AN ABSTRACT OF THE THESIS OF

Colin N. Sorhus for the Doctor of Philosophy in Agricultural and Resource Economics. Date thesis is Presented December 16,1980 . Title Estimated Expenditures by Sport Anglers and Net Economic Values of Salmon and Steelhead for Specified Fisheries in the Pacific Northwest. Abstract approved [redacted]

It is without doubt that outdoor recreation is important to almost all segments of society; however, it has been challenging for economists to fix a dollar value on the benefits of outdoor recreation. Increasing awareness of alternative uses for natural resources has focused much attention on values for all uses of these resources in order that high priority projects can be pursued with a clear understanding of the values of alternative projects and uses such as hydro-electric dams, timber harvesting, irrigation, public water needs, and a variety of recreational uses. It has been only recently that estimates of outdoor recreation have been counted as an opportunity cost when the cost benefit ratios are calculated for hydro-electric dams and other public projects. Measurement of outdoor recreation has been difficult and crude at best.

This study attempts to measure the economic importance of salmon and steelhead sport fishing in Oregon and salmon sport fishing in Washington. In accordance with these objectives, (1) estimates of expenditures were made for Oregon and Washington anglers, and (2) the "net economic value" was computed for this resource using the travel cost method of estimating benefits.

A mail questionnaire consisting of 9,000 questionnaires for Oregon and 5,000 questionnaires for Washington were sent to Washington and Oregon anglers. The 9,000 questionnaires sent to Oregon anglers were sent on a quarterly basis, and the 5,000 questionnaires sent to Washington anglers covered only the summer months. Approximately 55% of the questionnaires sent to Oregon anglers were returned and about 44% were returned by Washington anglers. Anglers were reminded to complete and return their questionnaires by telephone if the first two mailings failed to produce results. The anglers whose questionnaires were incomplete or suspected of being erroneous were also telephoned for corrections.

Estimated expenditures for fishing trips during 1977 for Oregon totalled approximately $29.7 million for the salmon and steelhead fishery and $66.7 million for all other fisheries. Durable fishing equipment used for all fishing was approximately $80 million for 1977.

Washington anglers spent approximately $86.5 million for salmon fishing trips, and the replacement value of the durable equipment used for salmon fishing was approximately $334.1 million.

Net economic value for the salmon and sport fishery in Oregon for 1977 was approximately $31 million. The net economic value for Washington sport salmon fishing for 1977 was approximately $33 million. As demand for recreational fishing increases coupled with an increase in population and increased income available for recreation, one would expect increases in the distance travelled and expenses incurred to go fishing, and as a result an increase in the calculated net willingness to pay values.

The fisheries are differentiated by species and location to give a better estimate of the net willingness to pay. Net economic values were calculated for the Oregon ocean salmon, fresh-water salmon, and the steelhead fisheries. The Net economic values were calculated for the Washington ocean, fresh-water, and Puget Sound salmon fisheries.

Estimated Expenditures by Sport Anglers and Net Economic Values of Salmon and Steelhead for Specified Fisheries in the Pacific Northwest.

by

Colin Sorhus

A Thesis

submitted to

Oregon State University

in partial fulfillment of

the requirements for the

Doctor of Philosphy

June 1981

Approved:

Professor of Agricultural and Resource Economics in Charge of Major

Head of Department of Agricultural and Resource Economics

Dean of Graduate School

Date Thesis is Presented: December 16, 1980

Typed by: Colin N. Sorhus, et.al.

Acknowledgement

This study would not have been made possible without Dr. William G. Brown's guiding hand and unlimited willingness to share problems, time and talents with me. Dr. Brown has been an inspiration in times of discouragment for which I am deeply indebted to him.

I am grateful to Ken Gibbs for help in designing the questionnaire and for his help and encouragement at all stages of the work.

I am indebted to the Pacific Northwest Regional Commission for funding this project and the Oregon and Washington departments of fisheries for their cooperation.

I am grateful also to Alan Christian for supervising the telephoning, to Dave Watkins who has been able to solve every computer programming problem, Helen Lowry and all the staff at the Survey Research Center who directed the mail questionnaire part of the project, and to all those who contributed their time, talents, and suggestions.

I am very grateful to my wife, Marianne, who patiently shared my burdens, as well as being a mother to our children.

CONTENTS

LIST OF TABLES

ESTIMATED EXPENDITURES BY SPORT ANGLERS AND NET ECONOMIC VALUES OF SALMON AND STEELHEAD FOR SPECIFIED FISHERIES IN THE PACIFIC NORTHWEST

CHAPTER 1
INTRODUCTION

The past two decades have seen a marked rise in interest by governmental agencies and the public concerning valuation and protection of natural resources. The support of the Environmental Protection Agency (EPA) and a surge in the number of privately organized environmental groups have attested to this fact.

The government has become involved in this resurgence for at least two reasons: From a management viewpoint, public agencies are faced with decisions of resource allocation among competitive resource users. For example, forest managers must be concerned not only with the harvesting of timber, but also with alternative uses, such as the preservation of wildlife and wilderness areas, protection of streams, reforestation, and recreation. Rational economic decisions could more easily be made if the prices of all the alternative uses were available. Although the value of timber can be calculated because it eventually passes through the market system where values and quantities are established, this is not the case for nonmarket uses, such as hunting and fishing. There is pressure from interest groups upon governmental agencies and public councils to provide protective regulation of the nonmarket uses of our natural resources. The second reason that valuation of our natural resources is needed is the fact that government expenditures for protection, maintenance, or enhancement must now be justified to insure an efficient allocation of scarce public monies.

Although there has been some effort to protect the fisheries of the Pacific Northwest, no firm guidelines have been developed by which the benefits of protection can be evaluated. For example, the Oregon Forest Practices Act of 1972 explicitly outlines protection of forests and streams in Oregon in hopes that future problems can be avoided and indicates the concern legislators have for protecting and regulating our streams. Section 24-446 states in part:

> During and after harvesting operations, stream beds and stream vegetation shall be maintained in as near natural state as possible in order to maintain water quality and aquatic habitat. (Oregon, 1975, p. 36)

This protection includes a restriction of cable yarding of timber through streams, a minimization of machine operations in streams, as well as providing a buffer strip along the streams.

In general, resource managers have found it difficult to manage resources because of the lack of information about recreational uses of natural resources. Specifically, biologists, hydrologists, and fishery and resource managers have expressed a strong desire to work with economists in determining economic values for fish populations and other natural resources to be sacrificed for proposed dams or other environment altering projects. It is only recently that the value of lost recreational resources has begun to be considered as a cost when calculating the social costs and benefits of proposed projects that alter the natural habitat of fish and wildlife.

CHAPTER 2

THEORY OF CONSUMERS SURPLUS AND TRAVEL COST METHOD OF ESTIMATING NET ECONOMIC VALUES

Just as the concept of utilitarianism dominated the economic thought of the early twentieth century, welfare economics has dominated resource economics the latter part of the century. This is due in part to the expanded multiple use of natural resources on public land which has forced the utilization of some natural resources to their limit resulting in the trade-off of priority uses. It is this trade-off process which is the basis for much of the work done in resource economics. Measuring the value of alternative uses of resources for comparative purposes or to measure net benefits has been difficult at best. One method used extensively is the measurement of consumers surplus.

Consumers surplus is the area under the demand curve and above the cost curve. The whole area under the demand curve is referred to as gross benefits while the area under the demand curve, but above the cost curve, is called the net benefits or consumers surplus. The cost refers to goods and services foregone as a result of pulling resources away from other economic uses. These costs then are opportunity costs. Strict use of the cost benefit analysis requires the choosing of a project that will maximize positive net benefits. Underlying this allocation process, are the Pareto optimality conditions.

The Pareto optimality conditions are satisfied when the project is choosen which results in no one being worse off as a result of the implementation of the project, and at least some being better off, thus resulting in increased total social welfare. The project is still considered feasible if the gainers can potentially compensate the losers. If full compensation were possible, this procedure would be a reasonable basis for project selection.

It is the measuring of benefits applied to cost benefit analysis

which is founded in consumers surplus. Although there is widespread acceptance of the general use of consumers surplus for measuring net benefits for recreational resources (Dwyer, Kelly, and Bowes, 1977), there is much less concensus on how it should be measured or its use in comparative measures.

The latter criticism stems from the fact that consumers surplus measures net willingness to pay or sell, while the feasibility of other projects are evaluated using marginal analysis. The selection of projects using marginal analysis ,i.e., marginal cost equals marginal revenue, are particularily prevalent in the private sector where the market has been established for the goods or services produced. It has been stated that mixing the two measurements, consumers surplus vs. marginal analysis, can result in a misallocation of resources. However, it has been argued that the demand curve for the latter measurement is perfectly elastic, thus the consumers surplus is accounted for and the two measurements are equivalent. The argument continues, and this study will not try to resolve the issue but merely point out the controversy involved in using consumers surplus as a comparative measure of net benefits.

Consumers surplus, as a measure of net benefits, is also subject to the problems of authoritarianism, separability, schizophenia, and measurement variations.

Authoritarianism is the term used to describe the condition in which the present users and decision makers allocate resources and distribute costs and benefits across unborn generations. This results in future generations inheriting the outcomes of decisions made now but having no voice in the decision. The impossibility of resolving this issue forces decision makers to either do nothing which will affect future generations, or ignore the criticism. In defence of this arguement, it should be pointed out that decision makers are sensitive to this issue and are conscientiously trying to measure the effect on the future generations in terms of pollution and other changes to the environment. Clearly doing nothing at the risk of injury to future generations is not a reasonable basis for project selection, thus ignoring the criticism is the only course left.

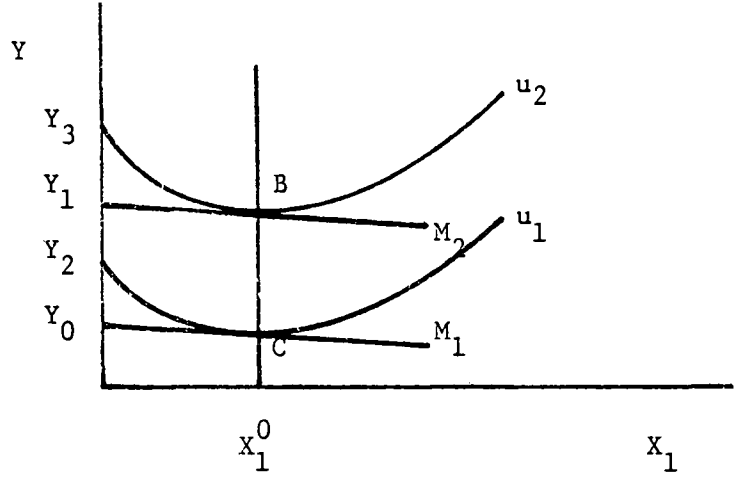
Separability is more of a theoretical problem and deals with the fact that one person can derive utility from the actions of another, thus the two utility functions are interrelated and interdependent. Demand theory requires that the consumer have a unique utility function. Thus, conceptualization of this problem is difficult, measurement is impossible, and this criticism too, is largely ignored.

The third criticism is called schizophrenia and refers to the condition where the individual may change the utility preference structure depending on the role one perceives himself to be playing. The utility structure will change depending on whether he views himself as a recipient or a provider of benefits. Thus, the individual may not have a unique utility function, but derives his utility from a perceived role.

In spite of these problems, consumers surplus continues to be useful from a theoretical standpoint; however, there is still considerable controversy on the actual measurement of benefits. Most researchers are aware of the two measures of consumers surplus: compensation variation and equivalent variation.

Compensation variation is defined as the amount of value the user would have to be compensated to forego the use of the resource in its present use. Compensation variation is referred to as willingness to sell. Equivalent variation, on the other hand, is the value the user would be willing to pay to continue to have the resource stay in its present use. Equivalent variation is referred to as willingness to pay. There would be no problem were the two measures always consistent; however, such is hardly ever the case. Hicks (1939) suggested the difference could be accounted for as a result of the income or wealth effect. Theoretically, the two measures should be the same if there is no income effect as illustrated in Figure 1.

FIGURE 1



Note that the equivalent variation is the distance between points B and C or the distance Y_o to Y_1 on the Y axis. The indifference curves, u_i, are vertically parallel such that at any income level m_i, the same quantity of X will be purchased, i.e. a zero income effect on the quanity of X purchased. Compensation variation is measured on the Y axis between Y_2 and Y_3, or where u_1 and u_2 cut the Y axis. Note that when there is no income effect (vertically parallel indifference curves), the equivalent variation measure, Y_o to Y_1, is equal to the compensation variation measure, Y_2 to Y_3. Should the income effect be greater or less than zero, the two measures are no longer equal. One is particularly vulnerable to this difference when using direct questionnaire techniques (which are discussed later). Often the responses to the willingness to sell and the willingness to pay questions are not even close. One criticism of the compensated variation measure is the fact that it is not bounded on the upper limit by the respondent's income, and as a result some responses can be unreasonably high. At the extreme, the respondent's willingness to pay is bounded by his income (Krutilla and Fisher, 1975). Faced with the dilemma of choosing which measure is likely to be correct, the researcher must rely on the hope that the differences between the two measures are relatively small or that one measure is more appropriate given the situation. In project feasibility studies, it is usually assumed that the compensation variation measure is inappropriate or that the magnitude of the differences are small. Most literature is silent on the use of the compensation variation but supports the equivalent variation measure.

For normal goods, the willingness to sell measure is greater than the willingness to pay measure, i.e., the compensating variation is greater than the equivalent variation. As a result, equivalent variation becomes the minimum measure.

Consumers surplus as a proxy of net benefits, has been criticised earlier in its use as a comparative measure; however, deciding on some amount less than the entire consumers surplus seems arbitrary. It has been suggested that a reasonable amount would be the maximum revenue which a single owner could obtain were the resource under his control. The suggestion for measuring the maximum revenue that would accrue to a single owner seems to have some appeal because all the consumers surplus could not be captured, except by a perfectly discriminating monopolist. The single owner measurement would be the best measure the public would have for obtaining a measure of the benefits that could actually be captured. Brown, Singh, and Castle used the single owner-maximum revenue measure:

> "Net economic value" will be our best estimate of the monetary value of the sport fishery resource which might exist if the resource were owned by a single individual, and a market existed for the opportunity to fish for salmon and steelhead. This net economic value would approximate the value of the resource to a single owner who could charge sport anglers for his permission to fish for salmon and steelhead. (Brown, Singh, and Castle, 1964, p. 28).

In support, Crutchfield (1962) suggests that a point should be picked which would "maximize net yield from leasing or selling rights to fish", (Crutchfield, 1962). Again it should be noted that picking a point on the demand curve is subjective and depends on the preliminary assumptions made concerning the measurement of net economic values.

ALTERNATIVE MEASURES TO CONSUMERS SURPLUS

An alternative method of evaluating net benefits is to compare benefits foregone or the benefits gained by the consumer as a result of the economic impact the project has on the area it serves. Using an input output framework yields not only the total economic impact, but also gives the distributional impacts of the costs and benefits of the project. This approach has been pursued as part of a concurrent study, using the basic data of this study which were made available to Professor Petry of Washington State University (Petry, 1980).

SUMMARY OF THE REASONS FOR USING CONSUMERS SURPLUS TO MEASURE NET BENEFITS

Dwyer, Kelly, and Bowes (1977) recommend the consumers surplus measurement as the appropriate measure of benefits received by those who gain from the recreational facility. Following Dwyer, et.al., it was decided to measure the entire willingness to pay measure based on equivalent variation for the following reasons. Equivalent variation generally refers to projects presently in use, it is bounded by the individual's income, as opposed to the willingness to sell criteria, and, given the fact that salmon and steelhead fishing is considered a normal good, the equivalent variation measure is the more conservative measurement. Measuring the entire consumers surplus area is as prudent as picking a point on the demand curve less than the whole area even though Clawson (1959) and Crutchfield (1962) did lay some groundwork for choosing the single owner-maximum revenue amount. Further, the entire area under the demand curve can be considered a maximum willingness to pay without precluding the possibility of making downward adjustments.

TRAVEL COST METHOD OF ESTIMATING NET ECONOMIC VALUE

The most popular approaches to measuring the consumers surplus fall into two categories, the direct and indirect methods.

The direct method consists of a set of questions which directly ascertains from the participant, his willingness to pay to retain the resource in its present use. The latter method (indirect) tries to establish the willingness to pay measure by first estimating the respondents'demand for the resource. The indirect measure becomes a minimum measure, reasoning that if the respondent actually purchased some quantity of the resource, the anticipated satisfaction derived from this use of the resource was worth at least the amount of the expenditure required to participate. It is an anticipated satisfaction, since upon reflection, the experience may not have been worth the expenditure.

The direct method of ascertaining value is based upon two key assumptions: (1) that the consumer can assign an accurate value to the resource use, or in this case, the recreational experience, and (2) that this valuation can be elicited from the respondent by means of a properly constructed questionnaire. The major criticisms of the direct method center on the fact that the situation is hypothetical in nature and therefore subject to gross measurement error (Bishop and Heberlien, 1979). The assigning of a dollar value to the recreational experience by the respondent is one of the most difficult tasks faced by the surveyor. Other problems include understanding the question, interviewer bias, and gaming stategy. A good discussion of the direct questionnaire technique and its limitations is contained in Dwyer et.al.(1977). There is renewed interest in the direct method because of the sophisicated questioning and bidding techniques that have recently been developed (Dwyer, Kelly, and Bowes, 1977).

Some have suggested that the indirect method is more appropriate for measuring recreational value because it does not rely on the fact that the recreationist must assign value to the recreational experience. The accounting and formulation of recreational expenditures has been the subject of much interest for the past twenty years. Methods have ranged from accounting for recreation as part of the GNP of the country to the travel cost and household production function methods of estimating value.

The household production function method approaches the problem by considering the households as producers and that the household maximizes its utility subject to production function relationships and the household's available time and income.

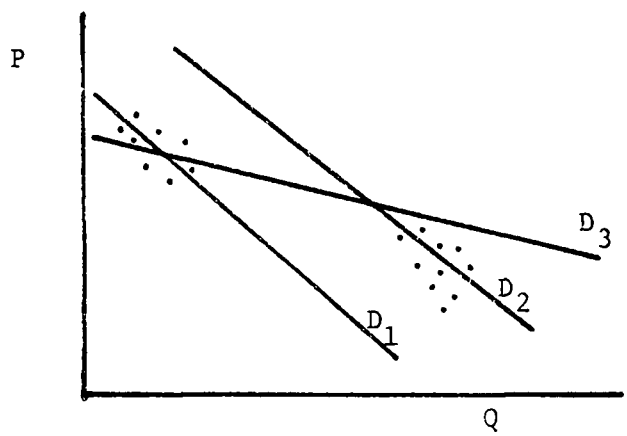
The dominant method which has emerged over the past few years, is the travel cost method of estimating value. The travel cost method was first suggested by Harold Hotelling (1949). In a letter to the forest service, he suggested drawing concentric circles or zones around the recreational site. The increasing travel cost incurred by the recreationists from different zones could be used as a proxy for price, while the number of trips would be the quantity variable. It was reasoned that various increasing travel costs incurred by the participants would act the same as increasing the entrance fee at the site. It was expected that there would be a negative relationship between increasing travel costs and the number of trips taken by the recreationists, thus giving a quantity demand relationship for the site. The net economic value, or willingness to pay, could then be calculated by taking the definite integral of the area under the curve and above the cost of participating.

Marion Clawson (1959) was the first to empirically estimate benefits using a travel-cost framework. Clawson's study, Methods For Measuring The Demand For and Value Of Outdoor Recreation, has been recognized for many years as the foundation for estimating outdoor recreational benefits. The simple travel cost model used by Clawson has since been improved extensively, mostly as a result of the limitations of the original simple travel cost procedure.

The simple travel cost is limited by four basic assumptions: (1) every distance zone must have homogenious preference functions for the recreational activity, (2) the marginal preference for travel in all zones equals zero, (3) time and other non-monetary constraints are not a factor, and (4) the price and availability of substitutes are equal for all zones.

The first limitation, homogeneous preference functions for the recreational activity for all zones, for example, assumes that individuals from the far zones have the same preference for salmon fishing as do individuals who live on the coast, that is, this assumption maintains that recreationists in Lake County, Oregon would have the same preference structure for salmon fishing as would persons living in a coastal county, such as Tillamook. In actual fact, it is unlikely that all zones would have the same preference structure for salmon fishing. It is possible that some persons choose to spend their retirement in coastal communities to take advantage of the salmon fishing. It is unlikely that fishing would be the only reason for making the move, but if it were, it is important to know what effect it would have on the estimates of value for the fishery. Even though the limitation of homogeneous preference functions for fishing cannot conveniently be relaxed, it would be helpful to know the direction of the bias. To find the direction of the bias, it is important to consider how the demand function would be constructed. The scatter of points in Figure 2 represent observations from zones for the travel cost model. Zones close to the site have low travel costs and high participation rates, while zones further away have higher travel costs and lower participation rates as shown in Figure 2.

FIGURE 2



D_1 represents the estimated demand curve for anglers near the site. (A linear model is used for illustrative purposes.) D_2 represents the estimated demand for anglers further away from the site. In order to determine the direction of the bias, note that D_3 would be estimated from all the observations when assuming a homogenious preference function for all zones. Note that the travel cost estimate, D_3, is more elastic than either D_1 or D_2. The calculated consumers surplus using D_3 is less than the sum of the consumers surplus computed from the other two demand curves. Thus, the assumption of a homogenious preference function for fishing will tend to underestimate the consumers surplus. Therefore, although this limitation is not resolved, the effect of the bias will result in a conservative estimate of the consumers surplus.

The travel cost model is also restricted by the assumption that respondents will react only to out-of-pocket expenses such as travel and destination costs, ignoring non-monetary costs, such as travel time. Knetsch (1963) pointed out that participants from further distance zones incur not only increased travel costs, but increased travel time as well. Knetsch demonstrates that if travel time is ignored, the value of the site will usually be underestimated. There has been some attempt to measure time simply by including it as a variable in the travel cost equation, or by specifying time in terms of dollars by multiplying the round trip travel time by a percentage of the wage rate. A problem arises from the selection of an appropriate percentage of the wage rate. Dwyer, Kelly, and Bowes (1977) suggest one-half to one-third the wage rate; however, these percentages are still arbitrary.

Simply including time as a variable in the regression has been unsuccessful because of the high degree of correlation between travel cost and travel time for aggregated data. Both travel cost and travel time are functions of distance, resulting in nearly perfect multicollinearity.

An attempt to separate the monetary costs from the non monetary costs was made by Brown and Nawas (1973). They reported that the standard errors for the coefficients of the distance travelled and travel cost were reduced by using individual observations. However, some recent research indicates some problems associated with the individual observation approach, including bias from measurement error, (Brown, Sorhus, Chou-Yang, and Richards, 1980).[1]

Thus, researchers are confronted by the dilemma of multicollinearity on the one hand, and specification bias on the other hand, should it be decided to drop one or the other of the variables. Cesario and Knetsch (1970) suggested combining travel cost and travel time into a single variable. A disadvantage to this proceedure is the fact that the researcher must assign one or more specific trade-offs between monetary cost and travel time.

None of the above treatments of the money-time trade-off seemed adequate. Given the importance of including time in the model, it was necessary to obtain a different formulation for the time variable. Oscar Burt [2] suggested expressing travel time in monetary terms by multiplying the round trip travel time by the respondent's hourly income, thus creating an opportunity cost of time variable. This new variable was included in the regression equation as an opportunity cost of travel time. The multiplication of the respondent's wage rate by the travel time reduced the correlation between opportunity cost of travel time and travel cost to reasonable levels, thus increasing the efficiency of both explanatory variables and at the same time reducing specification bias. (A more detailed specification of the opportunity cost of time variable is discussed later).

1/ Brown, W.G., Sorhus, C.N., Chou-Yang, B., and Richards, J.A., A Note Of Caution On The Individual Observations For Estimating Outdoor Recreational Demand Functions, Dept. of Agricultural and Resource Economics, Oregon State University, unpublished. (June 1980).

