Bonneville (especially at the upper end); this, in turn, would tend to give very high estimates of value with the exponential forms, for reasons mentioned earlier. A glance at Equations (20) and (21), which give the calculation of consumer surplus, indicates why size of the travel cost coefficient is important; the smaller it is, *ceteris paribus*, the larger the calculated net benefits.

The exponential individual specification yielded total benefits of $47,856, with a total of 4,251 main-reason visitors, for an average of $11.26 per visitor. The exponential group specification yielded total benefits of $48,544, or $11.42 per visitor, which may be unreasonably high.

Another possible contributor to the unusually large value estimates for Spring Creek might have been sample size - the regressions for Spring Creek had 30 observations, as opposed to 105 for Bonneville. However, approximately one-eighth of the total population of visitors was sampled at Spring Creek, compared to less than one-fiftieth at Bonneville.

Bonneville - Incidental Visitors

The total net benefits computed for the 319,000 incidental visitors to Bonneville Hatchery in 1974 and 1975 were $185,213, or $0.58 per visitor.

Spring Creek - Incidental Visitors

For incidental visitors to Spring Creek in 1974, the estimated net benefits were $5,557 for 9,051 visitors; this represents an average of $0.61 per visitor.

Kalama Falls - Incidental Visitors

Total net benefits calculated for 6,190 incidental visitors at Kalama Falls Hatchery in 1974 were $4,270, or approximately $0.69 per visitor.

Net Benefits to Bonneville Main-Reason Visitors, Computed with the Direct Question Technique

The site demand curve for main-reason visitors to Bonneville Hatchery, which was estimated by the direct question technique as a comparison to the travel cost method, yielded net benefits of $230 to the 910 questionnaires (or $0.25 per visitor) which had a response to Question 8 (Appendix Table 1). Thus, for main-reason visitors to Bonneville, the direct question technique estimated lower net benefits than obtained by the travel cost method. If the direct question technique had seriously overestimated net benefits compared to the travel cost method, there would be cause to think that benefits to incidental visitors to other hatcheries were overstated. However, since it appears that the direct question technique underestimated the net benefits as calculated by the travel cost method, it seems quite plausible to infer that the net benefits to incidental visitors are at least as high as stated previously.

SUMMARY AND CONCLUSIONS

Statistical demand functions were fitted which related the number of visits to specified Columbia River fish hatcheries to distance, cost of travel, and family income. From these demand functions, net economic values to hatchery visitors can be inferred.

Based upon results from the linear regression equations which best fitted the data for Bonneville Hatchery, net economic benefits ranged from $1.19 to $1.25 per visit for main-reason visitors in 1974; the total net benefits for the 211,000 visitors were estimated to have ranged from $251,000 to $264,000. In addition, total net economic benefits for the 319,000 incidental visitors in 1974 and 1975 were estimated to have been $185,000, or $0.58 per visitor. Thus, using these estimates of value, benefits in 1974 for Bonneville Hatchery would have been $1.19 x 211,000 ≐ $251,000 for main-reason visitors plus $0.58 x 92,000 ≐ $53,000, giving a total 1974 benefit of about $304,000. The annual cost of providing labor and facilities for handling visitors were estimated to be less than $7,000 in 1974. Therefore, an attractive benefit-cost ratio of $304,000/$7,000 ≐ 43 would be indicated for accommodating visitors at Bonneville Hatchery in 1974.

Because of a number of potential factors, including a different geographic distribution of population and visitation, benefits predicted for the main-reason visitors to Spring Creek Hatchery totalled roughly $48,000 for 4,251 visitors, or approximately $11.30 per visit. These considerably higher estimates should be viewed as much less reliable than those for Bonneville Hatchery, given the smaller sample size used. More research is warranted to further explore this facet of the problem. Incidental visitors to Spring Creek Hatchery were predicted to have received net benefits totalling $5,557 for the 9,051 visitors, or $0.61 per visit, a result similar to that obtained for incidental visitors to Bonneville.

The total net benefits for incidental visitors to Kalama Falls Hatchery in 1974 and 1975 were $4,270, or $0.69 to each of the 6,190 visitors in that two-year period.

Although more analysis certainly is desirable in this problem area, it seems reasonable to make some preliminary statements about net benefits that hatchery visitors receive. Although hatchery recreation is of a nature that the travel cost method seems best suited at present to the problem, certain difficulties, both in statistical estimation and methodology, do exist. The benefits estimated for Bonneville Hatchery seem to be the least uncertain, both because of the extensive data base and the degree of consistency with a priori expectations. The results derived for incidental visitors also appear at least reasonable; one would expect that their benefits might be somewhat less than those of main-reason visitors. The results for Spring Creek Hatchery, while not impossible, do appear to be less credible, and more work is needed to firmly establish the magnitude of net benefits. Spring Creek, being a relatively newer and more modern fish hatchery than Bonneville, may indeed have some qualitative advantages which give higher average values. Spring Creek is also less well known than is Bonneville Hatchery, and the way values may change with regard to increasing awareness of Spring Creek's facilities is unknown, as is the effect of substitutability between any of the Columbia River fish hatcheries, especially in light of increasing public knowledge.

In closing a word of caution. Each hatchery involved in this study, as well as the others involved in the Columbia River system (for which more work is needed) is unique in terms of quantity and quality of services and facilities, and in terms of the general public's awareness of their existence. Thus, there is scant basis for using the value per visit for one hatchery as an estimate of the value of recreation at another hatchery (an example is given by the different estimates obtained for main-reason visitors in this study). The values that were estimated here resulted from a static, or timeless, analysis, so even if they were accurately measured in 1974 and 1975, there could have been changes that occurred in the intervening time. In short, these values should be regarded as "rough estimates", and not as pinpoint-accurate and unchanging.

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Appendix Table 1. The Questionnaire Used in the Study

VISITORS' QUESTIONNAIRE

ONE QUESTIONNAIRE SHOULD BE COMPLETED BY EACH FAMILY (OR INDIVIDUAL) VISITING HATCHERY

(Please indicate the most appropriate answer to each question.)

Date

1. Where is your home? City ____ County ____ State ____

2. What is the head of family's occupation?

3. How many members of your family or group, including yourself, are visiting the hatchery today?

   Number ________

4. Indicate the number of your family members or group, including yourself, on this trip in each of the *following categories?*

	Number		*Number*
Under 10		40-49	
10-19		50-59	
20-29		60-69	
30-39		Over 70	

5. Was your visit to this hatchery the main reason for this trip?

   ☐ YES ☐ NO

   A. If YES, what was the TOTAL oneway mileage and time required?

   ________ MILES ________ HOURS

   B. If NO, what was the EXTRA oneway mileage and time required?

   ________ MILES ________ HOURS

6. How far, one way, would you be willing to travel to visit this hatchery?

   Check one

   0 miles ☐ 50 miles ☐
   10 miles ☐ 100 miles ☐
   20 miles ☐ 500 miles ☐

7. What was your mode of transportation?

   Check one

   Your car ☐ Bus ☐
   Business car ☐ Other ☐ ________ Specify
   Rental car ☐

8. If there had been a charge for visiting this hatchery, how much would you have been willing to pay per person? (NOTE: This is not intended to justify a future charge and is used only for analysis.)

   Check one

   0 ¢ ☐ 35 ¢ ☐ $1 ☐
   10 ¢ ☐ 50 ¢ ☐ $2 ☐
   25 ¢ ☐ 75 ¢ ☐ $3 ☐

9. How would you rate facilities and personnel?

	Excellent	Adequate	Poor	Needs improvement
A. Parking	☐	☐	☐	☐
B. Attractiveness of landscaping and design	☐	☐	☐	☐
C. Walkways, roads	☐	☐	☐	☐
D. Personnel	☐	☐	☐	☐
E. Other	☐	☐	☐	☐

10. What is your family income before taxes?

   Check one

   Under $2,500 ☐ $10,000 to $14,999 ☐
   $2,500 to $4,999 ☐ $15,000 to $19,999 ☐
   $5,000 to $7,499 ☐ $20,000 to $24,999 ☐
   $7,500 to $9,999 ☐ $25,000 or more ☐

11. Did you cross a toll bridge on the way to the hatchery?

   ☐ YES ☐ NO *Amount of toll* ________

12. Do you plan to cross a toll bridge on your way home?

   ☐ YES ☐ NO Amount of toll ________

13. Comments:

Appendix Table 2. Population of Oregon Counties (1970)