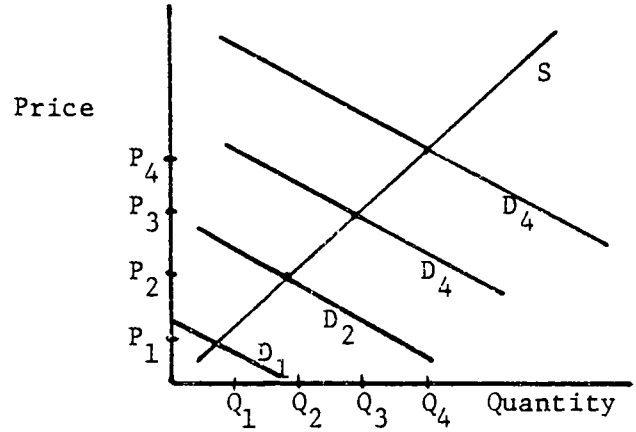
2/ Oscar Burt suggested this formulation of the time-money trade-off at the annual WAEA/AAEA meetings in Pullman, WA., 1979.

A further limitation of the simple travel cost method of estimating net economic value, is its failure to consider substitutes. When choosing a site the angler has the opportunity to consider, not only travel cost and travel time, but also alternative sites and activities. For example, the angler may have at his disposal a choice of three sites and three different fishing activities. The simple travel cost method does not account for these alternatives. It is possible, subject to certain constraints, to improve the specification of the travel cost model to include substitute activities. If one assumes that the angler has decided to go fishing as opposed to some other form of recreation, he is left to decide where he will fish and for which species. To find out if the fisheries are substitutes, complements, or independent, one need only take the partial of one activity with respect to the other. This hypothesis is not tested in this study but the opportunity to test this hypothesis should be pursued in subsequent research.

The travel cost method has been criticized as being an empirical procedure (Edwards, Gibbs, Guedry, and Stovener, 1976) relying on the tendency for large groups to have uniform behavior such that the aggregation of the responses of a large number of people results in an average, not as a result of a sound theoretical framework. Dwyer, Kelly, and Bowes (1977) on the other hand argue that the major appeal of the travel cost method, is its clear theoretical base. Faced with resolving this dilemma, one is forced to appeal to the strong statistical base of the travel cost method, its predictive powers, and its value for application to empirical problems.

The establishment of a statisical base for the travel cost method results from insightful observations by E.J. Working in his paper "What Do Statistical 'Demand Curves' Show?" (Working). In explaining the identification problem, Working observed that when supply variables are constant and a demand variable fluctuates over time, the locus of equilibrium prices and quantities will map out a supply curve.

FIGURE 3

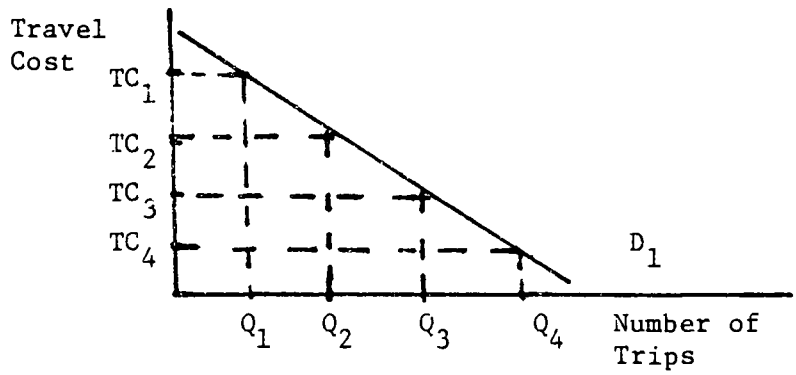


Thus as income is increased, the demand curve shifts from D_1 to D_2 and so on. Equilibrium prices and quantities trace out the supply curve S.

This same idea applies for identification of the statistical demand function. Thus, if the demand remains constant, and if supply fluctuates from year to year, then the locus of equilibrium prices and quanitities trace out the statistical demand curve.

This classic contribution by Working, with minor adaptations, proves to be very useful in providing a statistical basis for the travel cost method of estimating value. Note that travel cost is considered a supply variable repesenting the cost of supplying the participant with recreation. If the demand for recreation is constant across various distance zones, then the variation in travel costs with participation rates for the various distance zones will indeed trace out the statistical demand curve.

FIGURE 4



The travel cost variable is the cost participants must pay to provide themselves with Q_i recreation. Thus, as travel cost (TC_i) is varied from TC_1 to TC_4, the corresponding equilibrium quantities Q_1 to Q_4 give the coordinates for the statistical demand curve D_1.

Although the travel cost method is inappropriate for estimating the value when the recreationist visits more than one site, or where there are no travel costs incurred, it is useful in estimating value for most recreational sites and has some appealing qualities such as the fact that it is based upon observable behavior by recreationists, the predicted estimates can be compared with actual observations, and the total willingness to pay can be calculated for existing or proposed sites.

HYPOTHESES

(1) It is hypothesized that there is a negative relationship between monetary outlays, in terms of travel costs, and the number of angling trips taken to a recreational site.

(2) It is also hypothesized that a positive relationship exists between number of trips taken , income, and dollar amounts of fishing equipment owned by the respondent.

(3) It is further hypothesized that the relationship between travel time and the number of trips taken by the recreationist is negative. Also the correlation between travel cost and travel time can be reduced by expressing travel time as an opportunity cost of time, following a suggestion by Oscar Burt.*

*Oscar Burt suggested this formulation of the time-money trade-off at the annual WAEA/AAEA meetings in Pullman, WA., 1979.

ALGEBRAIC FORMULATIONS

In expressing the travel cost equation in algebraic terms, three formulations were considered: the linear, the semi log, and the double log forms.

The data were plotted in order to give some idea of the appropriate form. The double log formulation was rejected because it is unbounded above and as a result the consumers surplus measurement would be unbounded. It was decided not to arbitrarily set an upper limit but to use a bounded formulation.

Both the linear form and the semi log form are bounded above and therefore were used for each fishery. However, only the first fishery, ocean salmon, reports both the linear and the semi log formulations. The semi log formulation fit the data much better than did its linear counterpart, and in every case the semi log model was used. It should be noted that the estimates of consumers surplus were sensitive to the algebraic form used, and that the formulation chosen was a result of statistical significance and theoretical consistency.

CHAPTER 3

SURVEY DESIGN AND QUESTIONNAIRES EMPLOYED

Before presenting the numerical results and economic implications of this study, some factors considered in constructing the questionnaire should first be outlined. However, there were some differences between the Oregon and Washington surveys. Since it was originally proposed to only survey the Oregon sport anglers, the survey of Oregon anglers was designed first and was underway before the need for similar data from the Washington sport salmon anglers became known.

Sampling Procedure Used for Oregon Sport Anglers

An important consideration in the selection of the sample of Oregon anglers was the desire to reduce errors resulting from memory bias. Consequently, it was decided to mail questionnaires to the anglers at the end of each quarter during 1977. Also, to further minimize recall error, detailed information was requested for only the last three (and therefore the most recent) trips of the quarter. (We realize, of course, that memory bias is still a serious problem in spite of using quarters for the time frame. A study reported by Hiett and Worral [p.22] concluded that the recall period for reporting of fishing trips should not be longer than 60 days. They also reported that fishermen tended to overestimate by a considerable degree the effort [hours of fishing] for fishing trips and the total catch for fishing trips.)

The sample size was determined by first drawing approximately three percent of the total number of Oregon angling licenses purchased during 1977. Then, to avoid under-representing the more distant and sparsely populated regions of Eastern Oregon, names were drawn at a 33 percent rate from Multnomah, Clackamas, Washington, Marion, Lane, Linn, Benton, Polk, and Yamhill Counties. Names were drawn at a 50 percent rate from Douglas, Josephine, and Jackson Counties. In the remaining areas, all names were used, as explained in more detail in Appendix II. The sample was stratified in this way so as to increase the dispersion of travel costs incurred by the sport anglers in our sample. A wide range of observed travel costs

is important since travel cost is commonly used as a proxy for price in the travel cost method, pioneered by Clawson, 1959. If, for example, a non-stratified sample is drawn that results in very little variation in travel costs (and participation rates), then the explanatory power of the explanatory variable, travel cost, is greatly reduced. That is, if the participation rate is regressed on travel cost, the variance of the travel cost coefficient will be greatly increased if there is little variation in travel cost.

The above procedure resulted in a sample of 9,000 anglers drawn from the total number of Oregon angling licenses purchased during 1977. This sample was about 1.5 percent of the total licenses, including all in-state and out-of-state licenses of all categories, as listed in Question # 5 of the questionnaire in Appendix V . The sample was believed to be sufficiently large, based upon earlier experience with similar studies, e.g., Brown, Singh, and Castle, 1964.

Questionnaire employed for Oregon anglers

The questionnaire was composed of three major parts. The first part was designed to obtain demographic information concerning Oregon anglers' age, household size, employment, and income information. These questions were asked in order to identify some of the major characteristics of Oregon anglers.

The second major part of the questionnaire concerned the variable trip expenditures. The respondent was asked to complete expenditure data about the last three fishing trips. To help remind the respondent of some typical expenses and to put the information into a workable framework, a checklist of typical items was included for each of the last three trips. Location, catch information, trip duration, and mode of travel were also included in this section of the questionnaire and will be used to establish areas of greatest fishing activity and magnitude of fishing effort, as well as trip expenses.

The third area, and perhaps the most difficult to complete, pertained to durable equipment. Respondents were asked the purchase price, year purchased, and the state where their fishing equipment was purchased. (The questionnaire is reproduced in Appendix V .)

Distribution of mailings during the year

The questionnaires were mailed at the end of each of the 1977 quarters. For the period January 1 through March 31, 1,200 questionnaires were sent; 2,700 were sent out covering April 1 through June 30; 3,600 questionnaires for the period July 1 through September 30; and 1,500 for the period October 1 through December 31. It was thought that better data could be

obtained by concentrating the bulk of the sample in the most active fishing quarters, spring and summer.

At the end of each quarter, an introductory letter, map, questionnaire, and post-paid return envelope (shown in Appendix V) were sent to prospective respondents. As the questionnaires were returned, they were deleted from the master list of names. Approximately three weeks later, or when the number of returned questionnaires began to decline, a first reminder was sent to those who did not respond to the first mailing. Enclosed with the reminder letter was another questionnaire and a return envelope. As these questionnaires were returned, they too, were deleted from the master list. The respondents who did not respond to the second mailing were telephoned and asked to complete and return the questionnaire. Addresses were checked, and another questionnaire was mailed. This constituted the third mailing or second reminder. This telephoning procedure enhanced the return rate by an average of 12.9 percent for all quarters. The telephoning was time-consuming and expensive, but it gave the respondent a chance to ask a few questions and relieved the impersonal aspect of the survey. This same procedure was used for all quarters. Return rates are shown in Table 1.

Table 1. Oregon Survey Results

Response	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Total
Total Mailed	1,200	2,700	3,600	1,500	9,000
Total Delivered	1,152	2,557	3,365	1,387	8,461
First Mailing Return	342 (29.7%)	552 (21.6%)	778 (23.1%)	345 (24.9%)	2,017 (24.0%)
Second Mailing Return	279 (24.2%)	462 (18.1%)	581 (17.3%)	273 (19.7%)	1,595 (18.9%)
Third Mailing Return	168 (14.6%)	323 (12.6%)	461 (13.7%)	140 (10.1%)	1,092 (12.9%)
Total Questionnaires Returned	789 (68.5%)	1,337 (52.3%)	1,820 (54.1%)	758 (54.7%)	4,704 (55.6%)

Note: 9,060 names were originally drawn; however, 60 names were duplicates, leaving 9,000 usable names.

A total of 539 questionnaires were undeliverable by the Postal Service, leaving 8,461 questionnaires assumed to have been delivered to the intended respondent. The total return for all four quarters of the Oregon survey was 4,704 questionnaires (55.6 percent).

In addition to all non-respondents being reminded by telephone to complete and return the questionnaires, all respondents were telephoned whose questionnaire was incomplete or suspected to be erroneous in some respect. The complexity and detail of the questionnaire made it difficult for most respondents to accurately complete all phases. This made it necessary to contact as many respondents as could be reached by telephone to complete this information. While again this procedure was costly and time-consuming, the results were greatly enhanced and it was believed to be worth the expenditure. It is important to note that only 29.3 percent of the respondents returned the questionnaire complete in every respect. Telephoning for correction or completion raised the total completed questionnaires from 29.3 percent to 29.3 + 53.7 = 83.0 percent of all questionnaires returned. The results of the correction procedure are summarized in Table 2.

Table 2. Oregon Sport Angler Questionnaire Corrections

Response	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Total
Total Requiring Correction	579 (73.4%)[a/]	1,013 (75.8%)[a/]	1,303 (71.6%)[a/]	551 (72.7%)[a/]	3,446 (73.3%)[a/]
Number Contacted and Corrected	386 (66.7%)[b/]	688 (67.9%)[b/]	905 (69.5%)[b/]	344 (62.4%)[b/]	2,323 (67.4%)[b/]
Number Not Corrected	193	325	398	207	1,123 (32.6%)[b/]
Coded as Received	156	189	225	136	706 (20.5%)[b/]
Not Coded (unusable)	37	136	173	71	417 (12.1%)[b/]
Usable Questionnaires	697	1,255	1,632	706	4,290

[a/] Percentages calculated on the basis of total number of questionnaires returned.

[b/] Percentages calculated on the basis of questionnaires requiring correction.

Degree of questionnaire completion by Oregon anglers

The degree of completion of the questionnaires was categorized by using completion codes, ranging from one through nine. The respondents' questionnaires were classified by the completeness code, and the number of respondents in each category is presented in Table 3.

Table 3. Degree of Completeness of Questionnaires Returned and Questionnaires Completed and/or Corrected by Telephone Versus Incomplete Questionnaires

Code Number	Degree of Completeness of Questionnaire	Number of Respondents	Percent of Respondents in each code
1	Complete and correct as returned	1,261	29.4
2	Completed and/or corrected by telephone	2,300	53.6
3	Completed and/or corrected by telephone, except for income refused	23	0.5
4	Complete except for hours worked/week[a/]	13	0.3
5	Complete except for income[a/]	68	1.6
6	Complete except for all fishing allocation[a/]	50	1.2
7	Complete except for S-S fishing allocation[a/]	50	1.2
8	Complete except for no allocation of any kind[a/]	113	2.6
9	Complete except for equipment, page 4[a/]	412	9.6
	TOTAL	4,290	100.0

[a/] These respondents could not be reached by telephone.

The completeness code was cross-tabulated with the age of the respondent to see if there was any relationship between questionnaire completeness and age. The results are shown in Table 4. Only the first two completeness codes were used since these represented all of the complete questionnaires and over 83 percent of the total response. The younger respondents seemed to return the questionnaire complete more often than the older respondents but were not as available to have the questionnaire completed or corrected by telephone. For example, the number of questionnaires in age group 21-29 that were corrected was 352, only slightly higher than the 333

questionnaires that were corrected in the age group 60-69, but the percent of the questionnaires that were corrected for the older groups was 63 percent versus only 43 percent of the 21-29 age group.

Table 4. Respondents Classified by Completeness Code and Age Group

Code		Under 21	21-29	30-39	40-49	50-59	60-69	70-over	Total
(1) Complete as Returned	(No.)	184	324	259	179	149	82	66	1,261
	C*(%)	39.8	42.2	22.5	27.9	22.0	15.6	16.5	---
	R*(%)	14.6	27.1	20.5	14.2	11.8	6.5	5.3	100.0
(2) Corrected by phone	(No.)	224	352	378	353	407	333	253	2,300
	C*(%)	48.5	43.5	49.1	54.8	60.5	63.3	63.2	---
	R*(%)	9.7	15.3	16.4	15.4	17.7	14.5	11.0	100.0
Final Correct and complete	(No.)	408	693	636	531	555	415	319	3,561
	C*(%)	88.3	85.7	82.3	82.7	82.5	78.9	79.7	---
	R*(%)	11.5	19.5	17.9	14.9	15.6	11.6	9.0	100.0

*C = Column; R = Row.

The completeness code was also classified by the income group of the respondent to see if there was any relationship between questionnaire completion and income group. Only the complete and correct questionnaires, codes 1 and 2 were used for this analysis, also. Income did not seem to be an important factor, either for sending in a completed questionnaire or for having the questionnaire corrected by telephone.

Table 5. Number and Percent of Respondents with Correct and Complete Questionnaires by Income Categories

Income Category	(1) Complete as Returned		(2) Complete After Telephoning		Total Number	Percent Complete of Total
	Number of Respondents	Percent	Number of Respondents	Percent		
Under 3,000	58	28.3	119	58.0	177	86.3
3,000-4,999	68	23.6	164	56.9	232	80.5
5,000-7,999	100	24.2	241	58.4	341	82.6
8,000-11,999	183	31.3	314	53.8	497	85.1
12,000-14,999	167	29.9	312	55.8	479	85.7
15,000-17,999	215	33.5	346	54.0	561	87.5
18,000-24,999	257	29.7	472	54.5	729	84.2
25,000-34,999	140	34.3	212	52.0	352	86.3
35,000-49,999	39	29.5	76	57.6	115	87.1
50,000-100,000	27	32.9	41	50.0	68	82.9
over 100,000	7	50.0	3	21.4	10	71.4

Sampling Procedure Used for Washington Salmon Sport Anglers

As mentioned earlier, the survey of Oregon salmon and steelhead anglers was already underway in 1977 before it was learned that similar expenditure data were also needed from Washington salmon anglers. Fortunately, however, based upon catch data (Hoines, Ward, and Nye, 1977), p. 26), about 83 percent of the salmon sport fishing activity appears to take place during the four-month period, June, July, August, and September. Consequently, there was time to draw a sample of Washington salmon sport anglers and to mail them questionnaires regarding their summer fishing activities.

Questionnaires were mailed to a sample of 5,000 Washington salmon punchcard holders, drawn from those anglers who received a punchcard during 1976. The sample represented approximately a 1.1 percent sampling rate. The State of Washington was divided into five geographical areas (shown in Appendix III) with a stratified sample from each area to provide more precise estimates of the variables of interest.

The first step in stratifying the sample was to obtain from the Washington Department of Fisheries a three percent sample of the salmon punchcards issued in 1976. Then, Area #4 (Appendix III), which consisted of Pierce and King counties, was re-sampled at a 25 percent rate while areas three and five were re-sampled at a 33 percent level. This procedure was used to ensure that the high population areas were not over-represented to the exclusion of the less populated areas, as explained earlier for the Oregon sample. All the names were used in the remaining areas as shown in Table 6 (a list of all counties in each area is given in Appendix III).

Table 6. Stratification of the Sample Used to Draw Names of Washington Anglers

Area	Number of Punchcards 1976	Percent Punch-Cards	Estimated No. of Questionnaires Sent
1	23,525	5.4	630
2	27,825	6.4	724
3	101,245	23.2	806*
4	201,469	46.1	1,201**
5	83,138	19.0	690*
	437,202	100.1	4,051
Out-of-state			949
TOTAL			5,000

*33 percent rate **25 percent rate

Questionnaire employed for Washington anglers

The questionnaire was similar, but not identical to the questionnaire mailed to Oregon anglers, and is shown in Appendix V , along with cover letters. The questionnaire was composed of three major parts. The first part was designed to obtain demographic information concerning Washington anglers' age, household size, employment, and income information.

The second major area of the questionnaire was designed to obtain expenditure information for the last three fishing trips. A checklist of typical trip expenses was listed to help the respondent in completing

the section of the questionnaire as well as putting the information into a workable framework. The third part of the questionnaire consisted of a list of typical durable equipment expenditures. The anglers were asked the purchase price, year purchased, and the state where their fishing equipment was purchased.

Degree of questionnaire completion by Washington anglers

Questionnaires were mailed at the end of September, covering the period June 1 through September 30, 1977. An introductory letter, map, questionnaire, and post-paid return envelope were sent to the prospective respondents. The questionnaires were returned to Washington State University to avoid confusion for the respondent, rather than asking him to send the questionnaire directly to Oregon State University. The questionnaires were then forwarded to Oregon State University from Pullman for analysis. Those respondents who did not return their questionnaire from the first mailing were then sent a first reminder, along with another questionnaire. Finally, the respondent was telephoned if he did not return the second questionnaire. The telephoning procedure was also used in Oregon; however, due to limited time, the Washington telephoning was not as extensive as it was in Oregon. The third mailing (following the telephone reminder) increased the response rate 9.96 percent. The return rates are presented below:

Summary of Washington survey results:

Total mailing		5,000
Undeliverable	256	
Duplicates	5	
Deceased	10	
In a coma	1	272
		4,728
First mailing	1,202	
Second mailing	704	
Telephone reminder (Third mailing)	194	
TOTAL RETURN	2,100	

Response rate: 2,100 ÷ 4,728 = 44.4 percent

In addition to all non-respondents being reminded by telephone to complete and return the questionnaire, respondents whose questionnaire was incomplete (or suspected to be erroneous in some respect) were also telephoned. The complexity and detail of the questionnaire made it difficult for most respondents to accurately complete all phases. This made it necessary to contact as many respondents as could be reached by telephone to complete this information. The results of this correction procedure are summarized in Table 7.

Table 7. Washington Survey Corrections

	Number	Percentage
Total Questionnaires Returned	2,100	
Total Usable	1,948	92.8[a/]
Total Sent in Correct	645	30.7[a/]
Total Needing Correction	1,455	69.3[a/]
Total Contacted by Telephone	334	23.0[b/]
Total Not Contacted but Used	969	66.6[b/]
TOTAL UNUSABLE	152	10.4[b/]

[a/] Percentage based on total return of 2,100 questionnaires.

[b/] Percentage based on total questionnaires needing correction.

The number of respondents telephoned for correction was limited because of a money constraint, and as a result the correction procedure was not as extensive in Washington as it was in Oregon. There were 2,100 questionnaires returned of which 645 were complete as sent in, leaving 1,455 that needed correction. Of the 1,455 that needed correction, 334 were telephoned, but 14 of these refused to disclose their income. However, 969 respondents could not be reached by telephone within the limit available, but their questionnaires were coded and used "as is". Most of these 969 incomplete questionnaires that were coded were incomplete in only one respect (such as for the allocation of equipment between fishing or non-fishing, or lacked a complete listing of equipment) as shown in Table 8. There were also 152 respondents who could not be reached by telephone who had questionnaires

judged too incomplete to use, and these questionnaires were not coded for punching onto IBM cards.

Table 8. Degree of Completeness of Questionnaires Returned and Completed and/or Corrected by Telephone Versus Incomplete Questionnaires for Washington

Completion Code	Number of Respondents		Percent of Respondents in Each Code
(1) Complete and correct as returned	645		33.1
(2) Completed and/or corrected by telephone	320	334	16.4
(3) Completed and/or corrected by telephone except income refused	14		.7
(4) Complete except for hours worked/week[a/]	0		0
(5) Complete except for income[a/]	52		2.7
(6) Complete except for all fishing allocation[a/]	63		3.2
(7) Complete except for S-S fishing allocation[a/]	58		3.0
(8) Complete except for no allocation of any kind[a/]	185		9.5
(9) Complete except for equipment, page 4[a/]	611		31.4
TOTAL	1,948		100.0

[a/] These respondents could not be reached by telephone.

The telephone correction procedure raised the number of questionnaires complete in every regard from 645 to 965, an increase in percentage from $645 \div 4{,}728 \doteq 13.6$ percent to $965 \div 4{,}728 \doteq 20.4$ percent. The degree of completion of all questionnaires was categorized by using completion codes ranging from one through nine. The respondent's questionnaires were classified by the completeness code, and the number of respondents in each category are presented in Table 8.

The completeness codes were cross-tabulated with the age of the respondent to see if there was any relationship between questionnaire completeness and age. Only completeness codes 1, 2, 8, and 9 were used since these codes represented over 90 percent of the usable response. The results are presented in Table 9. Respondents in the 30-39 age group tended to complete their

questionnaire more often than the other age groups and were also able to have their questionnaire completed by telephone more often than any of the other age groups.

Table 9. Respondents Classified by Completeness Code and Age Group

Code		Under 21	21-29	30-39	40-49	50-59	60-69	70-over
(1) Complete as Returned	(No.)	82	120	161	96	102	70	14
	(%)	12.7	18.6	25.0	14.9	15.8	10.9	2.2
(2) Corrected by by Phone	(No.)	55	42	66	54	59	38	6
	(%)	17.2	13.1	20.6	16.9	18.4	11.9	1.9
(8) Complete except for no allocation	(No.)	10	15	38	37	46	36	3
	(%)	5.4	8.1	20.5	20.0	24.9	19.5	1.6
(9) Complete except for equipment	(No.)	63	76	113	102	128	94	35
	(%)	10.3	12.4	18.5	16.7	20.9	15.5	5.7

The completeness codes were also classified by the income group of the respondent to see if there was any relationship between questionnaire completeness and income group. Only completeness codes 1 and 2 were used for this analysis, and the results are presented in Table 10. Income did not

Table 10. Number and Percent of Respondents with Correct and Complete Questionnaires by Income Categories

	(1) Complete as Returned		(2) Complete After Phoning			
Income Category	Number of Respondents	Percent	Number of Respondents	Percent	Total Number	Total Percent
Under 3,000	10	30.3	6	18.2	16	48.5
3,000-4,999	13	28.9	8	17.8	21	46.7
5,000-7,999	35	31.8	14	12.7	49	44.5
8,000-11,999	62	31.0	37	18.5	99	49.5
12,000-14,999	72	34.0	39	18.4	111	52.4
15,000-17,999	92	36.3	35	14.1	127	50.4
18,000-24,999	187	37.2	93	18.5	280	55.7
25,000-34,999	113	35.6	56	17.7	169	53.3
35,000-49,999	43	36.8	20	17.1	63	53.9
50,000-100,000	15	28.8	10	19.2	25	48.0
over 100,000	3	18.8	2	12.5	5	31.3

seem to be an important factor either for sending in a completed questionnaire or for having the questionnaire corrected by telephone.

CHAPTER 4

ESTIMATED NET ECONOMIC BENEFITS OF THE OREGON SALMON AND STEELHEAD SPORT FISHERY

As explained in chapter 2, the net economic values for the anadromous salmonid sport fisheries were calculated using the travel cost method. This chapter contains an explanation of the differentiation of the anadromous salmonid fisheries, an explanation of the variables used in the regression equations, and the estimates of the consumer surplus for each of the fisheries.

Differentiation of Types of Fishing for The Oregon Anadromous Salmonid Fishery

One disadvantage of the questionnaire used in the 1962 survey of Oregon anglers (Brown, Singh, and Castle, 1964, pp. 44-47) was that the location where the fishing took place was not requested. Consequently, it was not possible to estimate values separately for ocean salmon fishing versus river salmon fishing. As a result, all salmon and steelhead fishing was lumped together, undoubtedly a gross oversimplification. However, the questionnaire used for the 1977 survey requested the name of the river, stream, lake, or ocean where the fishing took place, as well as the county where the port, river, lake, or stream was located, as shown in the questionnaire, Appendix V.

Given the information on location of fishing effort, travel cost-based demand functions were estimated separately for ocean salmon fishing, river salmon fishing, and steelhead fishing. It appears that separating out these different types of anadromous salmonid fishing should be much more accurate than aggregating them all together, as done for the earlier study by Brown, Singh, and Castle, 1964.

Ocean Salmon Sport Angling in Oregon

Even though the generally recommended travel cost method was selected for estimating sport angler benefits for this report, it needs to be noted that there is more than one specification of the travel cost-based demand model. For example, the quantity variable for recreational participation

has sometimes been specified in terms of recreational days. In other models, the number of trips or visits is taken to be the quantity variable. For this study, the unit of quantity is fishing trips, following the recommendation of Dwyer, Kelly, and Bowes, pp. 132. A description of all the variables used in the analysis is presented next.

Specification of variables in the demand for salmon-steelhead angling

As noted above, the number of fishing trips was selected as the unit of quantity. However, it should also be noted that considerable care must be taken in constructing the quantity variable if erroneous inferences are to be avoided, especially where a stratified sampling scheme has been employed, as for this study. The basic method used was to expand the number of trips in the sample so as to obtain an unbiased estimate of the total number of trips for the year for each distance zone. The blow-up factors varied by region and by quarter. Thus, the estimated total trips taken primarily to fish for salmon in the ocean for each zone were first computed. The number of salmon trips taken by the angler was asked in question 4 of the questionnaire (Appendix V). The expenditures per trip were calculated as an average of the last three salmon trips. A salmon trip was defined as a trip where the majority of the time spent fishing was for salmon. A more detailed explanation is contained in a later chapter.

After obtaining the expected total number of ocean salmon fishing trips for each zone, this zone total was divided by the population of the zone to give the expected per capita number of ocean salmon fishing trips for each zone. In most cases the zone population was simply the corresponding population of the county (or counties if there were two or more counties in the zone). However, for the case of some of the more populous counties, there were enough observations from the survey to subdivide the county into two or more zones.

At this point, it should be noted that each distance zone should contain approximately the same number of observations, if the travel cost demand function is to be estimated by ordinary least squares (OLS), as has usually been done. The reason that approximately equal numbers per zone are required if OLS is to be used is because the property of homoskedasticity is destroyed if unequal numbers of observations per zone are used, as explained by Johnston (1972, p. 229).

As was the case for all the regressions, the number of distance zones for a given species and river was determined by plotting the location of each respondent who fished that river throughout the state, and by dividing them into zones with approximately eight respondents per zone. The respondents were grouped into zones so as to have fairly uniform distances within the zone to the given river.

If there are enough observations from a populous county for two or more zones, how should the observations and population of the county be subdivided? Given the interest in the effect of income upon participation, a subdivision of the county by income would seem reasonable. However, in ordering the observations by income level, care should be taken to allocate the total population of the county in the proper proportion since the lower and middle income observations are drawn from a much greater proportion of the population than the respondents with high incomes. Therefore, the proportion of population represented by the various income classes needs to be based upon the income distribution, as discussed by Brown, 1976. For Oregon, the income distribution was based upon state income tax records (Oregon State Tax Commission, 1960).

In summary, the crucial quantity variable was defined as the expected number of per capita ocean salmon fishing trips per year per distance zone, or income subzone.

A listing and description of the dependent or quantity variable and various explanatory variables hypothesized to possibly influence salmon-steelhead and sport angling were the following:

$TRPSCAP_i$ is the estimated number of ocean salmon fishing trips per capita from distance zone i, as discussed above;

$TRVCST_i$ is the average travel cost in dollars (the three items under travel costs, Table 27) incurred by the anglers of zone i per ocean salmon fishing trip;

$TRVTM_i$ is the estimated average travel time in hours per ocean salmon fishing trip for zone i, computed by dividing total trip miles by 35 if trip was made in a camper or motorhome and by 40 if trip was by automobile or pickup;

$FSHEQP_i$ is the average replacement value ($) of fishing and related equipment used for all fishing per respondent for zone i;

$S\text{-}SEQP_i$ is the average replacement value ($) of fishing and related equipment used for salmon-steelhead fishing per respondent for zone i;

INC_i is the average income per respondent for zone i;

$INCSQ_i$ is INC_i squared;

$OPCSTM_i$ is the average estimated opportunity cost of travel time ($) per respondent of zone i, computed by multiplying travel time by the respondent's average hourly income. (If the respondent was retired, a student, or a part-time worker, their opportunity cost of time was set equal to zero.)

It should be noted that the OPCSTM variable is based upon an ingenious (but unpublished) suggestion by Professor Oscar Burt of Montana State University in July 1979, as a way to reduce multicollinearity resulting from the high positive correlation between travel cost and travel time. It has long been known that if the effect of travel time is ignored, the travel cost method will give an underestimate of the net economic benefits for an outdoor recreational activity, Knetsch (1963) and Cesario and Knetsch (1970). However, since travel costs and travel time are usually highly correlated, researchers have usually been forced to delete the travel time variable and to incur omitted-variable specification bias (Johnston, 1972, pp. 168-169). Although the correlation between travel cost and travel time was reduced, travel time was not significant at the 90 percent confidence level. Faced with the dilemma of choosing between specification bias and inefficiency of the expanatory variables, it was decided to delete the insignificant variables at the risk of incurring specification bias and at the risk of ignoring part of the theoretical framework. It was thought that the travel cost variable was more important to the understanding of the effect of travel cost on participation rates than the inclusion of the insignificant variables which decreased the explanatory power of the travel cost variable.

Estimated demand models for ocean sport salmon angling

Based upon some considerations to be discussed subsequently, the following equation was fitted by ordinary least squares (OLS),

$$(1)\quad \ln(TRPSCAP_i) = -2.467 \underset{(-2.52)}{-\ 0.01721\ TRVCST_i} + \underset{(0.92)}{0.00006402\ INC_i}$$

$$+ \underset{(0.12)}{0.00001761\ S\text{-}SEQP_i} \underset{(-0.26)}{-\ 0.001887\ OPCSTM_i} \underset{(-0.89)}{-\ 0.1084 \cdot 10^{-8}\ INCSQ_i}$$

$R^2 = 0.6625 \qquad n = 21 \qquad d = 1.50$

Values of t are given in parentheses below the estimated regression coefficients. All variables are the same as defined in the preceding section, and ln indicates the natural logarithm. The variable $S\text{-}SEQP_i$, average replacement value of S-S equipment per angler of zone i, was included in the set of explanatory variables as an indicator of tastes and preferences. It may be that value of S-S equipment was not statistically significant in (1) because much of the ocean salmon sport fishing is done on charter boats where all the necessary equipment is supplied. The opportunity cost of travel time, OPCSTM, also fell far short of statistical significance. However, it should be noted that the simple correlation between opportunity cost of time and travel cost was not as high as between travel time and cost, 0.78947 versus 0.95125. Improvements in the construction of the opportunity cost of time variable might lead to more significant results from this variable.

Deleting $S\text{-}SEQ_i$ and $OPCSTM_i$ from the model and refitting, Equation (2) was obtained:

$$(2)\quad \ln(TRPSCAP_i) = -2.508 \underset{(-5.70)}{- 0.01875\ TRVCST_i} + \underset{(1.21)}{0.00006931\ INC_i} - \underset{(-1.22)}{0.1224 \cdot 10^{-8}\ INCSQ_i}.$$

$R^2 = 0.6607 \qquad n = 21 \qquad d = 1.62$

Equation (2) was considered to be preferable to (1), especially given the greater precision indicated for the travel cost variable. (The travel cost variable is especially important because the estimated net economic benefits to the anglers depend crucially upon the coefficient of this variable.) Although Equation (2) was considered to be the best algebraic form of equation for estimating net economic benefits, the linear counterpart of (2) was also estimated, for sake of comparison:

$$(3)\quad TRPSCAP_i = 0.1284 \underset{(-2.58)}{- 0.001950\ TRVCST_i} + \underset{(0.67)}{0.8872 \cdot 10^{-5}\ INC_i} - \underset{(-0.8222)}{0.1905 \cdot 10^{-9}\ INCSQ_i}.$$

$R^2 = 0.3053 \qquad n = 21 \qquad d = 1.50$

It is interesting that the coefficients of the income and income squared variables in both Equations (2) and (3) indicate that per capita ocean salmon fishing first increases to a maximum for an income of around $23,000 for (3) and $28,000 for (2), then decreases. This quadratic behavior of

the income effect is similar to that reported by Brown (1976) for the 1962 Oregon salmon-steelhead sport fishery. It is thought that the statistical significance of the income coefficients could have been much higher, except for the high correlation between income and income squared, r = 0.97093. As a result, the variance inflation factor (VIF) for both coefficients were both approximately 17.6.

Estimated net economic benefits for Oregon ocean sport salmon anglers

Given the estimated travel cost-based demand functions, Equations (2) and (3), it is relatively simple to estimate the net economic benefits accruing to the ocean salmon anglers. Since estimated consumers' surplus was used for measuring net economic benefits (Dwyer, Kelly, and Bowes, 1977), for each zone an estimate of the area beneath the demand curve, but above the presently incurred travel cost, is needed. For Equation (2), the consumers' surplus for zone i is obtained by evaluating the definite integral:

$$(4)\quad \int_{TRVCST_i}^{\infty} b_i e^{-.01875X} dx$$

where b_i varies from zone to zone, depending upon the level of income or other explanatory variables in the demand equation. Actually, it is easy to show that (4) reduces to predicted $TRPSCAP_i$ divided by the negative of the travel cost coefficient, 0.01875. Computing the consumers' surplus per capita for each zone, then multiplying by the zone population, the total consumers' surplus for each zone was computed. Summing the consumers' surplus for each of the 21 zones gave a total estimated net economic benefit of approximately $13.1 million.

Dividing the total estimated net economic benefit by the total estimated number of trips gave an average net economic value of $13,081,150 ÷ 252,401 ≐ $51.82 per trip. (A discussion of the strengths and limitations of the preceding estimate of net economic benefits to Oregon ocean sport salmon anglers will be presented at the end of the chapter.)

Oregon Fresh-Water Sport Salmon Angling

As mentioned earlier with regard to ocean salmon sport angling, the demand for fresh-water salmon fishing was computed separately from the demand for ocean salmon fishing since these activities are essentially different commodities. Consequently, the demand for fresh-water salmon fishing was computed on a per river basis. Then, the estimated benefits will be summed for the individual rivers and added to the estimated benefits for ocean salmon fishing to give the estimated consumers' surplus for all sport salmon fishing by Oregon residents.

Estimated demand for fresh-water salmon angling

The procedure used to estimate the demand for fresh-water salmon angling was to select the eight most important salmon fishing rivers and to construct appropriate distance zones around each river. (Only eight rivers had enough respondents who fished for salmon in those rivers to permit construction of appropriate distance zones. As mentioned earlier, appropriate distance zones were constructed according to the number and location of the respondents' residences who fished a given river.) The slope of the demand curve was estimated by utilizing all the zone observations for all eight rivers, and consumers' surplus was calculated for each river. The more significant differences in per capita participation rates among the various rivers were accounted for by means of dummy variables. To avoid destroying the property of homoskedasticity (Johnston, p. 229), the number of observations per zone were kept approximately equal to seven. Some of the more populous counties were subdived into income subgroups to isolate the income effect, as explained earlier for ocean salmon angling.

From the set of explanatory variables explained earlier in detail for ocean salmon angling, the following demand equation for fresh-water salmon angling was estimated:

$$(5)\quad \ln(TRPSCAP_i) = -1.8132 - \underset{(-3.92)}{0.06088}\ TRVCST_i + \underset{(2.55)}{0.0004194}\ S\text{-}SEQP_i$$

$$- \underset{(-3.78)}{0.1125}\ OPCSTM_i + \underset{(1.92)}{2.581}X_5 - \underset{(-2.14)}{1.998}X_6 \quad . \qquad n = 25 \quad R^2 = 0.70203 \quad d = 1.96$$

Values of t are again given in parentheses below the estimated regression coefficients. The important travel cost variable, $TRVCST_i$, was again highly significant with a t value of nearly four. One important difference between the estimated demand for fresh-water salmon angling versus the earlier estimated demand for ocean salmon angling was that the replacement value for salmon-steelhead fishing and related equipment, $S\text{-}SEQP_i$, had much more explanatory value for fresh-water salmon angling. (As noted earlier, the fact that equipment is furnished for charter boat fishing would be expected to greatly reduce the effect of S-SEQP on ocean salmon angling participation.)

Also of considerable methodological interest is the fact that the variable measuring the opportunity cost of travel time, $OPCSTM_i$, was highly significant in Equation (5). (This variable, suggested by Professor Burt, was constructed by multiplying the respondent's travel time by the respondent's average hourly income.) One reason that $OPCSTM_i$ worked well in (5) was because the simple correlation between the travel cost variable, $TRVCST_i$, and $OPCSTM_i$ was only 0.30876, a remarkably low level compared to the correlation between, say, travel cost and estimated travel time.

Variables X_5 and X_6 were dummy variables for the Alsea and Clackamas rivers, respectively. It could be of considerable interest and value to further investigate the cause of the differences in participation rates for the various rivers.

Estimated net economic benefits for Oregon fresh-water salmon anglers

Following the same procedure outlined earlier for ocean salmon angling, consumers' surplus was computed for each distance zone of each river and summed to obtain the consumers' surplus for each of the eight rivers, shown in Table 11.

Table 11. Estimated Net Economic Benefits to Oregon Residents for Fresh-Water Salmon Angling, 1977, Based Upon Equation (5)

River	Estimated Net Economic Benefits
Columbia	$ 969,250
Rogue	332,770
Deschutes	179,240
Umpqua	167,870
Willamette	1,492,400
Alsea	100,380
Clackamas	166,160
Coos	39,090
Total	$3,447,160

The total estimated trips for fresh-water salmon fishing for the eight rivers shown in Table 45 were 205,176, yielding an average net economic value of $3,447,160 ÷ 205,176 ≐ $16.80 per trip. Since only eight rivers had enough respondents to include in the regression analysis, it was assumed that the other rivers would have had about the same average value of $16.80 per trip. There were an estimated 163,240 trips to these other rivers; therefore, the net economic benefit accruing to Oregon resident anglers for these other rivers was estimated to be 163,240 x $16.80 ≐ $2,742,400. Thus, the total net economic value of all fresh-water salmon fishing in Oregon to Oregon residents was estimated to be $3,447,160 + $2,742,400 ≐ $6.19 million. (Limitations pertaining to these and other estimates of benefits will be discussed in detail at the end of the chapter.)

Oregon Steelhead Angling

Just as ocean salmon sport angling seemed sufficiently different from fresh-water salmon angling to justify treating the two fishing activities separately, steelhead would also appear to differ significantly from fresh-water salmon angling, as well as from ocean salmon angling. Consequently, the demand for steelhead fishing was also estimated separately and in a manner similar to that for fresh-water salmon. This is, the travel cost-based estimates of demand were computed on a per-river basis, with distance zones being constructed for each river, but then combining all the rivers into one equation for greater efficiency in estimation.

Estimated demand for steelhead fishing

There were 18 rivers with sufficient observations to use in estimating the demand model for steelhead angling. These rivers were the Alsea, Chetco, Clackamas, Columbia, Coquille, Coos, Deschutes, John Day, Nehalem, Nestucca, Rogue (and its tributary, the Illinois), Trask, Umpqua, Wilson, Salmon, Sandy, Siletz, and Siuslaw. The following demand equation was estimated by ordinary least squares (OLS):

$$(6)\quad \ln(TRPSCAP_i) = -2.1761 - \underset{(-9.15)}{0.04846}\ TRVCST_i - \underset{(-3.63)}{1.3455}\ X_2 - \underset{(-2.09)}{1.4965}\ X_5$$
$$- \underset{(-2.58)}{1.3115}\ X_{14} - \underset{(-2.54)}{1.0731}\ X_{15} \qquad n = 63 \qquad R^2 = 0.62645 \qquad d = 1.94$$

One difference between the estimated demand for steelhead fishing in (6) versus the demand equations for ocean and fresh-water sport salmon angling was that none of the opportunity cost of time or fishing equipment variables came close to being statistically significant in the steelhead fishing demand equation, emphasizing the differences in the different types of angling. However, four of the rivers had significant dummy variables, X_2, X_5, X_{14}, and X_{15}, representing the Clackamas, Coos, Salmon, and Sandy rivers, respectively.

Although it is possible that some omitted-variable specification bias could be incurred by not including some of the income or S-S equipment related variables in (6), the results of fitting other regresssion equations that included these variables indicated that the squared error of the important travel cost variable would likely be greatly increased by including these other variables. Considering the fact that estimated net economic benefits are directly related to the travel cost coefficient, as shown earlier in the section on estimated benefits for ocean salmon angling, Equation (6) was judged to be the more accurate equation to use for estimating net economic benefits. However, additional research is needed to ascertain the reasons for the differences in demand for steelhead fishing versus inland and ocean salmon angling.

Estimated net economic benefits for Oregon steelhead anglers

Following again the same procedure outlined earlier for ocean salmon angling, net economic benefits were computed for each distance zone of each river and summed to obtain the estimated benefits for each of the 18 rivers, shown in Table 12.

It should be noted that the procedure used in estimating the net economic values in Tables 11 and 12 provides more precision for the predicted total or average benefits than for the estimated benefits from each individual river. The rivers with smaller estimated benefits were represented by only a few respondents per river, and the estimated benefits are, therefore, estimated with less reliability.

The average net economic value per steelhead trip was estimated to be $9,962,360 ÷ 417,612 ≐ $23.86 per trip. However, there were another 94,660 trips estimated for other rivers. If these other trips are assumed to be approximately the same in value, then the estimated total net economic benefits would be increased by approximately $2,258,600. Thus, total net economic benefits from steelhead angling in Oregon would sum to $9,962,360 + 2,258,600 ≐ $12.22 million.

Table 12. Estimated Net Economic Benefits to Oregon Residents for 1977 Steelhead Angling, Based Upon Equation (6)

River	Estimated Net Economic Benefits
Alsea	$ 280,240
Chetco	55,630
Clackamas	506,070
Columbia	944,330
Coquille	219,930
Coos	23,600
Deschutes	699,380
John Day	114,770
Nehalem	559,450
Nestucca	1,363,490
Rogue and Illinois	892,780
Trask	1,008,810
Umpqua	543,960
Wilson	1,038,840
Salmon	263,120
Sandy	440,880
Siletz	660,950
Siuslaw	346,130
TOTAL	$ 9,962,360

Conclusions and Limitations Regarding Estimated Oregon Net Benefits

Adding the estimated net economic benefits of the sport fishery for the ocean salmon, fresh-water salmon, and steelhead, a total net economic benefit to Oregon residents in 1977 was $13,081,150 + $6,189,560 + $12,220,560 ≐ $31.49 million. It is interesting that the estimated $31.49 million net economic benefits are more than twice the estimated $14.8 million S-S travel costs, shown earlier in Table 24. In fact, the $31.49 million estimated benefits exceed the sum of both travel and destination expenses of $29.68 million, Table 24. The high estimated net economic benefits relative to travel costs result from the fairly inelastic demands predicted from Equations (3), (5), and (6), at least at the mean values of the explanatory variables.

Certain limitations pertaining to the above estimated net economic benefits should be noted. Probably the strongest limitation is with regard to nonresponse bias. Out of 8,461 questionnaires supposedly delivered, only 1,261 were complete and correct as returned, and 2,300 more were completed and/or corrected by telephone, Table 3. Since only the 3,561 complete questionnaires could be used for estimating net economic benefits, a substantial nonresponse bias could result from the 8,461 - 4,704 = 3,757 persons not returning their questionnaires, as well as from the 4,704 - 3,561 = 1,143 incomplete questionnaires.

The effect of the nonresponse bias is thought to result in an overestimate of the number of trips and costs since the more enthusiastic anglers may be more likely to complete and return their questionnaires. Consequently, a corresponding overestimate of net economic benefits could result. However, the preceding remarks pertaining to the effect of nonresponse bias are admittedly speculative, and additional research is badly needed to better evaluate the effect of nonresponse. The magnitude of nonresponse bias could be identified for certain estimates of interest, such as catch, effort, and expenditures by tabulating these items by response category, i.e., first mailing return, second mailing return, third mailing return.

Another aspect of the estimated net economic benefits should also be mentioned. Although the consumers' surplus method for measuring net economic benefits is usually recommended and used (Dwyer, Kelly, and Bowes), the consumers' surplus approach respresents the maximum willingness to pay in that it assumes that each consumer's net benefit is the maximum price that he would pay minus the actual travel cost that he presently incurs. In reality, it would not be possible to know the unique, maximum price to charge each person. Therefore, Clawson (1959) estimated the one price that would maximize revenue to a single owner. Using the one price-single owner approach results in an estimated revenue to the single owner that is usually only about one-half that of the consumers' surplus approach (Brown, Singh, and Castle, p. 42). While the consumers' surplus approach does probably best measure the net economic benefit to the recreational participants, it needs to be kept in mind that not more than one-half of the estimated consumers' surplus could actually be captured by a single owner charging recreationists a single price.

CHAPTER 5

ESTIMATED NET ECONOMIC BENEFITS OF THE WASHINGTON SALMON SPORT FISHERY

Estimates for the net economic values for the anadromous salmonid fishery for Washington State were calculated using the same procedure as was used in Oregon. The travel cost method was used to estimate the consumer surplus in the same manner used in Oregon with the exception that only the salmon fishery was used. The salmon fishery was differentiated in Washington just as it was in Oregon. The rest of the chapter contains an explanation of the different fisheries along with the estimates of the net economic values for each fishery.

Differentiation of Types of Fishing for The Washington Salmon Fishery

As for the case of salmon and steelhead angling in Oregon, Chapter 6, the demand equations for different types of salmon sport fishing in Washington were estimated separately. In Washington, the three main types of salmon sport fishing appeared to be ocean, Puget Sound, and fresh-water fishing. Consequently, demand estimates for these three sport fisheries were estimated individually.