County	Population
Baker	14,919
Benton	53,776
Clackamas	166,088
Clatsop	28,473
Columbia	28,790
Coos	56,515
Crook	9,985
Curry	13,006
Deschutes	30,442
Douglas	71,743
Gilliam	2,342
Grant	6,996
Harney	7,215
Hood River	13,187
Jackson	94,533
Jefferson	8,548
Josephine	35,746
Klamath	50,021
Lake	6,343
Lane	215,401
Lincoln	25,755
Linn	71,914
Malheur	23,169
Marion	151,309
Morrow	4,465
Multnomah	554,668
Polk	35,349
Sherman	2,139
Tillamook	18,034
Umatilla	44,923
Union	19,377
Wallowa	6,247
Wasco	20,133
Washington	157,920
Wheeler	1,849
Yamhill	40,213
TOTAL	2,091,533

SOURCE: U.S. Bureau of the Census, County and City Data Book.

Appendix Table 3. Population of Washington Counties (1970)

County	Population
Adams	12,014
Asotin	13,799
Benton	67,540
Chelan	41,355
Clallam	34,770
Clark	128,454
Columbia	4,439
Cowlitz	68,616
Douglas	16,787
Ferry	3,655
Franklin	25,816
Garfield	2,911
Grant	41,881
Grays Harbor	59,553
Island	27,011
Jefferson	10,661
King	1,156,633
Kitsap	101,732
Kittitas	25,039
Klickitat	12,138
Lewis	45,467
Lincoln	9,572
Mason	20,918
Okanogan	25,867
Pacific	15,796
Pend Oreille	6,025
Pierce	411,027
San Juan	3,856
Skagit	52,381
Skamania	5,845
Snohomish	265,236
Spokane	287,487
Stevens	17,405
Thurston	76,894
Wahkiakum	3,592
Walla Walla	42,176
Whatcom	81,950
Whitman	37,900
Yakima	144,971
TOTAL	3,409,169

SOURCE: U.S. Bureau of the Census, County and City Data Book.

Appendix Table 4. Distribution of Population by Family Income Class: Oregon and Washington (1970 Levels)

Family income	Number of families	
	Oregon	Washington
Less than $1,000..............	10,788	15,950
$ 1,000 - 1,999.............	15,693	20,564
2,000 - 2,999.............	23,619	32,699
3,000 - 3,999.............	26,550	36,406
4,000 - 4,999.............	27,392	37,012
5,000 - 5,999.............	30,046	40,001
6,000 - 6,999.............	34,017	45,972
7,000 - 7,999.............	40,134	54,554
8,000 - 8,999.............	42,934	61,201
9,000 - 9,999.............	41,053	61,750
10,000 - 14,999.............	152,677	259,746
15,000 - 24,999.............	76,859	157,693
Over $25,000................	20,721	38,994
TOTALS...............	542,483	862,542

SOURCE: U.S. Bureau of the Census, Census of Population: 1970.

Appendix Table 5. Distribution of Oregon and Washington Population by Family Income Class Represented on the Questionnaire (Using Data in Appendix Table 4)

Family income class on questionnaire	Number of families		Percent
OREGON:			
Less than $2,500....	10,788 + 15,693 + 0.5(23,619)	= 38,290	7.06
$ 2,500 - $ 4,999......	0.5(23,619) + 26,550 + 27,392	= 65,752	12.12
5,000 - 7,499......	30,046 + 34,017 + 0.5(40,134)	= 84,130	15.51
7,500 - 9,999......	0.5(40,134) + 42,934 + 41,053	= 104,054	19.18
10,000 - 14,999......		= 152,677	28.14
15,000 - 19,999......	0.5(76,859)	= 38,429	7.08
20,000 - 24,999......	0.5(76,859)	= 38,430	7.08
Over $25,000..........		= 20,721	3.82
	TOTALS................	542,483	100.00
WASHINGTON:			
Less than $2,500....	15,950 + 20,564 + 0.5(32,699)	= 52,863	6.13
$ 2,500 - $ 4,999.......	0.5(32,699) + 36,406 + 37,012	= 89,768	10.41
5,000 - 7,499.......	40,001 + 45,972 + 0.5(54,554)	= 113,250	13.13
7,500 - 9,999.......	0.5(54,554) + 61,201 + 61,750	= 150,228	17.42
10,000 - 14,999.......		= 259,746	30.11
15,000 - 19,999.......	0.5(157,693)	= 78,846	9.14
20,000 - 24,999.......	0.5(157,693)	= 78,847	9.14
Over $25,000...........		= 38,994	4.52
	TOTALS.................	862,542	100.00