Ocean Salmon Sport Angling in Washington

Specification of the variables used to estimate the travel-cost based estimates of demand for Washington salmon sport angling was essentially the same as for those presented earlier for Oregon in Chapter 6. Also, the port areas included in our analysis of the ocean salmon sport fishery were primarily ports in marine areas 1, 2, 3, 4, and 5. (Marine area 5 was combined with marine areas 3 and 4, partly because it would have taken

unavailable time to have separated area 5 from areas 3 and 4.) These areas of the Washington salmon sport fishery are very important with anglers landing over 64 percent of the total Washington salmon sport catch (Hoines, Ward, and Nye, 1977, p. 12).

Estimated demand for ocean sport salmon angling

The procedure used to estimate the demand for ocean sport salmon angling in Washington was to construct appropriate distance zones around the main port areas from which sport fishing trips were made, namely, Ilwaco, Westport, and the combined marine areas 3, 4, and 5. (Neah Bay, La Push, Sekiu, and Pillar Point were combined since the sample contained fewer observations for these individual ports. Also, all of these ports were located within Clallam County).

The most satisfactory of the various demand equations estimated appeared to be the following:

$$(7)\quad \ln(TRPSCAP_i) = -1.9505 - \underset{(-5.43)}{0.02199}\ TRVCST_i - \underset{(-1.33)}{0.001948}\ OPCSTM_i - \underset{(-2.65)}{1.9418}\ X_4$$

$$n = 54 \qquad R^2 = 0.56286 \qquad d = 1.46$$

In (7), $\ln (TRPSCAP_i)$ again refers to the natural log of salmon fishing trips per capita for distance zone $_i$. The important travel cost variable, $TRVCST_i$ was again highly significant with a t value of over five. Although not significant at the five percent level, the opportunity cost of time variable, $OPCSTM_i$, was retained for better specification since its coefficient had the expected sign and would be significant at the 20 percent level. The income and income squared variables had very low values of t in equations where they were included and, therefore were not included in (7).

The variable X_4 represents a dummy variable shifter for anglers from the Seattle area who fished at Ilwaco. An equation similar to (7), but without X_4, greatly overestimated the per capita participation rate at Ilwaco since most Seattle residents would usually prefer to fish in the ocean from

Westport, rather than traveling further on to fish from Ilwaco. Since travel cost alone would not explain the sharp decline in participation rate by Seattle residents at Ilwaco, the variable X_4 was included in (7) to permit this shift. (The use of a more sophisticated set of estimating equations might better reflect the substitution among the parts, but an exploration of such models was not possible within the data constraints for this research. Also, as far as estimation of net economic benefits, it is believed that (7) gave fairly accurate estimates.)

Estimated net economic benefits to Washington residents from ocean sport salmon angling

Although the fishing in marine area 5, Sekiu and Pillar Point, is not usually designated as ocean fishing since it is located in the Strait of Juan de Fuca, it better fit the travel cost model to be included with marine areas 3 and 4, as explained earlier. Following the same procedure outlined earlier for salmon and steelhead angling in Oregon, consumers' surplus was computed for each distance zone of each of the three main port areas and summed to obtain the consumers' surplus for each port area, shown in Table 13.

Table 13. Estimated Net Economic Benefits to Washington Residents for Ocean Salmon Sport Angling, 1977, Based Upon Equation (7)

Port Area	Estimated Net Economic Benefits
Marine area 1, Ilwaco	$ 4,278,700
Marine area 2, Westport	8,255,500
Marine areas 3, 4, and 5	7,731,200
Total	$20,265,400

It needs to be kept in mind that the estimated benefits in Table 13 are benefits to Washington anglers only. (There were also large numbers of out-of-state anglers whose benefits are not included in Table 13 and the effect of the out-of-state angler trips will be considered next.) However, considering only Washington residents, the estimated benefits of $20,265,400 in

Table 13 result in an estimated net economic benefit per trip of $49.95.

Turning to the out-of-state anglers, these anglers caught an estimated 114,331 salmon in marine area 1 in 1977 as compared to 100,761 caught by Washington residents (Hoines, Ward, and Nye, pp. 43-45). If we assume that angling days, trips, and values for out-of-state anglers are in the same proportion as salmon catch, then out-of-state anglers realized a net economic benefit of 114,331÷100,761≐1.1347 times the net benefit to Washington resident anglers, i.e., 1.1347 ($4,278,700)≐$4,855,000. Thus, the total net economic benefit or value to all anglers fishing for salmon in marine area 1 would be about $9,134,000.

Similarly, the net economic benefits to out-of-state residents fishing in marine area 2 can be calculated on the basis of their proportion of the catch as 66,016 ÷ 217,953 ≐ 0.3029, indicating a net benefit to out-of-state anglers of about 0.3029 ($8,255,500) ≐ $2,500,600, or a total benefit to all sport anglers of about $10,756,000 from salmon fishing in marine area two. A similar computation for the combined marine areas 3, 4, 5 indicates an estimated out-of-state benefit of about 0.1600 ($7,731,200) ≐ $1,237,000, yielding a total benefit to all anglers in marine areas 3, 4, and 5 of about $8,968,000. Therefore, by this procedure for estimating benefits to out-of-state anglers, total estimated net economic benefits from salmon sport fishing in marine areas 1, 2, 3, 4, and 5 in 1977 would be $9,134,000 + $10,756,000 + $8,968,000 ≐ $28,858,000.

Comparison of estimated benefits with other studies

There have been relatively few studies that have attempted to estimate net economic benefits from salmon sport fishing. An updated analysis of 1962 survey data, originally reported by Brown, Singh, and Castle (1964), was made by Brown, Larson, Johnston, and Wahle (1976, pp. 15-19). The updated analysis resulted in an estimated net economic value of approximately $22 per day for all salmon-steelhead fishing in Oregon in terms of 1974 prices (Brown, Larson, Johnston, and Wahle).

From a 1967 survey using a direct question approach, Mathews and Brown (1970) estimated an average value per fishing day in ocean areas for Washington of around $63 in 1968 dollars. However, a carefully planned and well executed study by Crutchfield and Schelle (1978) reported total net benefits (1978 dollars) ranging from $21,426,500 to $29,400,000 to approximately $40,000,000, based upon willingness to sell and with various upper bounds. (The $29.4 million estimated benefit was associated with a $1,000 upper bound on individual responses whereas approximately $40 million was obtained with a $2,000 upper bound.)

To be more comparable with the net benefits estimated by Crutchfield and Schelle, the estimated benefits for the extra fishing trips going to marine area 5 need to be subtracted. Since marine area 5 had an estimated 103,355 marine angler trips as compared to 28,981 for area 3 and 56,238 for area 4, a crude estimate of benefits for marine areas 3 and 4 would be 85,219 ÷ 188,574 times the total benefit for areas 3, 4, and 5 of $8,968,000, equal about $4,053,000 for marine areas 3 and 4.

Adding the estimates of benefits for marine areas 1 and 2 plus combined areas 3 and 4, the estimated benefits would be $9,134,000 + $10,756,000 + $4,053,000 = $23,943,000. (This estimate would result in an average net value per fishing day of approximately $45.) The total value estimate of about $23.9 million is above the most restricted estimate of willingness-to-sell of $21.4 million by Crutchfield and Schelle, but below their estimate of $29.4 million with the $1,000 upper bound restriction.

Estimated net economic benefits per angler day for the Washington ocean sport salmon fishery are summarized in Table 14 for the various studies. The estimated net benefit of $45 per angler day is above the estimated willingness-to-sell of $40 with the $500 upper bound by Crutchfield and Schelle, but below their estimate of $55 per day with the $1,000 upper bound per angler. Neither my nor Crutchfield and Schelle's estimated benefits approach Mathews and Brown's estimate in real terms, and it is not known why the earlier Mathews-Brown estimate is higher in real dollars. However, Bishop and Heberlein (1979) did find that hypothetical willingness to sell estimates

Table 14. Comparison of Estimated Net Economic Benefits (Consumers' Surplus) per Salmon Fishing Day in Ocean Areas of Washington from Several Studies.

Investigators	Methodology	Net Benefits per Angler Day
Mathews & Brown	Direct Question, willingness to sell, $500 upper bound	$63 /a
Crutchfield & Schelle	Direct Question, willingness to pay, $500 upper bound	$18 /b
Crutchfield & Schelle	Direct Question, willingness to sell, $500 upper bound	$40 /b
Crutchfield & Schelle	Direct Question, willingness to sell, $1,000 upper bound	$55 /b
Crutchfield & Schelle	Direct Question, willingness to sell, $2,000 upper bound	$75 /b
Sorhus	Travel Cost Approach	$45 /c

a/ 1968 price level.

b/ 1978 price level.

c/ 1977 price level.

of value exceeded values based upon actual cash offers to sell, whereas travel cost estimates underestimated actual willingness-to-sell values.

Some important limitations of the estimates of benefits should be noted. The nonresponse by a large share of the anglers is thought to be a factor biasing the estimates upward, based on the premise that the more enthusiastic and active anglers tend to respond more than those anglers who fish less. On the other hand, the assumption of the same benefit per trip to out-of-state anglers as for Washington residents may understate the out-of-state angler benefits since Crutchfield and Schelle obtained higher estimates of willingness-to-pay and willingness-to-sell for the out-of-state anglers as compared to the Washington residents.

Salmon Sport Angling in the Puget Sound Area

Although fewer salmon were caught in Puget Sound as compared to the ocean, 326,514 salmon caught in marine areas 6, 7, 8, 10, 11, and 13 as compared to 694,951 salmon caught in marine areas 1, 2, 3 and 4 (Hoines, Ward, and Nye), the Puget Sound fishery led in terms of total marine angler fishing trips. Marine area 6-13 had almost two-thirds of the total marine angler trips in 1977. However, fishing trip miles averaged much less for the Puget Sound fishery, and fishing trip costs were much lower for Puget Sound than for the ocean fishery. As a result, much lower net economic benefits per trip were estimated from the demand model for Puget Sound as compared to the ocean fishery.

Estimated demand for sport salmon angling in Puget Sound

The procedure used to estimate the demand for sport salmon angling in Puget Sound was to construct distance zones around the main Puget Sound area, based primarily upon counties. (Another possible approach would have been to try to construct separate sets of distance zones around the various marine areas of Puget Sound. However, the lack of sufficient data precluded making this more elaborate analysis.)

One of the most satisfactory of various demand equations fitted appeared to be Equation (8):

$$(8)\quad \ln(TRPSCAP_i) = -1.9452 - \underset{(-7.24)}{0.1027}\ TRVCST_i + \underset{(5.51)}{0.6119.10^{-4}}\ INC_i$$

$$n = 18 \qquad R^2 = 0.87649 \qquad d = 2.19$$

Values of t, given in parentheses below the estimated regression coefficients, indicate that the effect of the travel cost variable, $TRVCST_i$,

was statistically highly significant, as was also true for the income variable. However, none of the other explanatory variables seemed to improve the performance of the demand equation, possibly because of the relatively low number of observations, n = 18.

It should be noted that the travel cost method is considered to be less reliable when it is applied to types of recreation that do not require much travel, or where the distances traveled by users do not show sufficient variation (Dwyer, Kelly, and Bowes, p. 139). Therefore, the application of the travel cost method to the Puget Sound sport salmon fishery may not work as well as the application to the ocean sport salmon fishery where the average distances traveled are much greater. Nevertheless, despite the shorter distances traveled to fish for salmon in Puget Sound, the effect of travel cost on participation was quite statistically significant in Equation (8), as indicated by a value of $t = -7.24$.

Estimated economic benefits from Puget Sound sport salmon angling

Following the same general procedure outlined earlier for the other sport fisheries, consumers' surplus was computed for each distance zone, then summed for all distance zones to obtain a total consumers' surplus of $6,430,900. However, in Puget Sound there is a great deal of salmon sport fishing occuring before or after the June-September period covered by the survey. Consequently, the estimated benefits for June to September need to be multiplied by the ratio, R, of all angling trips to the June-September angling trips, estimated to be $R \doteq 1.6789$. Therefore, the net economic benefits from the Puget Sound salmon sport fishery was estimated to be about $10.8 million.

Limitations of the preceding estimate of net economic benefits of $10.8 million from sport salmon angling in Puget Sound need to be specified. In addition to the usual problems of a fairly small sample and non-response bias, only a very limited number of specifications of the travel-cost based demand models were possible, due to limited data for the net economic benefit estimation. The sensitivity of the benefit estimation to the demand model specification needs further research, not only for the Puget Sound fishery, but for all the fisheries.

The total estimated benefit of $10.8 million is likely too low, based upon the research findings of Bishop and Heberlein discussed earlier. Also, Mathews and Brown estimated a total benefit for Puget Sound of $18.8 million (1968 prices), far higher than my estimate. However, as noted earlier, Bishop and Heberlein's study indicated a substantial overestimate from the hypothetical willingness to sell approach used by Mathews and Brown, and a substantial underestimate from the simple travel cost method. Additional research to respecify (8) so as to capture the effect of opportunity cost of travel time and other variables could well reduce the range of uncertainty associated with the estimated benefits from Equation (8)

Washington Fresh-Water Sport Salmon Angling

Although the largest share of the sport fishing effort in the ocean and in Puget Sound occurs during the June-September period covered by our survey of Washington anglers, slightly less than one-half of the fresh-water salmon in 1977 were caught from June to September (Hoines, Ward, and Nye, p. 41). Furthermore, since fresh-water salmon respresented only about eight percent of the total salmon sport catch, the problems of a small sample become acute in trying to estimate travel cost-based demand equations.

Estimated demand for fresh-water salmon angling

Following a similar procedure as that used for the other fisheries, distance zones were constructed around the most important rivers. Unfortunately, as noted earlier, there were very few observations for fresh-water salmon angling in Washington. Consequently, only eight distance zones could be constructed, using the Columbia, Cowlitz, and Lewis rivers. There were insufficient observations for the other rivers. At any rate, based upon these eight observations, the following equation was fitted:

$$(8)\quad \ln(TRPCAF_i) = -2.9371 - \underset{(-1.73)}{0.02394}\ TRVCST_i$$

$$n = 8 \qquad R^2 = 0.33236 \qquad d = 2.66$$

As might well have been expected with only eight observations, the important travel cost variable in (8) falls short of statistical significance at the five percent probability level. Thus, not very much confidence should be placed on the estimates of value based upon Equation (8).

Estimated net economic benefits from fresh-water sport salmon angling

Given the insufficient number of observations for estimating the demand equation for Washington fresh-water salmon angling, the Oregon demand equations for fresh-water salmon angling and steelhead angling would probably form a better basis for estimating the economic benefit per trip for Washington fresh-water salmon angling. Based upon the Oregon data, the Washington fresh-water salmon angling trips would have a net economic value of $16 to $20 per trip. The Washington survey (with admittedly scanty data) indicated about 154,560 fresh-water salmon angling trips. If so, then the net economic benefits are thought to range from about $16 (154,560) ≐ $2.5 million to around $20 (154,560) ≐ $3.1 million.

An estimated benefit per angler day of around $32 (1968 dollars) for fresh water salmon angling was reported by Mathews and Brown, far higher than my estimates. This discrepancy may be partly due to the difference in the methods of estimation, as shown by Bishop and Heberlein. However, additional research to improve the specification of the demand functions could reduce the uncertainty associated with the presently available estimates of value.

CHAPTER 6

CHARACTERISTICS AND EXPENDITURES OF OREGON ANGLERS

Effect of Age and Income Upon Fishing Patterns and Expenditures

As part of gathering the data necessary to estimate the net economic value of the various fisheries, there is an opportunity to examine a number of interesting information. Although this extra information is not directly connected with the central theme of the thesis, it is believed to be of sufficient value to be included in the text. The following type of information is potentially useful for subsequent research in this area of study, but just as important is the fact that the inclusion of the following data adds to the reservoir of information. The type of data contained in the chapter consists of demographic information such as age, income and expenditure patterns. Again, this information is not used in this study to calculate net economic values, but it will be used as a resource for demographic research, for legislative councils, and for comparative purposes.

Effect of age upon fishing and expenditures

The respondents were categorized according to age in one of seven age groups. The number of respondents in each category are listed in Table 15.

Table 15. Frequency of Respondents in Each Category

Age	Number of Respondents	Percent
Under 21	464	10.8
21-29	809	18.9
30-39	770	17.9
40-49	642	15.0
50-59	674	15.7
60-69	528	12.3
70-over	403	9.4
TOTAL	4,290	100.0

The bulk of the respondents ranged between the ages 21 to 59, which represented 67.5 percent of the total number of those anglers who responded to the questionnaire.

The total number of fishing trips includes trips that were primarily for fishing and trips for other purposes, but where some fishing was done. Total trips and trips primarily for fishing were sub-divided into age groups and the results are presented in Table 16. In both groups, total

trips and trips primarily for fishing, age groups under 21 and 21-29 took the most trips, on the average.

Fishing trips were also classified by the species of primary interest. These trips were then classified by age group to see which age groups fished for which species. The primary trips of interest were trips for steelhead, salmon, trout, and other species. The results are shown in Table 17. The younger anglers (under 21-49) tended to go on more steelhead and trout trips while the middle aged and senior aged anglers tended to go on more salmon fishing trips.

Table 16. Total Fishing Trips and Trips Primarily for Fishing by Age Group

Age	Total Fishing Trips Mean No. of Trips Per Respondent	Trips Primarily for Fishing Mean No. of Trips Per Respondent
Under 21	8.1	7.0
21-29	7.3	6.6
30-39	6.0	5.6
40-49	5.8	4.5
50-59	5.0	4.7
60-69	5.7	5.7
70-over	5.1	5.3

Table 17. Primary Species Trips by Age Group

Age	Steelhead Trips Per Angler	Salmon Trips Per Angler	Trout Trips Per Angler	Other Species Trips/Angler
Under 21	2.0	1.0	5.5	1.9
21-29	2.0	1.4	4.9	1.8
30-39	1.7	1.2	3.9	2.0
40-49	1.6	1.5	3.6	2.0
50-59	1.3	2.4	3.1	1.4
60-69	1.7	3.0	3.4	2.0
70-over	1.8	2.0	3.1	1.0

Average miles per trip and average expected time per trip were computed using the following procedure. The total miles the respondent travelled, the total time spent on the trip, and the total expected length of stay in hours were divided by three if the respondent reported trip

information for three trips; divided by two if he reported that he went on two trips, and one if he reported one trip. This procedure yielded the average miles travelled per trip, average length of stay in hours, and average expected length of stay in hours for the last trips of the quarter that the angler took. Average destination and average travel expenses were calculated in the same way. Travel expenses were a summation of food, drink, lodging, and transportation costs en route while destination expenses were a summation of expenditures at the destination for food, drink, lodging, guide service and charter fees, bait, lures, rental equipment, boat launching fees, and gas purchased for boats. Transportation costs were calculated on a cost per mile basis. The cost per mile estimate used for a pickup or car was 9.75 cents, while the cost per mile estimate for a camper, motor home, or pickup with camper was 11.6 cents per mile (U.S. Department of Transportation, 1977).

Average miles per trip, average expected length of stay per trip, and trip expenses were classified by age group to find out which age groups tended to go farther per trip, spend more money, and stay longer per trip. No great differences among age groups were observed, except for the under 21 groups which travelled and spent only about three-fourths of the average, and the over 70 groups which travelled and spent only about one-half as much per trip as the average.

Total replacement value of fishing and fishing-related equipment used for all fishing and total replacement value of fishing and related equipment used for salmon-steelhead (S-S) fishing, as listed on page 4 of the questionnaire, were classified by age group in Table 14. The middle-aged respondents, 40-49 and 50-59, accounted for the highest value for equipment allocated to all fishing, and also for S-S fishing, but to a lesser extent.

Table 18. Replacement Value of Fishing and Related Equipment Allocated to All-Fishing and S-S Fishing by Age Group

Age	Replacement Value of Equipment Allocated to All Fishing Per Respondent		Replacement Value of Equipment Allocated to S-S Fishing Per Respondent	
	Mean	Sample Total	Mean	Sample Total
Under 21	$ 353	$ 164,000	108	$ 50,000
21-29	472	383,000	236	191,000
30-39	756	583,000	354	272,000
40-49	1,049	673,000	498	319,000
50-59	981	663,000	438	295,000
60-69	736	388,000	350	184,000
70-over	$ 441	$ 178,000	165	$ 66,000

Effect of income upon fishing expenditures

The respondents were classified into income groups ranging from under $3,000 annual household income to over $100,000 annual household income. Various factors were classified by income group to check for relationships. The first table contains a breakdown of some general demographic characteristics of the Oregon angler by income group. The demographic characteristics believed to be important were number of persons per household and number of hours worked per week. The results are presented in Table 19. On the average, families with higher incomes tended to work more hours per week and had slightly larger families.

Table 19. Number of Persons Per Household and Number of Hours Worked Per Week by Income Group

Income Group	Average Number of Persons/Household	Average Number of Hours Worked Per Week
Under $3,000	2.6	21.1
3,000-4,999	2.1	20.4
5,000-7,999	2.5	27.0
8,000-11,999	2.7	33.4
12,000-14,999	3.1	35.7
15,000-17,999	3.2	35.5
18,000-24,999	3.3	38.0
25,000-34,999	3.5	38.8
35,000-49,999	3.4	40.3
50,000-100,000	3.2	41.8
Over 100,000	3.6	39.4
Av. per Sample	3.0	35.0

The number and type of fishing trip taken by respondent was classified by income groups, but there were no important trends between income and number of trips taken. However, income did seem to affect the characteristics of the trip, such as average miles per trip, average expenses, average time per trip, and average number of persons per trip. The sample data seemed to indicate that anglers with higher incomes tended to go farther per trip, stay longer, and spend more money, both for travelling and destination purchases, than those anglers with lower incomes. The average number of anglers in the group per trip did not follow much of a pattern. No matter what the income of the angler, the average number going on the fishing trip varied from one to two persons.

Durable equipment was also considered as it related to income. Durable fishing and related equipment was divided into four sub-groups, and each sub-group was classified by income group. The first two sub-groups were total equipment used for all fishing and total equipment used for S-S fishing. Fishing tackle used for all fishing and S-S fishing were the last two sub-groups. The results are presented in Table 20. Anglers with

higher incomes tended to buy much more equipment, both for all fishing and for S-S fishing, except at the very highest income level. (However, the highest income level was a very small sample with only ten completed questionnaires. Consequently, no conclusions should be drawn about the value of fishing equipment for the over $100,000 income group, based upon such a small number for observations.)

Table 20. Average Replacement Value of Equipment Used for all Fishing, Equipment for S-S Fishing, Tackle Used for All Fishing, and Tackle Used for S-S Fishing by Income Group

Income Group	Mean Value of All Fishing Equipment	Mean Value of S-S Fishing Equipment	Mean Value of Tackle for All Fishing	Mean Value of Tackle for S-S Fishing
Under $3,000	266	93	70	13
3,000-4,999	306	68	70	9
5,000-7,999	435	107	96	15
8,000-11,999	525	239	129	21
12,000-14,999	648	256	138	27
15,000-17,999	749	455	137	22
18,000-24,999	910	402	156	28
25,000-34,999	1,133	607	191	47
35,000-49,999	1,151	456	227	45
50,000-100,000	1,355	664	143	18
over 100,000	123	38	90	25

As important as the fishing trip and expenditures are, the ultimate reward is catch. Success per hour by species was broken down by income groups; however, no trend was apparent for any species between success per hour and angler income.

The conclusions regarding the characteristics of the Oregon anglers categorized by income group were that those anglers with high incomes tended to take about the same number of trips as those with low incomes. However, high income anglers tended to travel longer distances per trip, stay longer, and spend more money per trip than anglers with lower incomes. Anglers whose incomes were higher also tended to buy much more equipment for fishing; however, there seemed to be little difference in fishing success between the higher and lower income anglers.

Average Expenditures by Anglers in the Sample

The first part of this section contains a summation of the different types of trip expenses while the second section contains a summation of durable equipment expenditures.

Average Trip Expenses

Trip expenses were itemized and summarized as follows: each item of expenditure was summed over all the trips taken and divided by the number of anglers to obtain a weighted average for each type of trip expense in Table 2. Vehicle cost was the cost of operating and maintaining a vehicle on a cost per mile basis. The cost of operation differentiated between autos and pickups versus motor homes and campers. Autos and pickups versus campers and motor homes were calculated on a per mile basis as follows (U.S. Department of Transportation, 1977):

	Maintenance, parts tires, etc.		Gas, oil (no tax)		All Taxes		Total
Autos & pickups	4.3¢	+	3.4¢	+	2.05¢	=	9.75¢/mile
Motor homes & campers	5.6¢	+	3.8¢	+	2.2¢	=	11.60¢/mile

Average replacement value of durable equipment

Replacement value of fishing and related equipment purchased from 1970 to 1976 was computed by multiplying the cost of the item times the ratio of the Consumer Price Index (CPI) for 1977 to the CPI for the year of purchase. The cost of items purchased before 1970 was multiplied by the ratio of the CPI for 1977 divided by the 1970 index. The amount of items, such as boats or camping equipment, allocated to all fishing or salmon-steelhead (S-S) fishing depended upon the percent of time that the angler indicated that the item was used for all fishing or S-S fishing. Thus, the replacement value of total fishing and related equipment per angler was sub-divided into equipment used for all fishing versus equipment used for S-S fishing.