Appendix Table 6. Data Used in Computation of the Travel Cost Variable

VARIABLE COSTS OF DRIVING
Per mile (1970 level):

Gas and oil.............................. 2.76 cents/mile.
Maintenance.............................. 0.68 cents/mile.
Tires.................................... 0.51 cents/mile.
Total variable costs........ 3.95 cents/mile.

DEPRECIATION (1970 level)[a/]..................... 7.29 cents/mile.

Consumer price index b/	1970	1974	Change (1970-1974)	1975	Change (1970-1975)
Gasoline.......	105.6	159.9	1.514	170.8	1.617
All prices.....	116.3	147.7	1.270	161.2	1.386

PERSONAL CAR:

Travel Cost: (1974) = (3.95 ¢/mi.) 1.514 + (7.29 ¢/mi.) 1.270 = 15.24 ¢/mi.
(1975) = (3.95 ¢/mi.) 1.617 + (7.29 ¢/mi.) 1.386 = 16.49 ¢/mi.

RENTED CAR:

Travel Cost:[c/]

Company	Cents/mile	Gas charges per mile (see above)	Total
Avis..............	16	2.76	21¢/mile
Payless...........	15	2.76	18¢/mile
Hertz.............	21	(included in rental)	21¢/mile
		TOTAL......................	60¢/mile
		AVERAGE....................	20¢/mile

[a/] Variable costs and depreciation were taken from an Automobile Legal Association study reproduced in Changing Times (1970). Depreciation was found to be $729 per 10,000 miles driven and, for simplicity in this study, the rate of depreciation was assumed to be linear.

[b/] Statistical Abstract of the United States, 1976.

[c/] Quoted from phone calls to various rental car agencies in December 1976.

Appendix Table 7. U.S. Mean Family Income in 1974 - All Races, by Income Classes

Income class	Mean value	Number in class	Percent
Less than $1,000..........	$ -761	707,000	1.27
$ 1,000 - 1,499..........	1,252	766,000	1.38
1,500 - 1,999..........	1,744		
2,000 - 2,499..........	2,242	1,489,000	2.67
2,500 - 2,999..........	2,753		
3,000 - 3,499..........	3,229	2,040,000	3.66
3,500 - 3,999..........	3,742		
4,000 - 4,999..........	4,479	2,305,000	4.14
5,000 - 5,999..........	5,457	2,475,000	4.44
6,000 - 6,999..........	6,468	2,478,000	4.45
7,000 - 7,999..........	7,463	2,501,000	4.49
8,000 - 8,999..........	8,435	2,574,000	4.62
9,000 - 9,999..........	9,457	2,629,000	4.72
10,000 - 11,999..........	10,914	5,702,000	10.23
12,000 - 14,999..........	13,361	7,879,000	14.14
15,000 - 24,999..........	18,976	15,787,000	28.33
25,000 - 49,999..........	31,610	5,771,000	10.36
Over $50,000.............	67,998	614,000	1.10
	TOTALS.....................	$55,717,000	100.00

SOURCE: U.S. Bureau of the Census, Money Income in 1974 of Families and Persons in the United States.