Table 21. Average Expenditure Per Trip for All Angling by Different Types of Expenses During 1977

Type of Expenses	Weighted Average
(1) Vehicle cost	$ 6.53
(2) Food expense while travelling	4.03
(3) Lodging expenses while travelling	0.90
(4) Food expenses while at destination	1.75
(5) Lodging expenses while at destination	1.31
(6) Guide service expenses at destination	1.71
(7) Rental equipment expenses at destination	0.60
(8) Launching fees at destination	0.22
(9) Boat gas expenses at destination[a]	0.62
(10) Other rental expenses at destination	0.05
(11) Miscellaneous expenses at destination	1.07
Subtotal of travel expenses (items 1-3)	11.46
Subtotal of destination expenses (items 4-11)	7.33
TOTAL EXPENSES PER TRIP	$ 18.79

[a] Price per gallon was 66.9¢ from a survey of local service stations and an AAA representative.

Table 22 . Average Replacement Value of Equipment by Item Used for All Fishing and for S-S Fishing, 1977 Price Level

Item[b]	Ave. Replacement Value for Equipment Allocated to All Fishing	Total for Sample of All Fishing[a] Allocation	Ave. for S-S Fishing Allocation	Total for for Sample of Fishing Allocation[a]
Tackle	$ 137.32	$ 589,000	$ 24.33	$ 177,000
Boating equipment	159.29	683,000	147.20	108,000
Clothing	5.14	22,000	4.37	34,000
Camping equipment	396.50	1,701,000	143.70	1,047,000
Miscellaneous	$ 8.56	$ 37,000	$ 1.35	$ 11,000

[a] Total was for sample--expansion to the population will be presented in a later section.

[b] Individual items under each section are contained in the questionnaire in Appendix V .

The different equipment value categories used ranged from under $50 to over $5,000 per angler. These equipment value categories were broken down by average miles per trip to see if the respondents with higher equipment investment tended to go further per trip. The figures did show a positive trend between higher values of equipment and distance travelled per trip. This trend was stronger for the breakdown for equipment used for all fishing and peaked at the 1,001-1,500 dollar value. The trend was less pronounced for equipment used for S-S fishing.

Equipment used for all fishing and S-S fishing was sub-divided by item of purchase, and the sample summation is presented in Table 18. The percentage of all fishing equipment that anglers allocated to S-S fishing was 42 percent.

Estimated Total Expenditures by Oregon Anglers

Weighting and expansion factors

It is important at this point to discuss the weighting factors and the method of calculation. Each of the weighting factors were calculated on a regional, as well as a quarterly basis for expenditures related to all fishing. Region 1 includes Multnomah, Clackamas, Washington, Yamhill, Polk, Benton, Marion, Linn, and Lane counties; Region 2 includes Douglas, Jackson, and Josephine counties; and Region 3 includes all the remaining Oregon counties. The expansion factors used were based on licenses sold ("Oregon Department of Fish and Wildlife," 1977) in each region by quarter. Thus, N_{ij} represents the number of licenses sold in the i^{th} region in the j^{th} quarter.

The total number of licenses sold in the population was divided into annual and temporary licenses. The first quarter (January-March) population of the i^{th} region (N_{i1}) consisted of those anglers who purchased annual or temporary licenses during January, February or March in the "i^{th}" region. The second quarter population of the i^{th} (N_{i2}) consisted of those anglers who bought yearly licenses or temporary licenses during April, May, or June in the "i^{th}" region, plus the cumulated annual licenses from the preceding

quarter. Thus, those anglers eligible to fish in the second quarter are anglers who were already in possession of an annual license from the preceding quarter. It was assumed that any temporary licenses expired during the quarter in which it was purchased. It was further assumed that the anglers bought licenses in all the regions at the same proportional rate throughout the year. An example of each of the weighting methods is included in Appendix I along with the results of the calculations. Since different aspects of the study require different weighting systems, the method of calculating the expansion factors is found in Appendix I and the method and justification is associated with each of the items.

The cumulative method of calculating the expansion factors was used to estimate fishing trip expenses because it was believed that those anglers who purchased yearly licenses in the first quarter were eligible to fish and incur fishing trip expenses in the second quarter, and thus were added to those anglers who purchased yearly licenses during the second quarter. In general, the expansion factors were calculated by dividing the accumulated total number of licenses sold in each region for each quarter (N_{ij}) by the number of respondents who returned their questionnaire from each region for each quarter (n_{ij}). This procedure was repeated for each of the three regions for four quarters, yielding a total of 12 expansion factors which are listed in Appendix I, Method 7. These expansion factors were used to estimate the total number of trips, the trips taken primarily for all fishing, trips primarily for trout fishing, and all fishing trip expenses.

In order to estimate expenditures for S-S fishing trips, the number of S-S fishing trips, and other S-S related estimates, only anglers who would have been eligible to catch salmon or steelhead represent the population. Thus, the population represented only those anglers who had purchased an S-S tag or those who purchased a one, two, or three day license. The Oregon Department of Fish and Wildlife does not keep records on the distribution of S-S tags by area, but the records are kept by month. Consequently, the S-S expansion factors are stratified by quarter but not by region. The S-S tags for the "i^{th}" quarter were accumulated by quarter

to represent the total number of anglers eligible to fish for salmon or steelhead for each quarter (N_i). The daily license holders were kept separate and all expansions for daily license holders were made using this population, and then the expenditures estimated from the annual S-S tags and daily licenses were summed. The daily licenses were not cumulated over the four quarters since it was assumed that they expired within the quarter they were purchased. The total cumulative S-S tags for each quarter is contained in Appendix I, Method 2 and daily licenses in Method 3 of the same appendix.

The total number of trips taken by Oregon anglers was estimated by quarter for 1977. The results are presented in Table 23.

The average number of trips per angler per year was estimated to be 5,131,000 trips divided by 502,000 (the number of angling licenses from unpublished data supplied by the Oregon Department of Fish and Wildlife), approximately 10 trips per angler for 1977. The Survey Research Center (Lowry, 1978a) in their preference survey estimated that there were approximately 32.8 trips per angler while we obtained only 10 trips per angler.

Table 23. Estimated Number of Trips Taken by Oregon Anglers by Quarter and Region for 1977

Region	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
1[a/]	378,000	1,188,000	1,383,000	287,000	3,236,000
2[b/]	58,000	228,000	264,000	129,000	679,000
3[c/]	202,000	537,000	360,000	117,000	1,216,000
TOTAL	638,000	1,953,000	2,007,000	533,000	5,131,000

[a/] Includes Multnomah, Clackamas, Washington, Yamhill, Polk, Benton, Marion, Linn, and Lane counties.

[b/] Includes Douglas, Jackson, and Josephine counties.

[c/] Includes remaining Oregon counties.

This apparent discrepancy can be explained by the differing methods of calculation. The Survey Research Center counted a separate trip for each

species fished. For example, if an angler fished for trout, steelhead, and bass on the same trip, it was counted as three trips whereas, given the same situation, we would have asked for the main or primary species of interest and counted it as only one trip.

Trips primarily for fishing were also aggregated by region and by quarter and the estimated total primary trips for 1977 are presented in Table 24. Trips taken primarily for fishing averaged 9.4 per angler during 1977, computed by dividing 4,712,000 primary fishing trips by 502,000 anglers.

Table 24. Estimated Number of Trips Primarily for Fishing by and Quarter for 1977

Region	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
1[a/]	346,000	1,067,000	1,198,000	244,000	2,855,000
2[b/]	57,000	211,000	244,000	120,000	632,000
3[c/]	419,000	468,000	294,000	44,000	1,225,000
TOTAL	822,000	1,746,000	1,736,000	408,000	4,712,000

[a/] Includes Multnomah, Clackamas, Washington, Yamhill, Polk, Benton, Marion, Linn, and Lane counties.

[b/] Includes Douglas, Jackson, and Josephine counties.

[c/] Includes the remaining Oregon counties.

Trips primarily taken to fish steelhead and salmon were also estimated by quarter, but not by region. Trips taken primarily for trout were available by quarter and by region, and were calculated on that basis; however, the regions were combined after the calculations and the results are presented, along with estimated total trips for salmon and steelhead, by quarter in Table 25.

Table 25. Estimated Total Number of Salmon, Steelhead, and Trout Trips Taken During 1977.

Species	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Steelhead	132,090	95,850	102,020	133,610	463,570
Salmon	40,000	163,120	249,250	129,940	582,310
Trout	53,800	1,006,500	969,500	179,700	2,209,500

The number of trips for salmon and steelhead average about 1,045,880 ÷ 275,256 (number of annual S-S tags from unpublished Oregon Department of Fish and Wildlife data) equal to 3.8 trips for both species during 1977. For the same year, the number of trips for trout averaged 2,209,000 ÷ 502,000 ≐ 4 trips per angler. The total for all three species was 3,255,380 trips, less than the number of all trips primarily for fishing. (Fishing trips primarily for other species not specified accounted for the difference.)

The design of the questionnaire was not ideal for estimation of angler days. However, since many public agencies use angler days as a measure of resource use, we have converted fishing trips to angler days. Trips were converted to days by dividing the time spent at the trip's destination into 24-hour segments. Any time at the destination less than 24 hours was counted as a full angler day. If the time at destination was greater than 24 but less than 48 hours, the angler days for that trip were set equal to two, and so on. This procedure gave the number of days per trip. Days per trip were then multiplied by the number of people per trip to find the total number of angler days.

To allocate number of angler days to species, all the angler days were allocated to the species fished for most on the trip. For example, if the angler fished for both salmon and steelhead on the same trip, but fished for salmon longer than for steelhead, the trip was counted as a salmon trip. This procedure was used for the last three trips of the quarter (where detailed information on fishing times were given, Question #18, Appendix V). Thus the total number of salmon angler days per questionnaire was computed by multiplying the primarily salmon fishing trips by the weighted average of angler days per trip, based upon the last three trips. The same procedure was used to compute the number of steelhead angling days. The data were censored to exclude outliers, i.e., unreasonably large numbers of trips reported for the quarter. There were 1,155,300 salmon angler days estimated, and 659,500 steelhead angler days. The estimated 1,155,300 salmon angler days compares favorably to 1,130,862 salmon angler days reported by the Survey Research Center (Lowry, 1978 b). However, our estimate of 659,500 steelhead angler days appears to be too high, possibly due in part to

nonresponse bias, since Lowry reported only 500,842 steelhead angler days, based upon a much larger sample and a higher response rate.

The number of angler hours of fishing per trip was estimated to be 6.768 hours for salmon per trip and 4.5762 hours for steelhead per trip. There were an estimated $\frac{1,155,300 \text{ salmon angler days}}{582,310 \text{ salmon trips}} \doteq 1.984$ angler days per trips for salmon. The hours spent salmon fishing per angler day were $6.768 \div 1.984 \doteq 3.411$ hours per angling day. There were an estimated $\frac{659,470 \text{ steelhead angler days}}{463,570 \text{ steelhead trips}} \doteq 1.4226$ angler days per trip for steelhead. Hours spent steelhead fishing per angler day were $4.5762 \div 1.4226 \doteq 3.217$ hours per angler day.

Estimated Total trip expenses

Variable costs were sub-divided into two major categories: The first category consisted of those expenditures incurred while traveling to and from the recreational site. These expenditures included vehicle costs and food, and lodging expenses. The second category consisted of those expenses incurred at the site. Such costs included food and lodging costs at the destination, guide and charter boat service, launching fees, bait, rental equipment, and other miscellaneous expenditures. Variable or trip costs were also broken down by quarter and by region, as well as by travel and destination expenses. Although the questionnaire asked for expenses for the group, the expenses were calculated on a per angler basis by dividing the expenses for each trip by the number of participants. The results are presented in Table 26.

Table 26. Estimated Total Travel and Destination Expenses for All Fishing Trips in Oregon During 1977 by Region and by Quarter for Oregon Residents

Region	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
			Travel Expenses		
1	2,814,000	12,719,000	18,957,000	2,942,000	37,432,000
2	563,000	2,664,000	3,763,000	1,536,000	8,526,000
3	1,490,000	5,668,000	4,804,000	847,000	12,809,000
TOTAL	4,867,000	21,051,000	27,524,000	5,325,000	58,767,000
			Destination Expenses		
1	1,842,000	8,523,000	11,951,000	2,139,000	24,455,000
2	231,000	2,830,000	2,603,000	795,000	6,459,000
3	1,048,000	2,931,000	1,998,000	763,000	6,740,000
TOTAL	3,121,000	14,284,000	16,552,000	3,697,000	37,654,000

Total estimated travel and destination expenses were $96,421,000 for residents of Oregon who fished in Oregon in 1977. The 99 percent confidence interval for average travel and destination costs were 117.146± 11.238 and 75.059± 40.159 per angler, respectively. However, it needs to be noted that these travel and destination costs are subject to memory bias and reporting error. Therefore, the usual interpretation of confidence intervals is not appropriate for these data.

The various trip expenditures were categorized by item to show which items were of greatest expense. The results are presented in Table 27. Vehicle cost was the largest single expense. Travel costs accounted for 60.9 percent of the expenditures.

Table 27. Oregon Fishing Trip Costs in 1977 by Oregon Residents with Trip Costs Categorized by Type of Expenditure

Item	All Fishing Trip Expenses	Percent
Travel Costs		
Vehicle costs	$ 33,497,200	34.7
Food expense while travelling	20,668,400	21.4
Lodging expense while travelling	4,601,400	4.8
Destination Costs		
Food expense while at destination	8,961,300	9.3
Lodging expense while at destination	6,720,900	7.0
Guide service	8,788,800	9.1
Rental equipment	3,102,000	3.2
Launching fees	1,119,800	1.2
Boat gas	3,188,500	3.3
Other rental equipment	258,300	.3
Miscellaneous	5,514,400	5.7
TOTAL	$ 96,421,000	100.0

Trip expenses for trips primarily for salmon and steelhead (S-S) were also analyzed. The S-S weighting systems discussed earlier (Methods 2 and 3) were used to ascertain the total estimated expenditures for S-S trips. The same categories were used as were used in the all fishing category to permit a comparison of figures. The results are presented in Table 28.

Salmon and steelhead fishing trip expenses were 30.8 percent of the total trip expenses for all fishing by Oregon anglers during 1977, $29,676,900 ÷ 96,421,000 ≐ 30.8 percent. Travel expenses for S-S fishing trips were 49.9 percent of the total S-S fishing trip costs, whereas travel costs of trips for all fishing were 60.9 percent of the total. Salmon and steelhead

travel costs were $14.8 million, whereas travel costs for non S-S fishing trips were nearly $44 million. The average annual expense per S-S angler was approximately $69; $29,676,900 ÷ (275,256 + 155,571 ≐ $69. For non S-S fishing the average annual angler expense was $133; $66,744,100 ÷ 502,000 ≐ $133.

Trip expenses for S-S fishing by out-of-state anglers were calculated using total out-of-state ocean daily licenses divided by the number of out-of-state respondents with ocean daily licenses who indicated that they had an S-S tag, multiplied by the average sample trip expenses. Out-of-state S-S tag holders were used since daily licenses include an S-S tag and it was assumed that out-of-state anglers were aware that they had the S-S tag with the temporary license. The blow up factor was 71,078/119 = 597.294 Out-of-state trip expenses for S-S fishing totalled $9,869 from the sample (of which approximately 66 percent were travel costs), and expanded to the population, totalled $5,894,700. Average sample out-of-state trip expenses for trout trips were blown up for the total by multiplying by the ratio of non-resident daily and yearly licenses divided by out-of-state responding anglers minus those assumed to be S-S fishermen. The total out-of-state blow up factor was 139,492/292 = 477.71. Out-of-state trip expenses for trout for the sample totalled $6,703 destination costs and $3,677 travel costs for a total of $10,380 out-of-state trip expenses for the sample. Expanded to the population, out-of-state trout trip expenses were estimated to be $4,958,600.

In summary, out-of state anglers spent an estimated $5.9 million on S-S trips and $5.0 million on trout trips in Oregon during 1977. These amounts should be added to Oregon resident expenditures for total gross expenditures. Thus, total S-S fishing trip expenses were estimated to be approximately $35,572,000, and total non S-S fishing expenses were approximately $71,703,000 for a total for all fishing trip expenses of $107,275,000.

Estimated total equipment values and expenditures

Expenditures on fishing equipment were also estimated for Oregon anglers. Figures in Table 29 represent the replacement costs of all

Table 28.. Estimated Fishing Trip Expenses in 1977 by Type of Expenditure for Oregon Residents with Yearly S-S Tags and Daily Licenses, Non S-S Fishing, and All Fishing Totals

Item	Yearly S-S Tags	Daily Licenses	Total S-S Fishing Trip Expenses	Percent of S-S Total	Non S-S Fishing Trip Expenses	Total All Fishing Trip Expenses
Travel Costs						
Vehicle costs	$ 8,098,400	$ 792,800	$ 8,891,200	29.96	$ 24,606,000	$ 33,497,200
Food while travelling	4,010,900	509,800	4,520,700	15.23	16,147,700	20,668,400
Lodging while travelling	1,096,100	293,100	1,389,200	4.68	3,212,200	4,601,400
TOTAL	$ 13,205,400	$ 1,595,700	$ 14,801,100	49.87	$ 43,965,900	$ 58,767,000
Destination Costs						
Food at destination	$ 3,560,600	$ 380,900	$ 3,941,500	13.28	$ 5,019,800	$ 8,961,300
Lodging at destination	2,105,400	119,400	2,224,800	7.50	4,496,100	6,720,900
Guide and charter boat service	3,969,600	386,700	4,356,300	14.68	4,432,500	8,788,800
Rental equipment	801,100	58,300	859,400	2.90	2,242,600	3,102,000
Launching fees	360,100	5,300	365,400	1.23	754,400	1,119,800
Boat gas	1,602,300	31,200	1,633,500	5.50	1,555,000	3,188,500
Other rental equipment	96,500	---	96,500	.32	161,800	258,300
Miscellaneous	1,369,400	29,000	1,398,400	4.72	4,116,000	5,514,400
TOTAL	$ 13,865,000	$ 1,010,800	$ 14,875,800	50.13	$ 22,778,200	$ 37,654,000
GRAND TOTAL	$ 27,070,400	$ 2,606,500	$ 29,676,900	100.00	$ 66,744,100	$ 96,421,000

equipment up to the time each angler filled out the questionnaire, and the replacement costs were divided into equipment used for all fishing and equipment used for S-S fishing. These two major areas were further categorized into expenditures for tackle, boating equipment, special clothing, camping equipment, and miscellaneous expenses. A more detailed list of equipment is contained in the questionnaire in Appendix V.

Table 29. Estimated Total Replacement Value of Equipment Owned by Oregon (Residents Only) Anglers

Item	All Fishing Equipment: Total	Percent	S-S Fishing Equipment Total	Percent
Tackle	68,737,200	19.5	16,277,600	7.67
Boat equipment	79,842,700	22.6	100,119,600	47.16
Clothing	2,186,700	.7	3,550,900	1.67
Camping equip.	197,561,000	56.0	91,445,100	43.08
Miscellaneous	4,292,100	1.2	894,300	.42
TOTAL	352,619,700	100.0	212,288,000	100.0

A list of expansion factors, along with the method of calculation, are given in Appendix I. Expansion factors for estimating total replacement value of fishing equipment for all fishing were calculated using Method 6 in Appendix I. This method of expanding to the population was used because anglers need not have a license to purchase equipment. Thus, non-cumulative totals were used but it was assumed that only anglers or prospective anglers would be interested in purchasing fishing equipment; therefore, the total licenses represented the relevant population.

Methods 1 and 3 were used to expand S-S fishing equipment expenditures to the population because these methods represented more precisely the population who would purchase S-S fishing equipment.

The sample means per angler for all fishing and S-S fishing and related equipment, along with the 99 percent confidence intervals, were $702.91 ± 70.57 and $422.88 ± 51.52, respectively. The average total replacement value of S-S fishing equipment for those anglers who held annual S-S tags was $720.88, while for those anglers who purchased one, two, or three day licenses, the average total replacement value of S-S equipment was only $89.10 per angler.

Boating and camping equipment were, by far, the items of greatest expenditure, both for all fishing and S-S fishing equipment. S-S fishing equipment was 60 percent of the total value for all fishing equipment, $212,288,000 ≐ $352,619,700 ≐ 60 percent.

The method of calculation of the estimated value of S-S equipment purchased in 1976 was different than the method of calculation for equipment expenditures in 1977. Since all of his 1976 expenditures were known to the respondent when he filled out the questionnaire, the 1976 expenditures were simply multiplied by the blow-up factor which consisted of the total number of S-S tags divided by the total number of respondents in the sample (Method 8).

This was not the case for respondents who were asked to report their expenditures for 1977. Those respondents who were questioned at the end of the first quarter still had the rest of the year to purchase equipment, thus their expenditures were multiplied by four. Those respondents who reported their expenditures at the end of the second quarter reported those expenditures made to that date, and their expenditures were multiplied by two to account for the rest of the year. Those respondents who reported expenditures at the end of the third quarter reported expenditures for the first nine months of 1977, and that amount was multiplied by 1.33 to account for the last three months of 1977. The expenditures reported at the end of 1977 were used as they were reported.

The expansion factors were calculated as follows: The S-S tags sold during the first quarter were divided by the number of respondents in the first quarter. The second quarter expansion factor was calculated by

dividing the S-S tags sold in the second quarter by the respondents who had S-S tags in the second quarter. (See Methods 1 and 3, Appendix I.) A simple example will help to illustrate the methodology and weighting factors.

For simplicity, suppose there are 5,000 anglers who reported their expenditures at the end of two time periods. Also, suppose that the anglers sampled in the first time period purchased four times as much equipment per year as those in the second time period, and a one percent sample was taken. The results are shown below:

Example

Eligible for Sample	Average Expenditure Per Year	Number of Months to make Expendit.	1% Sample of Number of Anglers	Av. Reported Expenditure Per Angler	S_i= Sum of Sample Expend.	w_i	$\Sigma w_i S_i$
2,000	2,000	6	20	1,000	20,000	100x2	4,000,000
3,000	500	12	30	500	15,000	100	1,500,000
						Total	= 5,500,000

Note that the true expenditure should indeed be (2,000 x 2,000) + (3,000 x 500) = 5,500,000.

A procedure similar to the preceding example, Method 1, was used for expanding non S-S fishing equipment to the population, except that all licenses represented the population (see Method 6, Appendix I).

It should be noted that the estimated 1976 and 1977 fishing equipment expenditures were lower than expected. One possible reason for lower reported expenditures was that the fourth page of the questionnaire was tedious and time-consuming, and respondents may not have put down all their expenditures for equipment. The reported expenditures, especially for 1976 and before, may have been subject to memory bias.

Table 30. Estimated Expenditures for S-S Fishing, Non S-S Fishing, and All Fishing for Fishing and Fishing-Related Equipment Purchased During 1976 by Oregon Residents

Item	Total Expenditures for S-S Fishing Equipment	Total Expenditures for Non S-S Fishing Equipment	Total Expenditures for All Fishing Equipment
Tackle	$ 1,084,700	$ 5,336,500	$ 6,421,200
Boating equipment	7,856,300	7,900,700	15,757,000
Clothing	160,300	313,900	474,200
Camping equipment	5,568,000	28,640,500	34,208,500
Miscellaneous	8,800	1,688,500	1,697,300
TOTAL	$14,678,100	$ 43,880,100	$58,558,200

It is also possible that the drought in the latter part of 1976 and the early part of 1977 might have dampened the enthusiasm for fishing and was thereby reflected in the decreased expenditures for equipment. Catch data (Oregon Department of Fish and Wildlife, 1977) indicate a substantial drop in numbers of salmon and steelhead caught during 1977. Steelhead caught in 1976 was the lowest in the previous 11 years. Steelhead taken in 1975 totalled 186,450 fish, while for 1976 it was 118,275-- a 36.6 percent drop from the previous year. Salmon and steelhead catch for Oregon declined from 686,260 fish caught in 1976 to 567,112 in 1977, a drop of 21 percent.