Appendix Table 8. Values of the Travel Time Variable for Visitors to Bonneville Hatchery

County	Estimated miles to Bonneville Hatchery	TT
OREGON:		
Benton	125	2.27
Clackamas	55	1.00
Clatsop	135	2.46
Columbia	90	1.64
Coos	260	4.73
Crook	175	3.18
Curry	340	6.18
Deschutes	170	3.09
Douglas	225	4.09
Gilliam	115	2.09
Hood River	30	0.55
Jackson	330	6.00
Jefferson	125	2.27
Josephine	295	5.36
Lane	175	3.18
Lincoln	180	3.27
Linn	125	2.27
Marion	95	1.73
Multnomah	40	0.73
Polk	115	7.09
Sherman	85	1.56
Tillamook	115	2.09
Wasco	65	1.18
Washington	55	1.00
Wheeler	160	2.91
Yamhill	80	1.46
WASHINGTON:		
Benton	165	3.00
Clark	60	1.09
Cowlitz	95	1.73
King	220	4.00
Skamania	10	0.18

Appendix Table 9. Values of the Travel Time Variable for Visitors to Spring Creek Hatchery

County	Estimated miles to Spring Creek Hatchery	Estimated hours of travel time
OREGON:		
Clackamas	75	1.36
Coos	280	5.09
Harney	275	5.00
Hood River	4	0.07
Lane	195	3.54
Multnomah	60	1.09
Wasco	35	0.64
Washington	75	1.36
WASHINGTON:		
Benton	145	2.64
Clark	80	1.45
Cowlitz	115	2.09
King	240	4.36
Klickitat	45	0.82
Pend Oreille	325	5.91
Skamania	30	0.55
Stevens	325	5.91
Yakima	110	2.00

Appendix Table 10. Willingness to Pay Expressed by Incidental Visitors to Spring Creek, Bonneville, and Kalama Falls Hatcheries - Cumulative Frequencies (Main-Reason Visitors to Bonneville are Included for Comparison)

Price per person	Spring Creek	Bonneville	Kalama Falls	Bonneville (main-reason)
$0.00	387	825	58	910
0.10	308	781	54	861
0.25	298	759	52	825
0.35	229	536	32	363
0.50	213	472	31	191
0.75	90	174	13	27
1.00	70	120	11	5
2.00	10	11	2	3
3.00	5	2	2	1

Appendix Table 11. Total Visitor Counts at Bonneville, Spring Creek, and Kalama Falls Hatcheries, by Month and Year

1974	Bonneville	Spring Creek	Kalama Falls	1975	Bonneville	Spring Creek	Kalama Falls
Jan.	1,194	—	53	Jan.	12,391	172	80
Feb.	14,490	—	95	Feb.	8,798	191	143
Mar.	18,102	—	112	Mar.	17,596	382	170
Apr.	23,236	—	111	Apr.	18,656	649	168
May	30,479	—	194	May	24,664	754	244
June	39,070	—	654	June	33,502	1,266	991
July	52,478	—	562	July	54,100	1,590	852
Aug.	44,292	—	454	Aug.	54,266	2,304	749
Sept.	29,784	—	656	Sept.	45,755	4,967	1,074
Oct.	31,532	—	686	Oct.	19,144	471	639
Nov.	11,501	—	148	Nov.	15,193	248	70
Dec.	7,120	—	166	Dec.	6,462	305	160
TOTAL VISITORS	303,278		3,891	TOTAL VISITORS	310,527	13,299	5,340
Questionnaires obtained	1,472	—	115	Questionnaires obtained	571	607	23

NOTE: Not all questionnaires were usable for purposes of analysis.

SOURCE: Columbia River Program Office, National Marine Fisheries Service, Portland, Oregon.

Appendix Table 12. Values of the Variables Used in the Models for Main Reason Visitors to Spring Creek Hatchery

County - Subzone	VR	VRI	TC	TCI	TT	INC	POP	N
CLACKAMAS...........	0.0497	0.6317	50.45	21.99	2.72	12,782	100,695	5
CLARK:								
1...............	0.2849	1.6830	25.87	6.47	2.90	26,673	17,547	5
2...............	0.4259	1.3628	17.64	6.50	2.90	17,500	11,741	5
3...............	0.1939	0.7756	12.32	4.50	2.90	12,500	25,785	6
4...............	0.1329	0.5290	19.35	7.35	2.90	7,299	37,633	6
HOOD RIVER:								
1...............	3.4795	13.2331	9.50	2.97	0.14	26,927	1,437	5
2...............	2.0678	6.1154	5.12	2.47	0.14	14,430	2,418	5
3...............	1.0513	2.9934	4.47	1.82	0.14	10,505	4,756	5
4...............	1.0929	1.9645	6.14	2.76	0.14	4,314	4,575	4
KLICKITAT:								
1...............	1.5959	6.5670	8.79	4.03	1.64	17,809	3,133	5
2...............	2.1891	8.7557	4.62	1.26	1.64	12,500	2,284	5
3...............	1.2005	2.1076	2.79	2.41	1.64	8,205	4,165	5
4...............	2.4900	7.0782	2.41	1.32	1.64	2,742	2,008	4
MULTNOMAH:								
1...............	0.4720	1.3215	23.81	8.41	2.18	35,112	10,594	5
2...............	0.4720	1.6990	21.37	6.64	2.18	35,112	10,594	5
3...............	0.0849	0.4482	22.29	5.70	2.18	20,833	58,906	5
4...............	0.0609	0.3682	23.70	8.44	2.18	13,696	82,069	5
5...............	0.0226	0.1081	21.40	7.32	2.18	10,092	221,543	6
6...............	0.0293	0.1315	21.90	7.64	2.18	4,071	170,907	6
ALL OTHER OREGON....	0.0205	0.0675	81.32	16.11	8.88	23,210	243,646	3
SKAMANIA:								
1...............	4.4683	18.7764	3.65	1.26	1.10	24,045	1,119	5
2...............	7.6453	38.6656	5.03	1.21	1.10	14,128	654	5
3...............	6.8213	34.0923	2.94	0.59	1.10	12,500	733	5
4...............	5.4000	17.5428	3.12	1.23	1.10	11,125	926	5
5...............	2.0721	8.1522	2.70	1.26	1.10	5,548	2,413	6
WASCO:								
1...............	0.7051	3.7911	9.14	3.82	1.28	13,505	7,091	5
2...............	0.6474	2.1416	10.11	3.73	1.28	5,750	7,723	4
WASHINGTON..........	0.0749	0.7660	27.58	6.17	2.72	15,010	66,800	4
ALL OTHER WASHINGTON STATE...............	0.0053	0.0103	12.64	4.62	10.92	14,252	937,725	3
Yakima-Benton.......	0.0258	0.1043	43.32	17.43	4.36	10,294	193,753	6

Appendix Table 13. Values of Variables Used in the Models for Main Reason Visitors to Bonneville Hatchery