A Comparison of 1962 and 1977 S-S Expenditures

As noted earlier, fishing trip expenses for 1977 were divided into two parts--travel costs and destination costs. Estimated total travel costs for all fishing by Oregon residents were approximately $58.8 million. The estimated travel costs for S-S fishing were approximately $14.8 million. Estimated total destination costs for all fishing were approximately $37.7 million while destination costs for S-S fishing trips were approximately $14.9 million. How do the S-S trip costs compare with those of earlier years?

The 1977 S-S fishing trip costs can be compared with 1962 S-S trip costs published earlier (Brown, Singh, and Castle, 1964). To make the trip costs more comparable, the 1977 trip costs were deflated to the 1962

Table 31. Estimated Total Expenditures for S-S and Non S-S Fishing Equipment Purchased by Oregon Residents During 1977

Item	Estimated Value of S-S Equipment by Yearly S-S Tags	Estimated Value of S-S Equipment by Daily Licenses	Total S-S Equipment	S-S Equipment Percent	Total Value of Non S-S Equipment	Total Value of All Equipment
Tackle	$ 1,641,800	$ 304,900	$ 1,946,700	11.01	$ 7,911,200	$ 9,857,900
Boating equipment	10,223,000	-0-	10,223,000	57.84	11,523,200	21,746,200
Clothing	144,900	-0-	144,900	.82	298,900	443,800
Camping equipment	5,056,400	23,400	5,079,800	28.74	41,817,800	46,897,600
Miscellaneous	280,900	-0-	280,900	1.59	1,103,500	1,384,400
TOTAL	$ 17,347,000	$ 328,300	$ 17,675,300	100.00	$ 62,654,600	$ 80,329,900

price level by using the Consumer Price Index (U.S. 1973), equivalent to multiplying the 1977 costs by 0.5166. Estimated total S-S fishing trip costs in 1962 by all anglers, both Oregon residents and non-residents, were $8,155,000 while 1977 trip costs for S-S fishing (by Oregon residents only) in terms of 1962 dollars were $15,331,000, an increase of approximately 88 percent.

A more detailed comparison of S-S fishing trip expense items is provided in Table 32. Lodging expenses increased more than three times while almost all other expenses doubled.

It needs to be kept in mind that the 1977 trip expenses in Table 28. were for Oregon residents only whereas the 1962 expenses were for all anglers, both residents and non-resident. When the non-resident angler 1977 S-S trip expenses of $5,894,700 are included, total 1977 S-S trip expenses of $35,572,000 are estimated. Multiplying 0.5166 times $35,572,000 gives about $18,376,000, the estimated 1977 S-S trip expenses in 1962 dollars. Thus, in real terms, S-S trip expenses actually increased by $18,376,000 ÷ $8,155,000 ≐ 225 percent.

Salmon and steelhead equipment expenditures increased from approximately $9.35 million in 1962 to $11.87 million in 1976--an overall increase in equipment expenditures of approximately 27 percent. When converted to 1962 dollars, the 1976 fishing equipment expenditures were less than the 1962 expenditures. However, the lower expenditures for 1976 in Table 29 may have been the result of anglers failing to recall all purchases made a year or two earlier. Angler equipment expenditures of approximately $17.7 million were estimated for 1977, about the same level as for 1962, if the 1977 expenditures are deflated to 1962 dollars by the Consumer Price Index. In terms of 1977 dollars, expenditures for camping, boating, and miscellaneous equipment approximately doubled in 1977 as compared to 1962, whereas dollars spent on tackle remained about the same, and dollars spent on special clothing decreased.

Table 32. Comparison of S-S Fishing Trip Expenses by Oregon Anglers in 1962 Versus 1977, All in Terms of 1962 Dollars

Item	Estimated 1962 Trip Expenses by All Anglers	Estimated 1977 Trip by Oregon Residents Only[a]
Vehicle cost	$ 2,391,000	$ 4,593,200
Food while travelling Food while at destination	2,847,700	4,371,600
Lodging while travelling Lodging at destination	511,300	1,867,000
Guide service	912,600	2,250,400
Rental equipment Launching fees Boat gas	1,056,900	1,476,600
Other rental equipment Miscellaneous	435,500	772,300
TOTAL	$ 8,155,000	$ 15,331,100

[a] The 1977 prices were deflated to the to the 1962 level by multiplying by 0.5160, based upon the consumer price index (U.S. 1973).

Table 33. Comparison of Oregon S-S Fishing Equipment Expenditures in 1962 Versus 1976 and 1977

Item	Estimated 1962 Expenditures for Fishing Equipment	Estimated 1976 Expenditures for Fishing Equipment	Estimated 1977 Expenditures for Fishing Equipment
Tackle	$ 1,904,800	$ 876,900	$ 1,946,700
Boating equipment	5,493,900	6,351,400	10,223,000
Clothing	362,600	129,600	144,900
Camping equipment	1,434,700	4,501,400	5,079,800
Miscellaneous	150,500	7,200	280,900
TOTAL	$ 9,346,500	$ 11,866,500	$17,675,300

CHAPTER 7

CHARACTERISTICS AND EXPENDITURES OF WASHINGTON ANGLERS

Effect of Age and Income Upon Fishing Patterns and Expenditures

The angler characteristics thought to be potentially important were age, income, and expenditure patterns. Each of these characteristics were considered in detail as they related to items of purchase, value of equipment, fishing success, length of fishing trip, number of trips, and other demographic information.

Effect of age upon fishing and expenditures

The respondents were categorized according to age in one of seven age groups. The number of respondents in each category is listed in Table 34. The distribution of anglers by age group was surprisingly uniform. All age groups were between 200 and 400 anglers with the exception of the 30-39 age group and the over 70 age group. The median age of the anglers was estimated to be about 41 years.

Table 34. Frequency of Anglers in Each Age Category

Age	Number of Respondents	Percent
Under 21	241	12.4
21-29	276	14.2
30-39	414	21.3
40-49	324	16.6
50-59	370	19.0
60-69	258	13.2
70-over	65	3.3
TOTAL	1,948	100.0

The total number of fishing trips included trips that were primarily for fishing and trips for other purposes, but where some fishing was done. Total trips and trips primarily for fishing were sub-divided into age groups,

and the results are presented in Table 35. There seemed to be no strong relationship between age and trips. In fact, the participation by age group was surprisingly uniform.

Table 35. Average Number of Fishing Trips Per Respondent, Trips Primarily for Fishing, and Salmon Trips by Age Group

Age	Total Fishing Trips Ave. No. Trips per Respondent	Trips Primarily for Fishing Ave. No. Trips Per Respondent	Trips Primarily for Salmon Ave. No. Salmon Trips/Respondent
Under 21	7.4	6.0	3.7
21-29	7.2	6.5	3.1
30-39	7.4	6.6	3.7
40-49	6.8	6.0	4.2
50-59	5.9	5.4	3.6
60-69	5.6	4.7	3.6
70-over	5.7	5.5	4.4

Average miles per trip, average time, and average expected time per trip were computed using the following procedure: The total miles the respondent travelled, the total time spent on the trip, and the total expected length of stay in hours were divided by three--if the respondent reported he went on at least three trips--divided by two if the respondent reported he went on two trips, and divided by one if the respondent reported he went on one trip. This procedure yielded the average miles travelled per trip, average length of stay in hours, and average expected length of stay in hours for a maximum of the last three trips of the quarter that the angler took. Average destination and travel expenses were calculated in the same way. Travel expenses were a summation of food, drink, lodging, and transportation costs en route, while destination expenses were a summation of food, drink, lodging, bait, lures, rental equipment, guide service (including charter boat fees), boat launching fees, and gas purchased for the boat at the destination. Transportation costs were calculated on a cost per mile basis. The cost per mile estimate used for a pickup or car was 9.75 cents, while the cost per mile estimate for a camper, motorhome, or pickup with camper was 11.6 cents per mile (U.S. Department of Transportation, 1977).

Average miles per trip, average expected length of stay per trip, and trip expenses were classified by age group to find out which age groups tended to go farther per trip, spend more money, and stay longer per trip. Some of the results are presented in Table 36. Generally, as the age of the anglers increased, they went further per trip, spent more time on the trip, expected to stay longer, and spent more money for travel costs and destination costs per trip. This pattern was consistent up to age 70, in which case most costs and time spent per trip declined.

Table 36. Average Length of Time Per Trip and Average Expected Time Per Trip by Age Group for All Fishing Trips

Age	Average Time Per Trip[a]	Average Expected Time Per Trip[a]
Under 21	24.0 hours	18.8 hours
21-29	22.4 hours	18.5 hours
30-39	26.8 hours	21.0 hours
40-49	29.3 hours	22.1 hours
50-59	29.5 hours	23.8 hours
60-69	32.8 hours	24.8 hours
70-over	29.6 hours	21.0 hours

[a] Expected time was the time the respondent expected to spend on the trip when making plans for the trip.

Total replacement value of fishing and related equipment used for all fishing and total replacement value of equipment used for salmon fishing, as listed on page 4 of the questionnaire, were classified by age group in Table 37. The middle aged anglers, ages 30 to 59, accounted for the highest value for all fishing and salmon fishing equipment expenditures.

It was hypothesized that experience may be an important factor in fishing success. It was further hypothesized that experience was positively correlated with age. Therefore, the number of salmon caught per hour by those fishermen who caught one or more salmon on the trip was classified by age. The older anglers seemed to be more successful at catching salmon; however, this increase might be a result of more hours spent fishing per trip by older anglers since the older anglers averaged more time per trip, Table 36.

Table 37. Replacement Value of All Fishing and S-S Fishing Equipment By Age Group

Age	Replacement Value of All Fishing Equipment Per Respondent		Replacement Value of SAL Fishing Equipment Per Respondent	
	Mean	Sample Total	Mean	Sample Total
Under 21	421	101,000	383	92,000
21-29	450	124,000	308	85,000
30-39	911	377,000	679	281,000
40-49	1,181	382,000	797	258,000
50-59	739	273,000	584	216,000
60-69	649	167,000	493	127,000
70-over	505	31,000	365	22,000

Effect of income upon fishing and expenditures

The respondents were classified by income levels ranging from under $3,000 annual household income to over $100,000 annual household income. Various factors were classified by income to see if there were any relationships. Table 38 contains a breakdown of some general demographic characteristics of Washington anglers by income group. Household size and hours worked per week tended to increase with income level, as shown in Table 38.

A breakdown of the total number of fishing trips taken and the number of trips taken primarily for fishing by income level is presented in Table 38. There were no important trends between income and number of all trips taken, but trips primarily for fishing first increased, then decreased, as income increased.

Table 38. Number of Persons Per Household and Number of Hours Worked Per Week by Income Group

Income Group	Average Number of Persons/Household	Average Number of Hours Worked Per Week
Under $3,000	3.35	10.37
3,000-4,999	2.58	25.59
5,000-7,999	2.13	22.48
8,000-11,999	2.70	26.15
12,000-14,999	3.02	31.29
15,000-17,999	3.13	33.84
18,000-24,999	3.56	35.39
25,000-49,999	3.51	35.29
50,000-100,000	3.67	37.85
over 100,000	2.94	22.00
Entire Sample	3.18	32.71

Table 39. Total Fishing Trips Versus Trips Primarily for Fishing, by Income Group

Income Group	All Trips		Trips Primarily for Fishing	
	Sample Mean	Sample Total	Sample Mean	Sample Total
Under $3,000	7.0	183	3.8	98
3,000-4,999	6.9	247	5.9	212
5,000-7,999	7.3	672	6.5	589
8,000-11,999	6.1	1,100	5.5	987
12,000-14,999	7.4	1,347	6.4	1,157
15,000-17,999	7.1	1,570	6.3	1,387
18,000-24,999	6.7	3,040	6.0	2,685
25,000-34,999	6.8	1,945	5.8	1,653
35,000-49,999	5.5	567	4.8	499
50,000-100,000	6.0	293	5.2	253
over 100,000	5.0	70	4.0	52
Entire Sample	6.7	11,034	5.9	9,572

Average time spent at the destination per trip and average number of persons per trip were classified by income, and the results are presented in Table 40 for all types of fishing trips. Most anglers, regardless of income, travelled approximately the same number of miles per trip and spent about the same number of hours at their destination with the exception of the lower income levels.

Table 40. Average Hours at Destination and Number in Group by Income for All Fishing Trips

Income Group	Average Number of Hours Spent at Destination	Average Number in Group
Under $3,000	24.9	1.9
3,000-4,999	26.7	2.2
5,000-7,999	20.6	2.4
8,000-11,999	38.9	2.7
12,000-14,999	30.2	2.8
15,000-17,999	29.6	3.2
18,000-24,999	30.3	3.2
25,000-34,999	27.6	2.8
35,000-49,999	29.9	3.5
50,000-100,000	34.9	3.7
over 100,000	30.2	2.9

Durable equipment was next considered as it related to the income level of the respondents. Durable fishing and related equipment (listed on page 4 of the questionnaire) was divided into four sub-groups, and each sub-group was classified by income level. The first two sub-groups consisted of equipment used for all fishing while the second consisted of equipment used for salmon fishing. These two major sub-groups were further divided into the tackle sub-groups and used for all fishing and tackle used for salmon fishing, as shown in Table 41.

Table 41. Average Replacement Value of Equipment Used for All Fishing, Equipment Used for Salmon Fishing, Tackle Used for All Fishing, and Tackle Used for Salmon Fishing, by Income Group

Income Group	Mean Value of All Fishing Equipment	Mean Value of Salmon Fishing Equipment	Mean Value of Tackle for All Fishing	Mean Value of Tackle for Salmon Fishing
Under $3,000	190	72	32	1
3,000-4,999	624	445	85	8
5,000-7,999	416	183	136	40
8,000-11,999	443	395	162	25
12,000-14,999	482	441	137	23
15,000-17,999	586	405	124	30
18,000-24,999	793	646	156	33
25,000-34,999	1,147	747	197	36
35,000-49,999	1,394	960	202	45
50,000-100,000	1,329	681	168	12
over 100,000	911	858	50	1

Anglers with higher incomes tended to buy more equipment for both all fishing and salmon fishing, except at the very highest level. Between $3,000 per annum income and $100,000, the pattern of more income and more equipment was fairly consistent. The over $100,000 income group expenditures dropped quickly--particularly for tackle expenses.

The fishing trip and expenditures are important, but the ultimate reward is catch. Therefore, success per hour for salmon was broken down by income level to see if there was any relationship between success per hour and income. Although the trend was not entirely consistent, the average number of salmon caught per hour tended to increase with the higher income levels. However, it should be remembered that anglers at the higher income levels took more trips on the average and had more investment in equipment, which may partly explain the increased success rate.

Characteristics of Washington anglers as they relate to income can be summarized by stating that higher income levels tended to go farther per trip, take more people per trip, spend more money, and buy more equipment.

Average Expenditures by Washington Anglers

The first part of this section contains a summation of the different types of trip expenses while the second section is concerned with durable equipment expenditures.

Average salmon fishing trip expense

Trip expenses were itemized and summarized as follows: each item of expenditure was summed over all trips taken and divided by the number of respondents to obtain a weighted average for each type of trip expense. Vehicle cost was the cost of operating and maintaining a vehicle on a cost-per-mile basis. The cost of operation differentiated between autos and pickups versus motor homes and campers. Cost per mile for autos and pickups was computed at 9.75 cents, as explained earlier for Oregon angler trip expenses. The cost per mile for campers and motor homes was 11.6 cents (U.S. Department of Transportation, 1977).

Table 42. Average 1977 Washington and Out-of-State Resident Expenditures Per Salmon Fishing Trip, Categorized by Type of Expense

Type of Expense	Washington Residents	Out-of-State Residents
(1) Vehicle cost	$ 5.78	$ 14.19
(2) Food expense while travelling	2.09	14.81
(3) Lodging expense while travelling	0.77	8.54
(4) Food expense at destination	3.33	11.76
(5) Lodging expense at destination	2.02	6.65
(6) Guide service and charter boat expenses	3.93	9.28
(7) Rental equipment	1.42	5.08
(8) Launching fees	0.84	1.04
(9) Boat gas expenses	3.53	2.10
(10) Other rental equipment	0.16	0.46
(11) Miscellaneous expenses	0.96	0.17
Sub-Total of Travel Expenses (items 1-3)	8.64	37.54
Sub-Total of Destination Expenses (items 4-11)	16.19	36.54
TOTAL TRIP EXPENSES	$ 24.83	$ 74.08

Average replacement value of durable equipment

Replacement value of total equipment per angler was sub-divided into equipment used for all fishing versus equipment used for salmon fishing. The different equipment value categories ranged from under $50 to over $5,000 per angler. These equipment value categories were broken down by average miles per trip to see if the respondents with higher equipment investment tended to go further per trip. The results are shown in Table 43.

Table 43. Effect of Value of Equipment Investment Upon Average Miles Traveled Per Trip for all Fishing

Replacement Value of Equipment Per Angler	Average Miles Per Trip for All Fishing Equipment	Average Miles Per Trip for Salmon Fishing Equipment
Under $50	103	93
50-100	83	75
101-200	91	101
201-400	87	87
401-700	89	100
701-1,000	99	100
1,001-1,500	104	97
1,501-2,000	87	104
2,001-5,000	97	78
over 5,000	105	75

There seemed to be no consistent trend between amount of equipment and distance travelled to fish for either all fishing equipment or salmon fishing equipment. Equipment used for all fishing and salmon fishing was also sub-divided by item of purchase, and the sample summation is presented in Table 44.

The percentage of all fishing equipment allocated to salmon fishing was 66.6 percent. It should be noted, however, that only salmon fishermen were sampled and as a result, the percentage of all fishing equipment allocated to salmon fishing is higher than for the population of all anglers.

Table 44. Average Replacement Value of Equipment Owned by Washington Resident Anglers by Item for All Fishing and for Salmon Fishing[a]

Item	Av. Replacement Value for Equipment Allocated to All Fishing	Total for Sample of All Fishing Allocation[b]	Av. Salmon Fishing Allocation	Total for Sample of Salmon Fishing Allocation[b]
Tackle	$ 158.	$ 308,000	$ 29.	$ 56,800
Boating equip.	334.	650,700	322.	626,900
Clothing	2.	4,800	2.	4,700
Camping equip.	250.	487,600	145.	281,900
Miscellaneous	4.	8,000	36.	5,800

[a] Individual items under each section are contained in the questionnaire in Appendix V .

[b] Total was for sample-expansion to the population will be presented in next section.

Total Expenditures by Washington Anglers

It is important at this point to discuss the expansion factors for Washington and the method of calculation. The sample was drawn from salmon punchcard holders by the Washington Department of Fisheries. The blow-up factors for Washington were calculated on a regional basis to account for ocean fishing, fishing in Puget Sound, freshwater fishing, and fishing in Washington by out-of-state residents. Region 1 (ocean) included Pacific, Clallam, Jefferson and Grays Harbor counties. Region 2 (Puget Sound) included Mason, Thurston, Pierce, King, Snohomish, Skagit, Whatcom, San Juan, Island, and Kitsap counties. Region 3 (freshwater) included the remaining Washington counties, and Region 4 was out-of-state. Since the survey covered only four months (June to September) the other eight months were accounted for by multiplying Regions 1, 2, 3 and 4 by 1.068, 1.552, 2.020, and 1.1777, respectively. These figures were calculated based on participator rates and catch for the region for the four summer months as a ratio of the entire year (Hoines, Ward, and Nye, 1978).

The blow-up factors for Regions 1-4 were obtained by dividing the number of salmon punchcards for each region by the number of respondents, then multiplying by the factor to account for the other eight months not covered in the survey. Thus, the blow-up factors were as follows:

Region 1	35,557/106 * 1.068	=	358.455
Region 2	316,322/827 * 1.552	=	593.630
Region 3	103,196/1015 * 2.020	=	205.375
Region 4	164,448/396 * 1.1766	=	488.610

Since the punchchards from which the sample was drawn represented potential Washington salmon sport anglers and not the population of all Washington anglers, inferences about the number of trips and expenditures for species other than salmon could be misleading. However, based upon our sample, the average number of salmon fishing trips per Washington resident angler was estimated to be about five trips for 1977. Average number of salmon fishing trips by out-of-state sport anglers was estimated to be approximately two.

Variable costs were divided into two major categories, with items listed within each major category. The first category consisted of those expenditures incurred by the angler while travelling to and from the fishing site. These expenditures included vehicle costs, food, and lodging expenses. The second category consisted of those expenses incurred at the site. Destination or site costs included such expenses as food, lodging, guide and charter boat services, launching fees, bait, rental equipment, and other miscellaneous expenditures. Variable or trip costs were expanded to the population on a regional basis for travel costs and destination costs, respectively. Variable salmon trip expenditures were categorized by item, indicating items of greatest expense, as shown in Table 43. The total estimated travel and destination expenses were $86,505,800 for salmon fishing trips during 1977. The 99 percent confidence interval for travel and destination costs per angler per year were $45.39 ± 3.89 and $84.98 ± 3.30, respectively for Washington resident anglers. However, it should again be noted that estimated costs are subject to memory bias and reporting error. Therefore, the usual interpretation confidence intervals is not appropriate for these data.

Table 45. 1977 Washington Resident and Out-of-State Sport Angler Salmon Trip Expenses, Categorized by Type

Item	Washington Residents	Out-of-State Residents	Total Expenditures
Travel Cost			
Vehicle cost	$13,812,300	$5,206,600	$19,018,900
Food expenses while travelling	4,994,300	5,434,800	10,429,100
Lodging expenses while travelling	1,848,900	3,134,900	4,983,800
Destination Costs			
Food expenses at destination	7,948,600	4,314,400	12,263,000
Lodging expenses at destination	4,816,700	2,438,700	7,255,400
Charter boat and guide service	9,394,600	3,405,600	12,800,200
Rental equipment	3,383,200	1,862,600	5,245,800
Launching fees	2,014,300	380,100	2,394,400
Boat gas	8,445,800	770,000	9,215,800
Other rental equipment	385,400	167,600	553,000
Miscellaneous	2,284,600	61,800	2,346,400
Total Travel Costs	20,655,500	13,776,300	34,431,800
Total Destination Costs	38,673,200	13,400,800	52,074,000
GRAND TOTAL TRIP COSTS	$59,328,700	$27,177,100	$86,505,800

Guide and charter boat services and vehicle costs were the two largest items of the total expenditures in Table 45. Travel costs accounted for 39.8 percent of the expenses while destination costs accounted for the remaining 60.2 percent of total expenditures by both out-of-state and Washington residents.

Expenditures for salmon equipment was also estimated for Washington resident anglers. The figures represent the replacement costs of fishing equipment allocated to salmon fishing. The equipment was divided into subcategories: tackle, boating equipment, special clothing, camping equipment,

and miscellaneous expenses. The expansion to the population was done on a regional basis, and the results are presented in Table 47. A more detailed listing of the equipment is found on page 4 of the questionnaire, Appendix V. The average replacement value for salmon equipment was approximately $734 per angler, considerably higher than the $423 for S-S equipment per angler reported for Oregon in the preceding chapter. The replacement value for Washington salmon fishing equipment may be higher because the location of Puget Sound may encourage Washington anglers to invest heavily in boating equipment.

Table 46. Estimated Total Replacement Value of Fishing and Related Salmon Equipment Owned by Washington Anglers

Item	Total	Percent
Tackle	$ 16,108,100	4.8
Boating equipment	235,607,800	70.5
Clothing	1,144,400	.5
Camping equipment	77,877,700	23.3
Miscellaneous	3,072,500	.9
TOTAL	$ 334,107,500	100.0

Table 47. Estimated Salmon Equipment Expenditures by Washington Resident Anglers During 1977

Item	Expenditures for Salmon Equipment	Percent
Tackle	$ 1,031,000	2.3
Boating equipment	30,239,300	76.0
Clothing	180,400	.4
Camping equipment	8,187,700	20.6
Miscellaneous	158,200	.4
TOTAL	$39,796,600	100.0

Expenditures for equipment purchased during 1977 were also expanded to the population. Since the last three months of the year were not covered by the questionnaire and the angler was still able to purchase equipment during that period, a factor was used to account for this period. The estimates from the sample were multiplied by 12/9 to account for the remaining three months that the angler could still purchase equipment. Using expansion factors on a regional basis, 1977 salmon equipment expenses were estimated and the results are presented in Table 43.