County - Subzone	VR	VRI	TC	TCI	TT	INC	POP	N
CLARK:								
1..............	0.4465	1.8866	15.45	4.30	2.18	25,485	20,156	9
2..............	0.7567	3.6955	16.48	3.51	2.18	16,338	11,894	9
3..............	0.7239	3.1371	16.13	3.89	2.18	12,500	12,432	9
4..............	0.7239	2.9762	16.08	4.05	2.18	12,500	12,432	9
5..............	0.7673	4.2007	16.65	3.35	2.18	12,282	11,729	9
6..............	1.4746	5.5713	15.29	4.35	2.18	8,750	6,103	9
7..............	1.4746	5.2436	15.29	4.54	2.18	8,750	6,103	9
8..............	1.4746	5.7551	16.29	4.35	2.18	8,750	6,103	9
9..............	1.1831	4.7529	16.13	4.52	2.18	7,364	7,607	10
10..............	0.9487	3.5100	16.21	4.84	2.18	6,250	10,541	10
11..............	0.4282	1.7444	15.29	5.03	2.18	3,059	23,354	10
WASHINGTON:								
1..............	0.5011	2.6429	16.29	3.75	2.00	26,528	17,959	9
2..............	1.3416	6.5589	16.65	3.73	2.00	17,500	6,708	9
3..............	0.7622	4.7718	15.80	3.29	2.00	14,078	11,807	9
4..............	0.4950	2.0353	15.80	3.94	2.00	12,500	18,179	9
5..............	0.4950	1.8702	15.45	4.27	2.00	12,500	18,179	9
6..............	1.0564	3.8738	18.69	6.61	2.00	8,750	8,519	9
7..............	1.0564	4.4607	16.81	4.30	2.00	8,750	8,519	9
8..............	1.0564	4.4607	16.48	3.92	2.00	8,750	8,519	9
9..............	1.2636	5.3236	16.81	4.38	2.00	7,911	7,122	9
10..............	1.6737	6.3237	16.29	4.87	2.00	6,250	5,377	9
11..............	1.6737	6.3237	15.29	4.41	2.00	6,250	5,377	9
12..............	1.6737	5.9517	16.24	4.98	2.00	6,250	5,377	9
13..............	1.6737	6.6957	15.97	4.19	2.00	6,250	5,377	9
14..............	0.3230	1.6499	16.81	5.14	2.00	2,817	30,886	10
MULTNOMAH:								
1..............	0.4719	1.9927	12.92	3.43	1.46	35,112	19,069	9
2..............	0.4369	1.6965	13.08	3.84	1.46	23,797	20,599	9
3..............	0.4328	1.5873	13.08	3.84	1.46	22,500	20,790	9
4..............	2.0628	7.5629	12.73	3.84	1.46	17,500	4,363	9
5..............	2.0628	8.7088	13.00	3.40	1.46	17,500	4,363	9
6..............	2.0628	10.0839	13.08	2.77	1.46	17,500	4,363	9
7..............	2.0628	9.3964	12.05	2.69	1.46	17,500	4,363	9
8..............	2.0628	8.4796	13.25	3.32	1.46	17,500	4,363	9
9..............	2.0628	8.0213	12.24	3.24	1.46	17,500	4,363	9
10..............	2.0628	7.3338	10.01	3.51	1.46	17,500	4,363	9
11..............	2.0628	9.6255	13.08	2.99	1.46	17,500	4,363	9
12..............	2.0628	8.9380	11.83	2.94	1.46	17,500	4,363	9
13..............	0.9674	3.8697	13.08	3.54	1.46	12,500	9,303	9
14..............	0.9674	4.2997	13.08	3.05	1.46	12,500	9,303	9
15..............	0.9674	4.1922	12.73	3.05	1.46	12,500	9,303	9
16..............	0.9674	4.6222	12.92	2.86	1.46	12,500	9,303	9
17..............	0.9674	4.6222	12.92	2.99	1.46	12,500	9,303	9
18..............	0.9674	3.9772	12.40	3.29	1.46	12,500	9,303	9
19..............	0.9674	3.7622	13.25	3.70	1.46	12,500	9,303	9
20..............	0.9674	4.0847	12.24	3.13	1.46	12,500	9,303	9
21..............	0.9674	4.7297	11.89	2.50	1.46	12,500	9,303	9
22..............	0.9674	3.9772	12.57	3.40	1.46	12,500	9,303	9
23..............	0.9674	4.1922	12.24	2.99	1.46	12,500	9,303	9
24..............	0.9674	4.2997	13.25	3.10	1.46	12,500	9,303	9
25..............	0.9674	3.5472	14.09	3.86	1.46	12,500	9,303	9
26..............	0.9674	3.9772	12.24	3.05	1.46	12,500	9,303	9
27..............	0.9674	3.9772	12.73	3.13	1.46	12,500	9,303	9
28..............	0.9674	3.5472	13.08	3.62	1.46	12,500	9,303	9
29..............	0.9833	4.3841	11.04	2.77	1.46	11,713	9,153	9
30..............	1.0434	4.1735	14.96	4.13	1.46	8,750	8,626	9
31..............	1.0434	4.9850	13.08	3.13	1.46	8,750	8,626	9
32..............	1.0434	4.5213	12.73	3.02	1.46	8,750	8,626	9
33..............	1.0434	4.1735	12.24	3.16	1.46	8,750	8,626	9
34..............	1.0434	4.7532	12.73	3.10	1.46	8,750	8,626	9
35..............	1.0434	4.0576	12.24	3.24	1.46	8,750	8,626	9
36..............	1.0434	3.9416	12.57	3.43	1.46	8,750	8,626	9

- continued -

Appendix Table 13. Values of Variables Used in the Models for Main Reason Visitors to Bonneville Hatchery (continued)