Estimated Trip Expenses Incurred In Washington Counties

In order to ascertain a more accurate estimate of the trip expenses made to each county, the travel expenses for a "within" county trip were added to the destination expenses of that county. It was assumed that if the angler lived in County A and fished in County A, that he did not travel outside County A and, therefore, "within" county travel expenses and all on-site expenses could be allocated to that county. It should be noted that this procedure underestimates total travel expenses since travel costs for trips made outside the county of residence were not included. It was hoped that the procedure would at least yield the minimum expenditures that could be allocated to each county. The summation of "within" county travel costs and all destination costs are presented in Table 44 for each county.

Limitations of Estimated Washington Expenditures

It needs to be kept in mind that the results of the 1977 Washington survey of salmon anglers are even more limited than for the corresponding Oregon survey. For one thing, the response rate was only 44.4 percent for Washington as compared to 55.6 percent for Oregon. Furthermore, there was time to correct by telephone only 23 percent of the incomplete Washington questionnaires as compared to correction by telephone of over 67 percent of incomplete Oregon questionnaires. Consequently, there were only 965 Washington questionnaires complete in every regard out of 4,728 that were supposedly delivered to anglers by mail, only 20.4 percent, compared to $3,561 \div 8,461 \doteq 42$ percent for Oregon. Although additional questionnaires from both states were complete in most regards and could be used for most computations, the nonresponse problem was obviously more serious for the Washington data.

Table 48. Estimated "Within" County Travel Costs and All Destination Costs for Salmon Fishing for Washington Counties.

County	"Within" County Travel Costs	Destination Cost	County Total
Region 1			
Clallam	228,100	9,371,600	9,599,700
Grays Harbor	217,900	12,486,100	12,704,000
Jefferson	-0-	849,700	849,700
Pacific	53,800	10,357,900	10,411,700
TOTAL	499,800	33,065,300	33,565,100
Region 2			
Island	210,900	2,463,300	2,674,200
King	932,500	1,618,500	2,551,000
Kitsap	472,200	2,796,100	3,268,300
Mason	30,300	234,700	265,000
Pierce	311,000	2,256,300	1,467,300
San Juan	-0-	890,000	890,000
Skagit	207,300	845,700	1,053,000
Snohomish	302,900	1,775,500	2,078,400
Thurston	211,300	846,600	1,057,900
Whatcom	21,300	507,000	528,300
TOTAL	2,699,700	14,233,700	16,933,400
Region 3			
Adams	-0-	-0-	-0-
Asotin	-0-	5,900	5,900
Benton	51,300	148,500	199,800
Chelan	26,100	283,400	309,500
Clark	384,500	392,100	776,600
Columbia	-0-	284,400	284,400
Cowlitz	633,500	1,265,300	1,898,800
Douglas	200	87,000	87,200
Terry	-0-	75,500	75,500
Franklin	5,500	156,300	161,800
Garfield	-0-	-0-	-0-
Grant	5,400	393,200	398,600
Kittitas	5,400	127,000	132,400
Klickitat	100	29,200	29,300
Lewis	230,300	465,600	695,900
Lincoln	-0-	51,500	51,500
Okanogan	28,000	251,500	279,500
Pend Oreille	-0-	69,300	69,300
Skamania	1,600	142,200	143,800
Spokane	41,200	99,900	141,100
Stevens	-0-	58,300	58,300
Wahkiakum	-0-	141,500	141,500
Walla Walla	23,900	41,100	65,000
Whitman	5,200	55,200	60,400
Yakima	75,400	151,100	226,500
TOTAL	1,517,600	4,775,000	6,292,600
GRAND TOTAL	4,717,100	52,074,000	56,791,100

CHAPTER 8

SUMMARY AND CONCLUSIONS

Estimated expenditures in 1977 by salmon-steelhead sport anglers fishing in Oregon were estimated to be about $35.6 million for fishing trip expenses and $17.7 million for equipment, adding to a total expenditure of around $53.3 million. For Washington, estimated 1977 fishing trip expenses were $86.5 million, and estimated salmon equipment expenditures were $39.8 million, adding to a total estimated 1977 expenditure of around $126 million.

Although gross expenditures may be of interest to sport anglers and the public, the usefulness of gross expenditures by themselves is very limited. Considerable additional information is needed to even estimate the economic activity generated by gross expenditures. Even then, gross expenditures cannot be used to infer the net economic benefit or value to sport anglers from fishery resouces, as explained in detail in Chapter 6. Instead, what is needed is some measure or estimate of willingness-to-pay by recreational users of fishery resources.

A recommended procedure for estimating the net economic benefits to recreationist is the so-called "travel cost" method. This method was used to estimate the net economic benefits to sport anglers of several fisheries in Oregon and Washington.

Based upon a commonly used specification of the travel cost method, estimated net economic benefits to Oregon salmon and steelhead anglers were the following:

Fishery	Estimated Net Economic Benefits
Oregon ocean salmon sport angling	$13.1 million
Oregon fresh-water salmon sport angling	6.2 million
Oregon steelhead sport angling	12.2 million
Total	$31.5 million

Estimated net economic benefits to salmon sport anglers fishing in Washington were the following:

Fishery	Estimated Net Economic Benefits
Washington ocean salmon sport angling	$28.9 million
Puget sound salmon sport angling	10.8 million
Washington fresh-water salmon sport angling	2.8 million
Total	$42.5 million

The measure of consumer surplus was used to estimate the net economic value for the Oregon and Washington anadromous salmonid fisheries as opposed to selecting the single owner maximization point on the demand curve as suggested by Brown (1964) and Crutchfield (1962). The consumer surplus value becomes in context, a maximum net benefit measurement.

Equivalent variation or willingness to pay was used to measure the net economic value of the anadromous salmonid fisheries as opposed to the compensated variation measurement because the willingness to pay measurement generally refers to projects already in place, equivalent variation is bounded at the extreme by the respondent's income, and, given a normal good, equivalent variation is a more conservative measure than compensation variation.

The formulation of the opportunity cost of travel time variable seemed promising, however it was significant in a limited number of demand curve estimations. Worthly of note, however, is the substantial decrease in the correlation between travel cost and travel time. Better specification of the opportunity cost of time variable may improve the results of this variable.

The fishing equipment variable used as a proxy for tastes and preferences was consistant in the Oregon fishery, but it was not significant in the Washington fisheries. Further research is needed to explain the differences in the two fisheries which would cause equipment to be significant in some Oregon fisheries, but not in Washington.

The use of dummy variables for each of the rivers in the Washington and Oregon fisheries indicated a significant difference in participation rates among certain rivers. It has been suggested that these differences could be partially explained by the use of a success variable associated with each river. The inclusion of a fishing success variable was tried, but without success. The data were not available to try a variety of specifications of the variable for this study, but further research and better specification of the variable should prove to be fruitful.

Another limitation of the study was the magnitude of the non-response bias. Further investigation is needed to explain the magnitude and direction of the bias on the estimates of salmon and steelhead sport angler expenditures and fishing effort. Additional research is also needed to explain the differences in the explanatory variables which were significant among the various fisheries. For example, research is needed to explain why opportunity cost of travel time was significant for Oregon fresh water salmon, but not for Oregon steelhead angling.

This study provides a unique opportunity to test the validity of mail questionnaires as an accurate source of data by comparing the answers the respondents gave before and after they were telephoned. This proceedure would indicate the magnitude of memory bias, the general direction of the bias, and the effect of having the question explained to them vs having them simply reading the question on their own.

Some of the hypothesis yet to be explored are the relationships of the Oregon and Washington anglers. Such areas of interest include the effect of income on equipment purchased, fishing success, and length of stay at the fishing site. Other interesting questions remain, such as the effect of the amount of fishing equipment and age on the fishing success rate. Some of these correlations are pointed out in the text but more rigorous examination should be pursued.

Some of this additional research has already gotten underway in an effort to answer some of these issues and more is expected to be done using the data collected for this study.

BIBLIOGRAPHY

Bishop, R.C. and T.A. Heberlein, "Measuring Values of Extramarket Goods: Are Indirect Measures Biased?" American Journal Agricultural Economics. (61): 926-930, December 1979.

Brown, W.G., A. Singh, and E.M. Castle, An Economic Evaluation of the Oregon Salmon and Steelhead Sport Fishery. Oregon Agriculture Experiment Station Technical Bulletin 78, Corvallis, September 1964

Brown, W.G. and Nawas, F. "Impact of Aggregation on the Estimation of Outdoor Recreation Demand Functions." American Journal of Agricultural Economics 55 (May 1973); 246-249.

Brown, W.G. "Economic Implications of Allocation." Marine Recreational Fisheries. Sport Fishing Institute, Washington, D.C., 1976. pp. 29-36.

Brown, W.G., D.M. Larson, R.S. Johnston, and Roy J. Wahle, Improved Economic Evaluation of Commercially and Sport-Caught Salmon and Steelhead of the Columbia River. Oregon Agriculture Experiment Station Special Report #463, Corvallis, August 1976.

Cesario, F.J. and J.L. Knetsch, "Time Bias in Recreation Benefit Estimates." Water Resources Research, 6 June, 1970, pp. 700-704.

Clawson, Marion, Methods for Measuring the Demand for and Value of Outdoor Recreation. Reprint No. 10, Resources for the Future, Inc., Washington, D.C., 1959.

Crutchfield, James A., Jr. and Kurt Schelle, An Economic Analysis of Washington Ocean Recreational Salmon Fishing with Particular Emphasis on the Role Played by the Charter Vessel Industry. Department of Economics, University of Washington, Seattle, October 1978

Crutchfield, James A. "Valuation of a Fishery Resource," Land Economics, Vol XXXVIII (No. 2), May 1962.

Dwyer, J.F., J.R. Kelly, and M.D. Bowes, Improved Procedures for Valuation of the Contribution of Recreation to National Economic Development. Water Resources Center Research Report #128, Unviersity of Illinois at Urbana-Champaign, September 1977.

Edwards, J.A., K.C. Gibbs, L.J. Guedry, and H.H. Stoevener, The Demand for Non-Unique Outdoor Recreational Services: Methodological Issues. Oregon Agriculture Experiment Station Technical Bulletin #133, Corvallis, May 1976.

Hicks, John R. 1939 Value and Capital, second ed. Oxford: Oxford University press.

Hiett, R.L. and J.W. Worrall, Marine Recreational Fishermen's Ability to Estimate Catch and to Recall Catch and Effort Over Time. Human Sciences Research Inc., McLean, Va., July, 1977

Hoines, L.J., W.D. Ward, and G.D. Nye, Washington State Sport Catch Report 1977. Washington Department of Fisheries, Olympia, Washington, 1978.

Hotelling, H., Letter to the Director of the National Park Service, reproduced by the Land and Recreational Planning Division, National Park Service, The Economics of Public Recreation (The "Prewit Report"), Washington, D.C. 1949.

Johnston, J., Econometric Methods, 2nd Ed., New York: McGraw-Hill Book Co., 1972.

Knetsch, J.L., "Outdoor Recreation Demands and Benefits." Land Economics, 39, November 1963, pp. 387-396.

Krutilla, John V. and Fisher, Anthony C. 1975 The Economics of Natural Environments. Baltimore: John Hopkins Press for Resources For The Future.

Lowry, Helen M. (a) Preference Survey of Oregon Resident Anglers. Survey Research Center, Oregon State University, Corvallis, August 1978

Lowry, Helen M. (b) Report of the 1977 Oregon Angler Survey. Survey Research Center, Oregon State University, Corvallis, OR., September 1978.

Mathews, S.B. and G.S. Brown, Economic Evaluation of the 1967 Sport Salmon Fisheries of Washington. Technical Report #2, Washington Department of Fisheries. Olympia, April 1970

Oregon State Tax Commission, Present Versus Broad Base Income Taxes, Salem, Oregon, March 1960

Oregon State, Oregon Blue Book 1979-1980, State Printing Department, State Capitol, Salem, Oregon, February 1971, p. 225.

Petry, G.H., Blakeslee, L.L., Butcher, W.R.,Fuller, R.J.,Staitieh, S.K. Pacific Northwest Salmon and Steelhead Fishery Report. The Economics and Employment Impacts of Commercial and Sport Fishing for Salmon and Steelhead in the Pacific Northwest, Volumes I and II, Washington State University, Feb.,1980.

Portland State University, Center for Population Research and Census. Portland, Oregon, 1977.

U.S. Bureau of the Census, Statistical Abstract of the United States: 1977. (98th edition) Washington, D.C. (1977), pp. 478-479.

U.S. Department of Transportation, 1976 Cost of Owning and Operating an Automobile. Federal Highway Administration, Highway Statistics

U.S. Bureau of the Census, County and City Data Book 1977 (a statistical abstract supplement) U.S. Government Printing Office, Washington, D.C. 20402, 1978.

U.S. Bureau of the Census, Census of the Population: 1970 Vol. 1. Characteristics of the Population. Part 49, Washington U.S. Government Printing Office, Washington, D.C. 20402, 1973.

Working, E.J., "What Do Statistical 'Demand Curves' Show?", Quarterly Journal of Economics, Vol. 41 (1927). pp. 212-235.

APPENDICES

APPENDIX I

EXPANSION FACTORS USED FOR THE OREGON SAMPLE

APPENDIX I

EXPANSION FACTORS USED FOR THE OREGON SAMPLE

Method

1 S-S tag holders non-cumulative (permanent or annual)

Q_i S-S tags in Popn in Quarter i/Sample S-S tags in Quarter i

Q_1 = 76,153/444 = 171.5

Q_2 = 85,022/596 = 142.6

Q_3 = 84,841/572 = 148.3

Q_4 = 29,240/270 = 108.3

SUMS 275,256/1,882

2 S-S tag holders cumulative (permanent or annual)

Q_1 = S-S $tags_1$/sample S-S $tags_1$

Q_2 = (S-S $tags_1$ + S-S $tags_2$)/S-S $tags_2$

.
.
.

Q_4 = (S-S $tags_1$ + ... + S-S $tags_4$)/S-S $tags_4$

Q_1 76,153/444 = 171.5

Q_2 161,175/596 = 270.4

Q_3 246,016/572 = 430.1

Q_4 275,256/270 = 1,019.5

3 Daily license holders (1, 2, and 3 day angling licenses). Anglers who purchase daily licenses are eligible to fish for salmon and steelhead without a tag, hence, these anglers were considered to be temporary S-S anglers. These anglers were not cumulated from one quarter to the next since we assumed all daily licenses expire during the quarter they were purchased. Anglers who purchased a daily license more than once accounted for approximately 17 percent of the daily licenses.[a/]

[a/] From R.L. Berry, Oregon Department of Fish and Wildlife.

Method

3 Q_i Daily licenses in Quarter i/sample daily licenses in Quarter i

Q_1	2,390/8	=	298.8
Q_2	43,374/25	=	1,735.0
Q_3	80,903/168	=	481.6
Q_4	28,904/21	=	1,376.4
TOTAL	155,571/222		

4 S-S tags were also divided into counties on a percentage basis according to the percentage of the sample. Cumulated S-S tags over the four quarters four each county were calculated as follows:

County i

Q_1; S-S $tags_1$* % in county i/sample S-S $tags_i$

Q_2; (S-S $tags_1$* % in county i + S-S $tags_2$* % in county i)/

sample S-S $tags_{2i}$

.
.
.

Q_4; (S-S $tags_1$* % in county i + ... + S-S $tags_4$* % in county i)/

sample S-S $tags_{4i}$

where: S-S $tags_{ji}$ = S-S tags sold in quarter "j" in county "i"

S-S $tags_i$ = S-S tags sampled in Quarter "i"

Expansion Factors for S-S Tags by County Distributed According to the Respondents in the Sample and Cumulated to Account for Four Quarters.

Region 1	Expansion Factor	Region 3	Expansion Factor
Benton	414.0	Baker	379.0
Clackamas	400.9	Clatsop	408.6
Lane	401.4	Columbia	407.9
Linn	395.9	Coos	401.1
Marion	404.7	Crook	417.4
Multnomah	407.5	Curry	407.2
Polk	399.5	Deschutes	414.0
Washington	400.5	Gilliam	379.8
Yamhill	399.5	Grant	379.5
		Harney	506.0
Region 2		Hood River	406.6
Douglas	403.2	Jefferson	414.1
Jackson	407.4	Klamath	396.7
Josephine	406.6	Lake	379.0

Method	Region 3 (cont.)	Expansion Factor
4	Lincoln	403.5
	Malheur	375.8
	Morrow	455.4
	Sherman	455.4
	Tillamook	404.7
	Umatilla	399.4
	Union	421.7
	Wallowa	433.6
	Wasco	404.7
	Wheeler	379.4

5 S-S tags purchased during 1977 divided by the number of S-S tags purchased in each quarter.

Q_1 275,256/444 = 619.9 Q_3 275,256/572 = 481.2

Q_2 275,256/596 = 461.8 Q_4 275,256/270 = 1,019.5

6 Non-cumulative blow-up factors for all fishing caluclated by quarter by region as follows:

Region i

Q_i = Total licenses sold in Quarter i/sample licenses reported in Quarter i.

7 Expansion factors for all fishing trip expenses and trips by quarter by region calculated as follows:

Region i

Quarter 1: Permanent licenses$_{(1i)}$ + temporary licenses$_{(1i)}$ = N_{1i}/n_{1i}

Quarter 2: Permanent licenses$_{(1i + 2i)}$ + temporary licenses$_{(2i)}$ = N_{2i}/n_{2i}

⋮

Quarter 4: Permanent licenses$_{(1i + 2i + 3i)}$ + temporary licenses$_{(4i)}$ = N_{4i}/n_{4i}

where: Permanent licenses$_{(1i)}$ = yearly licenses sold in first quarter in Region:

Temporary licenses$_{(1i)}$ = temporary licenses sold in first quarter in Region i

Region 1

Q_1	96,283/222	=	433
Q_2	223,604/399	=	560
Q_3	294,449/519	=	567
Q_4	277,038/225	=	1,231

Region 2

Q_1	18,246/81	=	225
Q_2	42,076/147	=	286
Q_3	54,863/191	=	287
Q_4	51,678/83	=	623

Region 3

Q_1	41,863/388	=	108
Q_2	96,103/698	=	137
Q_3	124,572/907	=	137
Q_4	120,355/393	=	306

NOTE: Permanent licenses are cumulated throughout the four quarters but temporary licenses are assumed to have expired during the quarter they were purchased.

8 S-S tags (yearly)/S-S tags in sample.

275,256/1882 = 146.26

APPENDIX II

DEFINITION OF SAMPLING AREAS FOR OREGON

Area	Counties	
A	Columbia	Tillamook
	Clatsop	Lincoln
B	Coos	Curry
C	Multnomah	Washington
	Clackamas	
D	Yamhill	Marion
	Polk	Linn
	Benton	Lane
E	Douglas	Jackson
	Josephine	
F	Hood River	Deschutes
	Wasco	Crook
	Sherman	Klamath
	Jefferson	
G	Gilliam	Umatilla
	Wheeler	Wallowa
	Morrow	Union
	Grant	Baker
H	Lake	Malheur
	Harney	

Area	% of Licenses	Number of Licenses (1974)	3% Sample	Questionnaires Sent Out
A	5.0	28,438	853	853
B	3.7	21,647	649	649
C	35.8	206,637	6,199	2,066**
D	27.0	155,946	4,678	1,559**
E	11.7	67,542	2,026	1,013*
F	9.5	54,726	1,642	1,642
G	5.1	29,446	883	883
H	2.3	13,174	395	395
TOTAL	100.1	577,556	17,325	9,060

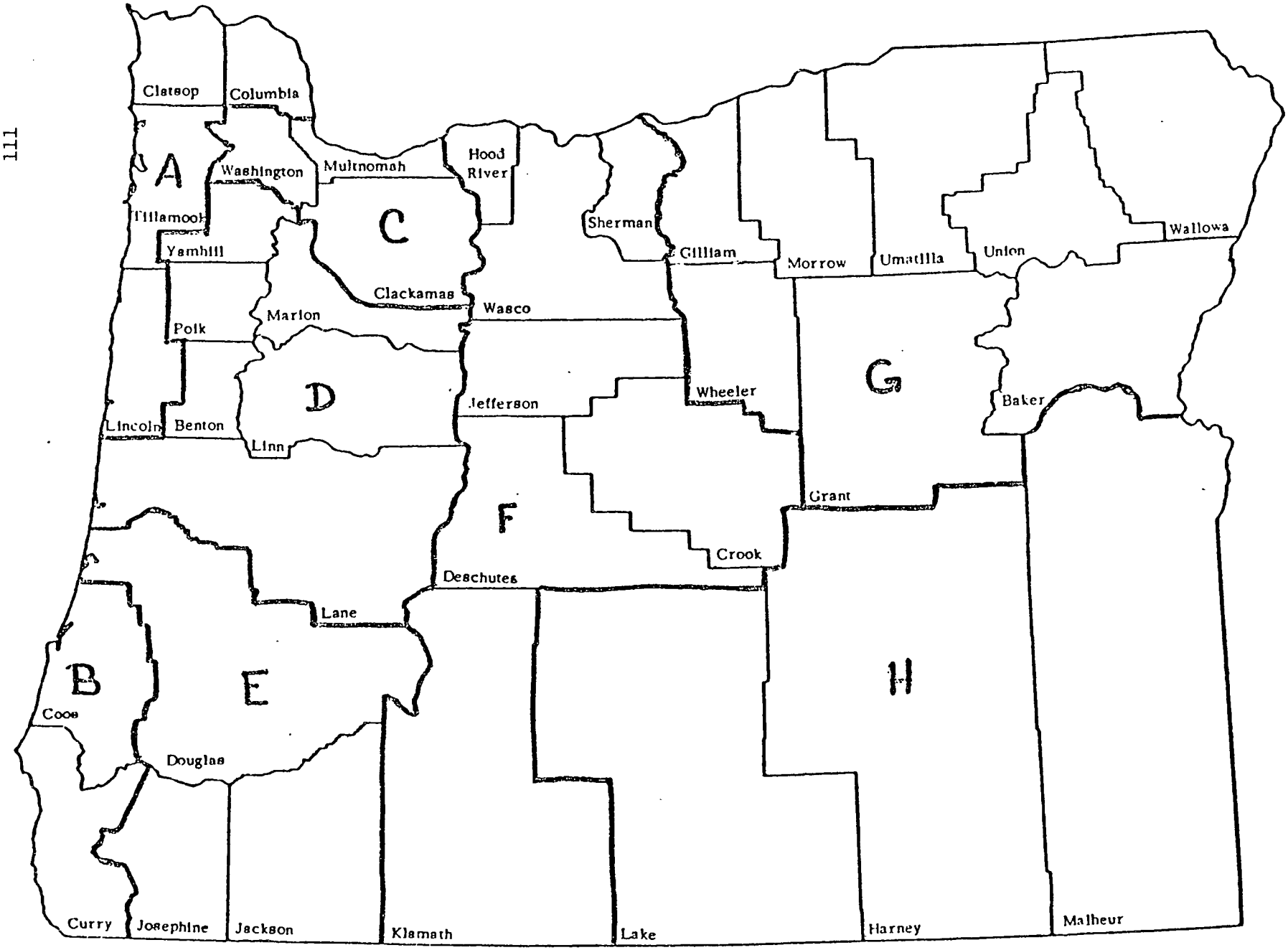
* 50% rate
**33% rate

The sample was 50 percent of names drawn in Area E, and 33 percent in Areas C and D. In all other areas, all names drawn were used.