County - Subzone	VR	VRI	TC	TCI	TT	INC	POP	N
MULTNOMAH (cont.)								
37..............	1.0434	4.0576	11.89	3.62	1.46	8,750	8,626	9
38..............	1.0434	4.0576	12.24	3.26	1.46	8,750	8,626	9
39..............	1.0434	4.0576	11.89	3.13	1.46	8,750	8,626	9
40..............	1.0434	3.9416	12.92	4.73	1.46	8,750	8,626	9
41..............	1.0434	4.5213	12.24	2.91	1.46	8,750	8,626	9
42..............	1.2572	4.9080	13.60	3.94	1.46	6,584	7,159	9
43..............	1.2903	4.5876	14.28	4.24	1.46	6,250	6,975	9
44..............	1.2903	5.7345	13.60	3.21	1.46	6,250	6,975	9
45..............	1.2903	5.8779	12.73	3.59	1.46	6,250	6,975	9
46..............	1.2903	5.4478	13.25	3.54	1.46	6,250	6,975	9
47..............	1.2903	5.4478	12.57	3.29	1.46	6,250	6,975	9
48..............	1.2903	4.5876	12.40	3.59	1.46	6,250	6,975	9
49..............	1.2903	4.7310	12.73	3.78	1.46	6,250	6,975	9
50..............	1.2903	5.8779	12.40	2.91	1.46	6,250	6,975	9
51..............	1.2903	4.7310	13.76	4.30	1.46	6,250	6,975	9
52..............	1.2903	5.8779	13.41	3.13	1.46	6,250	6,975	9
53..............	1.2903	4.5876	13.41	4.05	1.46	6,250	6,975	9
54..............	1.0561	3.6058	12.92	3.94	1.46	4,659	8,522	9
55..............	0.9222	3.3816	14.44	4.32	1.46	3,750	9,759	9
56..............	0.9222	3.4841	13.76	3.97	1.46	3,750	9,759	9
57..............	0.9222	3.6891	12.92	3.56	1.46	3,750	9,759	9
58..............	0.9223	3.5738	13.19	3.70	1.46	3,750	8,674	8
59..............	0.9223	3.1126	12.43	3.94	1.46	3,750	8,674	8
60..............	0.9223	2.8821	12.24	4.27	1.46	3,750	8,674	8
61..............	0.8405	3.1172	13.38	3.84	1.46	2,890	9,518	8
62..............	0.6640	2.7388	13.00	3.48	1.46	1,032	12,049	8
63..............	0.6640	2.6558	12.43	3.40	1.46	1,032	12,049	8
64..............	0.6640	2.4068	11.86	3.62	1.46	1,032	12,049	8
CLACKAMAS:								
1..............	0.3996	4.1685	15.80	3.45	2.00	20,595	22,519	9
2..............	0.4891	2.8918	15.61	3.51	2.00	13,957	18,399	9
3..............	0.3068	1.4318	17.33	4.11	2.00	12,500	29,333	9
4..............	0.3917	1.9580	15.97	3.54	2.00	10,876	22,975	9
5..............	0.5031	1.9565	16.81	4.46	2.00	8,750	17,889	9
6..............	0.3184	1.6496	15.67	3.59	2.00	7,129	28,262	9
7..............	0.1601	0.5589	16.05	5.22	2.00	3,758	49,981	8
CENTRAL WILLAMETTE VALLEY:								
Benton, Lincoln, Linn, Marion, Polk..............	0.0493	0.2622	17.84	4.03	4.06	8,830	182,729	9
Tillamook-Clatsop.	0.1525	0.6562	9.98	2.58	4.68	10,152	19,676	3
Columbia (Ore.)...	0.4130	2.2801	21.84	4.81	3.28	11,829	16,951	7
NORTHCENTRAL OREGON:								
Crook, Deschutes, Gilliam, Sherman, Jefferson, Wasco, Wheeler...........	0.1654	0.8270	21.03	4.73	4.18	12,500	24,187	4
SOUTHWEST OREGON:								
Coos, Curry, Jackson, Josephine....	0.0460	0.2580	14.20	4.22	10.24	8,832	152,148	7
Douglas, Lane.....	0.0370	1.0009	13.57	3.94	7.04	11,525	216,311	8
SOUTHWEST WASHINGTON:								
Cowlitz, Grays Harbor, Kitsap, King, Kittitas, Klickitat, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Yakima, Wahkiakum, Benton.	0.0036	0.0142	23.39	6.20	4.46	9,145	1,096,226	4
HOOD RIVER...........	1.0168	5.8665	8.05	1.82	1.10	9,581	10,819	11
YAMHILL..............	0.2584	1.9898	20.26	4.76	2.92	11,686	19,898	8