Fish & Wildlife Areas	Our Areas	% of Licenses	3% Sample	Questionnaires Sent Out
1	A+C+D	67.8	11,730	4,478
2	B+E	15.4	2,675	1,662
3	F	9.5	1,642	1,642
4	G	5.1	883	883
5	H	2.3	395	395

Area	Punchcards No. of Lic.	% of Tags	3% Sample	Questionnaires Sent Out
1	23,525	5.4	706	630
2	27,825	6.4	835	724
3	101,245	23.2	3,037*	806
4	201,469	46.1	6,044**	1,201
5	83,138	19.0	2,494*	690
	437,138	100.1	13,116	4,051
6			OUT-OF-STATE	949
			TOTAL	5,000

*33% rate
**25% rate


Clatsop
Columbia
A
Washington
Multnomah
Hood River
C
Tillamook
Yamhill
Sherman
Gilliam
Morrow
Umatilla
Union
Wallowa
Clackamas
Wasco
Marion
Polk
D
G
Jefferson
Wheeler
Baker
Lincoln
Benton
Linn
Grant
F
Crook
Deschutes
Lane
B
E
H
Coos
Douglas
Curry
Josephine
Jackson
Klamath
Lake
Harney
Malheur

APPENDIX III

DEFINITION OF SAMPLING AREAS FOR WASHINGTON

Area 1

County	No. of County Licenses
Pend Oreille	125
Stevens	425
Ferry	125
Douglas	425
Lincoln	350
Spokane	9,275
Whitman	875
Adams	575
Franklin	1,950
Grant	2,300
Benton	4,925
Walla Walla	1,275
Asotin	575
Columbia	125
Garfield	200
TOTAL LIC. FOR AREA	23,525
TOTAL LIC. FOR STATE	437,162
PERCENTAGE OF STATE	5.38%

Area 2

County	No. of County Licenses
Okanogan	900
Chelan	4,125
Kittitas	1,400
Yakima	9,625
Klickitat	975
Skamania	1,350
Lewis	9,450
TOTAL LIC. FOR AREA	27,825
TOTAL LIC. FOR STATE	437,162
PERCENTAGE FOR STATE	6.365%

Area 3

County	No. of County Licenses
Cowlitz	17,574
Wahkiakum	950
Pacific	2,950
Grays Harbor	11,524
Thurston	19,524
Mason	4,625
Jefferson	3,350
Clallam	14,474
Clark	26,274
TOTAL LIC. FOR AREA	101,245
TOTAL LIC. FOR STATE	437,162
PERCENTAGE OF STATE	23.16%

Area 4

County	No. of County Licenses
Pierce	63,623
King	137,846
TOTAL LIC. FOR AREA	201,469
TOTAL LIC. FOR STATE	437,162
PERCENTAGE FOR STATE	46.08%

Area 5

County	No. of County Licenses
Snohomish	33,739
Skagit	8,400
Whatcom	9,350
Kitsap	24,449
Island	6,600
San Juan	600
TOTAL LIC. FOR AREA	83,138
TOTAL LIC. STATE	437,162
PERCENTAGE OF STATE	19.017%

Area	Punch Cards No. of Lic.	% of Tags	3% Sample	Questionnaires Sent Out
1	23,525	5.4	706	630
2	27,825	6.4	835	724
3	101,245	23.2	3,037*	806
4	201,469	46.1	6,044**	1,201
5	83,138	19.0	2,494*	690
SUBTOTAL	437,202	100.1	13,116	4,051
6			OUT-OF-STATE	949
			TOTAL	5,000

* 33% rate
**25% rate

OREGON OCEAN SALMON

ZONE	COUNTIES	BuF_1	BuF_2	BuF_3	BuF_4	Q1	Q2	Q3	Q4	Est. Total Trips	Population Obs.		Trips/Capita Trips	Travel Cost ATSAL	Destination Cost ATSAL	Travel Time ATHSAL	All Fish. Equipment ATEQ
1	Clatsop Curry	58.11	221.45	416.13	587.47	0	14	41	3	22,903	8	46,400	.60136	2.900	8.125	.250	1780.4
2	Coos 1 (13,500)	97.45	203.35	348.09	440.32	0	5	5	3	4,078	9	39,600	.10298	6.889	19.556	.667	761.4
3	Coos 2	40.14	95.73	191.36	218.05	9	11	15	0	4,285	8	23,600	.18157	6.375	11.750	.625	4592.9
4	Lincoln Tillamook	78.69	208.15	382.06	411.69	0	0	59	6	25,012	6	51,200	.48852	8.667	16.667	2.000	191.3
5	Benton Columbia	130.31	184.77	722.40	858.41	0	19	14	1	14,483	10	103,000	.14061	17.300	37.300	2.500	364.8
6	Douglas	422.93	351.18	449.26	938.90	0	11	36	1	20,975	14	105,700	.24475	19.000	27.000	3.429	1247.6
7	Jackson	303.12	218.39	261.30	614.33	0	4	9	4	5,683	10	124,500	.04565	40.000	14.500	6.100	561.1
8	Josephine Polk Washington Yamhill	492.48	511.23	755.47	1523.77	0	9	11	4	19,006	11	361,800	.05253	28.909	56.455	5.091	951.4
9	Lane 1 (16,500)	453.40	523.34	483.73	1853.38	1	0	33	0	16,416	10	294,400	.08444	18.300	12.100	3.200	589.8
10	Lane 2	634.00	573.20	309.98	716.00	0	0	0	2	4,222	6	67,900	.06218	26.333	37.833	4.833	3261.5
11	Clackamas 1 (16,500)	876.75	800.10	746.81	2788.00	0	6	3	0	7,041	8	163,000	.04320	33.750	83.875	5.625	940.6
12	Clackamas 2	608.67	309.11	442.52	541.39	0	10	2	0	3,976	7	57,000	.06975	74.000	77.429	4.714	452.1
13	Linn	435.36	649.60	655.77	1142.06	1	1	10	0	7,643	6	88,300	.08656	50.333	58.833	5.167	1775.2
14	Marion	388.54	637.23	715.36	1140.92	0	5	30	2	26,929	9	287,300	.14377	25.222	113.500	6.833	1459.8
15	Multnomah 1 (16,500)	607.57	887.38	1247.73	2028.15	0	3	31	0	41,341	8	343,700	.12029	27.125	88.000	3.875	908.0
16	Multnomah 2 (21,000)	106.55	159.63	175.53	530.89	0	0	40	0	7,021	7	63,100	.11127	35.875	81.429	3.857	469.0
17	Multnomah 3 (49,800)	659.88	715.95	637.74	1618.36	0	2	7	1	7,514	7	142,000	.05292	47.429	72.857	6.149	941.9
18	Crook Deschutes Hood River Jefferson Sherman Wasco Wheeler	133.18	129.64	306.77	624.07	0	5	2	3	2,817	9	114,850	.02453	87.556	43.667	11.000	2284.0
19	Klamath	267.47	175.53	206.00	820.00	0	2	15	0	3,441	7	58,700	.05862	62.143	71.714	9.857	5151.0
20	Baker Grant Harney Lake Malheur Morrow Union Wallowa	122.49	148.74	180.53	537.22	0	1	5	1	1,589	7	101,850	.01560	159.000	173.714	20.000	466.9
21	Umatilla	93.40	113.11	149.86	313.19	0	2	6	0	1,125	7	53,900	.02087	125.857	99.571	18.000	1840.9

OREGON OCEAN SALMON

Zone	COUNTIES	S-S Fishing Equipment ATRSEQ	AINC	Miles AMLSSAL	Opportun. Cost of Tm AOPYCSTM
1	Clatsop Curry	1556.5	18475	14.5	1.500
2	Coos 1 (13,500)	253.6	7709	21.6	1.000
3	Coos 2	3079.3	27325	18.8	3.875
4	Lincoln Tillamook	111.7	18167	80.3	10.167
5	Benton Columbia	218.4	26790	91.1	19.900
6	Douglas	977.1	24350	120.0	35.143
7	Jackson	315.3	21910	226.9	48.300
8	Josephine Polk Washington Yamhill	737.0	16727	193.6	17.727
9	Lane 1 (16,500)				
10	Lane 2	398.7	13000	119.3	17.600
11	Clackamas 1 (16,500)	2389.8	30933	171.7	53.333
12	Clackamas 1 (16,500)	299.5	15000	206.3	35.750
12	Clackamas 2	4466.7	33629	247.3	73.286
13	Linn	776.5	37450	203.3	77.167
14	Marion	1125.0	30881	168.9	44.333
15	Multnomah 1 (16,500)	750.5	12938	156.8	23.125
16	Multnomah 2 (21,000)	552.5	21500	143.8	27.333
17	Multnomah 3 (49,800)	337.7	49800	236.6	112.714
18	Crook Deschutes Hood River Jefferson Sherman Wasco Wheeler	1047.8	22896	428.9	45.444
19	Klamath	2658.3	26129	352.9	110.286
20	Baker Grant Harney Lake Malheur Morrow Union Wallowa	331.0	17786	768.6	101.143
21	Umatilla	610.7	17286	651.4	150.143

OREGON FRESHWATER SALMON

Cumulative Lic. Popn. | Cumulative Lic. Popn. | Cumulative Lic. Popn. | Cumulative Lic. Popn. | Not Cumulative Resp. | Not Cumulative Resp. | Not Cumulative Resp. | Not Cumulative Resp. | Trips | Trips | Trips | Trips | Σ Trips | Σ Trips | Σ Trips | Σ Trips | | | |

Zone	COUNTIES	Obs.	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Σ Trips	Zone Popl.	Trips per Capita
1	Columbia Clatsop 1 (16500) .741	9	2390	6484	13520	10259	22	41	19	9	49	12	1	0	4332	1897	711	0	6943	42870	.16505
2	Columbia Clatsop 2 (21500) .123	7	397	767	1630	1703	11	20	6	8	4	39	0	0	146	1496	0	0	1640	7950	.20633
3	Columbia Clatsop 3 (49800) .136	4	439	1190	1802	1477	7	10	6	3	4	49	0	0	250	5831	0	0	6081	8790	.69212
4	Clackamas Wasco Marion Benton Linn	6	28105	76232	115432	120619	75	155	169	107	8	8	3	0	2998	3935	2049	0	8982	585300	.015347
5	Umatilla Baker Grant Wallowa	6	4335	11760	17806	18606	40	98	109	48	1	8	0	0	108	120	0	0	228	85400	.00267
6	Multnomah, Hood River, Washington 1 (10,000) .565	6	17342	47037	71225	74426	27	41	48	19	2	15	2	0	1285	17209	2968	0	21462	440193	.04874
7	Multnomah, Hood River, Washington 2 (16500) .176	10	5402	14652	22187	23184	19	61	51	23	10	15	2	0	2843	3603	870	0	7316	137120	.05335
8	Multnomah, Hood River, Washington 3 (21500) .259	6	7969	21562	32650	34117	28	59	85	34	1	5	1	0	284	1827	384	0	2495	201790	.01236
9	Jackson Klamath Douglas 1 (16500) .741	8	11492	31172	47203	49325	35	115	144	59	1	2	13	1	328	542	4261	836	5967	199260	.02995
10	Jackson Klamath Douglas 2 (21500) .259	4	4017	10896	16499	17240	12	60	75	27	0	5	2	0	0	908	440	0	1353	69650	.01936
11	Coos Josephine Curry	7	5873	15931	24124	25208	78	92	78	73	1	7	2	4	72	1212	618	1381	3283	111400	.02950
12	Wasco	7	1022	2772	4197	4386	15	38	13	10	0	45	0	0	0	3283	0	0	3283	21400	.15341
11	Crook Wallowa Jefferson Columbia, Sherman, Klamath	4	7944	21549	32631	34098	54	158	128	44	0	6	1	0	0	818	255	0	1073	124800	.00860
14	Douglas 1 (16500) .741	6	4701	12751	19308	20176	11	46	38	19	0	28	0	10	0	7761	0	0	10619	63300	.16891
15	Douglas 2 (21500) .259	4	1643	4457	6749	7053	4	3	20	10	6	1	4	0	2465	1486	1350	0	5301	32300	.21643
16	Coos Curry Line	5	28077	49034	74249	77586	83	135	178	93	0	6	1	0	0	2179	417	0	2596	394400	.00658
17	Clackamas 1 (13500) .626	6	5926	16073	24338	25431	4	14	20	4	15	9	2	0	22222	10333	2434	0	35989	137720	.26136
18	Clackamas 2 (16500) .374	4	3540	9602	14534	15194	10	26	37	24	6	14	0	0	2124	5170	0	0	7294	82280	.08865
19	Clatsop Columbia	5	3226	8750	13250	13845	45	71	31	18	10	7	0	0	717	863	0	0	1580	64800	.02438
20	Multnomah Washington 1 (13500) .626	8	18546	50303	76171	79595	26	52	58	29	8	4	0	0	5706	27086	0	0	32792	478260	.06856
21	Multnomah Washington 2 (16500) .115	5	3407	9241	13993	14622	13	34	29	12	34	4	0	0	8902	1087	0	0	9989	87860	.11155
22	Multnomah Washington 3 (21500+) .259	5	7671	20812	31515	32931	27	56	84	32	8	4	0	0	2273	1541	0	0	3814	197680	.01937
23	Multnomah Benton Linn Marion	3	37999	103070	156072	163086	97	176	230	129	0	0	9	0	0	0	6107	0	6107	893400	.00684
24	Clackamas Multnomah Washington	7	39092	106032	160558	167773	80	180	228	101	6	11	1	0	2932	6480	704	0	10116	994000	.01018
25	Coos Douglas	5	9458	21683	31640	12958	64	108	106	69	1	1	1	1	148	602	298	478	1526	148900	.01025

Coos Clark/Alsea/Willamette River/Umpqua River/Deschutes River/Rogue River/Columbia River

OREGON FRESHWATER SALMON

Zone	COUNTIES	Travel Cost ATSAL	Destination Cost ADSAL	Travel Time ATMSAL	All Fishing Equipment ATREQ	S-S Fishing Equipment ATRSEQ	AINC	Miles AMLSSAL	Oportun Cost of Tr. AOPYCSTH
1	Columbia Clatsop 1 (16500) .741	14.778	11.889	.556	483.7	218.0	13722	25.3	3.889
2	Columbia Clatsop 2 (21500) .123	8.000	3.714	.429	2259.3	1400.1	21500	19.1	4.000
3	Columbia Clatsop 3 (49800) .136	3.000	12.000	.250	4469.8	3694.8	49800	9.5	4.250
4	Clackamas Wasco Marion Benton Linn	13.333	13.833	1.834	7373.2	5737.2	32650	67.5	1.672
5	Umatilla Baker Grant Wallowa	43.667	27.333	6.833	1968.0	675.0	8660	260.3	14.333
6	Multnomah, Hood River, Washington 1 (10,000; .565	9.000	19.833	1.667	286.8	141.7	8417	70.0	3.333
7	Multnomah, Hood River, Washington 2 (16500) .176	6.900	8.200	1.200	1596.6	1066.9	15300	42.3	6.100
8	Multnomah, Hood River, Washington 3 (21500) .259	13.333	21.000	1.833	2725.5	2289.3	35650	64.3	19.500
9	Jackson Klamath Douglas 1 (16500) .741	17.375	42.000	2.875	1172.0	681.5	13250	109.0	2.375
10	Jackson Klamath Douglas 2 (21500) .259	7.500	181.000	.750	1458.5	690.3	35650	33.5	12.000
11	Coos Josephine Curry	6.714	9.857	1.714	509.4	302.9	13714	63.9	8.429
12	Wasco	7.143	4.710	1.143	124.1	44.7	15757	48.7	8.000
13	Crook Wallowa Jefferson Columbia, Sherman, Klamath	11.250	1.250	2.500	2302.5	2214.3	21950	88.8	8.500
14	Douglas 1 (16500) .741	4.400	5.800	1.000	202.4	122.8	10700	35.2	1.000
15	Douglas 2 (21500) .259	5.500	2.750	1.000	3755.0	2491.3	35650	38.3	14.500
16	Coos Benton Lane	15.000	25.600	3.400	693.6	370.6	20560	121.6	27.800
17	Clackamas 1 (13500) .626	6.833	5.833	.833	903.7	548.5	8928	26.2	1.333
18	Clackamas 2 (16500) .374	1.900	2.800	.000	836.0	389.8	24160	6.4	1.200
19	Clatsop Columbia	24.100	12.400	.800	1018.2	974.8	20252	39.2	6.600
20	Multnomah Washington 1 (13500) .626	9.000	13.875	1.250	2032.8	1168.9	11313	50.3	5.000
21	Multnomah Washington 2 (16500) .115	5.800	4.200	1.200	1911.4	1749.8	16500	40.0	4.800
22	Multnomah Washington 3 (21500+) .259	5.000	7.600	.800	2104.4	1322.0	32820	37.6	16.400
23	Multnomah Benton Linn Marion	24.333	28.667	4.333	1545.3	1157.7	30933	147.7	42.300
24	Clackamas Multnomah Washington	8.428	9.000	.714	291.6	126.7	15751	35.4	2.714
25	Coos Douglas	24.200	9.800	1.600	409.4	124.6	8992	57.0	6.600

Coos/Clackamas/Willamette River/Umpqua River/Deschutes River/Rogue River/Columbia River

OREGON STEELHEAD

Zone Raw Data

Zone	COUNTIES	Obs	Trips Q1	Trips Q2	Trips Q3	Trips Q4	License Q1	License Q2	License Q3	License Q4	Respondents Q1	Respondents Q2	Respondents Q3	Respondents Q4	Total Q1	Total Q2	Total Q3	Total Q4	Σ Trips	Zone Population	Trips/ Capita
1	Benton Lincoln	8	18	0	1	12	4607	12498	18025	19775	31	37	31	36	2675	0	610	6592	9877	109000	.09877
2	Linn	4	12	0	0	15	4790	12992	19673	20557	11	20	30	38	5225	2	0	17131	23006	88300	.25318
3	Coos Jackson Klamath	4	9	0	0	0	12279	33307	50436	52702	81	185	209	97	1364	0	0	0	1364	246300	.00554
4	Curry	6	40	0	0	0	776	--	--	--	22	--	--	--	1411	0	0	0	1411	16900	.08419
5	Wasco Yamhill Washington Marion	4	1	2	1	0	22899	62087	94013	98238	59	133	122	66	388	934	771	0	2093	473500	.00442
6	Clackamas Multnomah 1 (13500) .626	8	6	7	1	3	18684	50680	76742	14731	25	53	52	31	0	6694	1476	7760	15930	481300	.03309
7	Clackamas Multnomah 2 (16500) .115	4	0	1	1	5	3433	9311	14099	14733	15	27	41	16	0	345	344	4604	5293	88440	.05985
8	Clackamas Multnomah 3 (21500) .259	5	1	5	5	0	7731	20969	31752	33179	25	59	95	41	309	1777	1671	0	3757	199170	.01886
9	Columbia	4	1	92	2	0	1745	4733	7167	7489	23	50	14	9	76	6709	1021	0	9902	35300	.28053
10	Clackamas Multnomah Wasco	7	1	10	8	0	30870	83732	126790	132487	80	177	201	98	386	4731	5046	0	10163	790700	.01286
11	Coos 1 (16500) .741	6	26	0	0	1	2307	6259	9478	9904	30	41	35	27	1999	0	0	367	2366	46330	.05052
12	Coos 2 (21500) .123	4	4	1	0	1	383	1039	1573	1644	11	11	8	8	139	94	0	206	469	7770	.06036
13	Coos 3 (49800) .136	4	27	0	0	0	423	1149	1740	1818	8	7	5	5	1428	0	0	0	1428	8600	.16605
14	Douglas	3	4	0	1	0	6344	17208	26057	27228	15	49	58	29	1692	0	449	0	2141	85700	.02498
15	Coos	5	18	0	0	0	3114	8442	12791	13365	49	59	48	40	1144	0	0	0	1144	63200	.01810
16	Wasco 1 (13500) .626	6	3	21	0	0	530	1435	2622	2739	7	23	6	2	274	1584	0	0	1858	13210	.14065
17	Wasco 2 (16500)	7	3	2	7	1	383	1037	1570	1640	8	15	7	8	196	138	1570	205	2019	7890	.25589
18	Hood River Multnomah 1 (13500) .626	4	4	1	10	0	13427	36420	55149	57627	28	49	50	27	1918	741	1030	0	(3689	153130	.03677
19	Hood River Multnomah 2 (16500) .374	6	0	1	15	0	8022	21759	32948	34429	31	71	92	36	0	306	5372	0	5678	211000	.02691
20	Deschutes Crook Jefferson Klamath Marion 1 (13500) .626	4	4	2	1	0	12321	33421	50607	52881	38	108	109	44	1297	619	464	0	2380	199260	.01194
21	Deschutes Crook Jefferson Klamath Marion 2 (16500) .374	5	0	1	7	1	7361	19967	30234	31595	42	97	107	56	0	206	1978	564	2748	119000	.02308
22	Gilliam Grant Wheeler Wasco	7	11	0	5	1	1806	4900	7487	7831	22	58	61	17	903	0	614	461	1978	33000	.05994
23	Harney Deschutes Crook	5	5	1	0	0	5465	14825	22449	23458	40	81	83	41	683	181	0	0	866	69750	.01242
24	Union Umatilla	3	4	4	0	0	3227	8754	13256	13852	35	79	93	46	369	443	0	0	812	77400	.01491
25	Clackamas Tillamook Multnomah	4	12	1	0	0	31035	84130	--	--	82	156	--	--	4582	500	0	0	5082	789000	.00644
26	Columbia Washington	4	32	1	0	0	10989	29805	--	--	38	91	--	--	9254	328	0	0	9582	249200	.03845
27	Lincoln Tillamook Polk Yamhill 1 (10000) .565	4	3	4	2	0	4017	10896	16499	17240	19	22	21	14	634	1981	1571	0	4186	82430	.05078
28	Lincoln Tillamook Polk Yamhill 2 (13500) .435	7	11	24	0	2	3092	8389	12703	13274	29	33	31	23	1173	6101	0	1154	8428	108100	.07796
29	Marion Clackamas 1 (16500) .741	7	7	5	10	2	14506	39329	59551	62229	18	36	46	17	5639	5402	12946	7341	31368	301810	.10393
30	Marion Clackamas 2 (21500) .259	7	6	0	7	7	5068	13747	20816	21751	22	47	69	49	1302	0	2112	3107	6601	105490	.06257
31	Multnomah Jefferson Wasco	6	4	2	1	3	22043	59790	90536	94605	69	152	150	75	3278	787	604	3784	6453	580300	.01112
32	Washington	4	0	5	1	3	9244	25072	37965	39671	15	41	40	11	0	3058	949	9155	13162	215000	.06122
33	Umatilla Union Morrow Gilliam Sherman	3	3	2	0	0	3911	10610	--	--	39	89	-	--	301	238	0	0	539	88200	.00611

Columbia/Clackamas/Chetco/Alsea/ Coos/Coquille/ John Day/ Deschutes/ Nehalem/ Nestucca

OREGON STEELHEAD

Raw Zone Data

	Zone	Counties	Travel Cost ATSAL	Destination Cost AOSAL	Travel Time ATMSAL	All Fish. Equipment ATREQ	S-S Fish. Equipment ATRSEQ	AINC	Miles AMLSSAL	Opportun. Cost of Ti AOPYCSTH
Alsea	1	Benton Lincoln	10.375	4.625	1.625	992.6	839.1	12938	60.9	7.250
	2	Linn	8.250	4.250	2.250	1265.0	850.3	14875	83.5	7.500
Chetco	3	Coos, Jackson, Klamath	67.250	26.500	10.250	2729.8	1546.0	19565	238.0	53.750
	4	Curry	2.333	7.167	0.667	1017.5	231.7	19883	24.0	3.333
Clackamas	5	Wasco, Yamhill Washington, Marion	15.250	5.750	2.250	887.5	332.8	16500	71.8	18.000
	6	Clackamas, Multnomah 1 (13500) .626	4.375	1.875	1.125	511.6	355.8	10745	32.1	2.000
	7	Clackamas, Multnomah 2 (16500) .115	5.750	4.500	.250	475.3	243.8	16500	16.5	2.000
	8	Clackamas, Multnomah 3 (21500) .259	6.200	6.600	.800	509.8	25.6	32820	27.2	6.200
Columbia	9	Columbia	1.500	3.250	.250	1627.0	331.3	12250	1.5	1.250
	10	Clackamas, Multnomah, Wasco	15.571	7.286	2.000	1177.7	859.9	22257	68.9	15.857
Coquille	11	Coos 1 (16500) .741	6.833	3.167	1.500	385.3	291.3	12750	47.3	4.333
	12	Coos 2 (21500) .123	4.250	.750	1.000	1353.3	998.5	21500	38.8	9.250
	13	Coos 3 (49800) .136	6.750	.000	.750	1172.5	638.0	49800	31.5	15.250
Coos	14	Douglas	12.333	2.000	2.000	242.0	144.3	22100	83.3	15.000
	15	Coos	7.000	3.000	1.200	1090.8	799.4	23860	43.0	9.200
Deschutes	16	Wasco 1 (13500) .626	5.833	14.500	.833	200.8	79.7	10410	25.8	1.667
	17	Wasco 2 (16500)	7.857	1.857	1.429	477.6	322.0	24114	52.6	19.000
	18	Hood River, Multnomah 1 (13500) .626	18.000	33.500	3.500	632.3	462.5	13500	135.3	22.500
	19	Hood River, Multnomah 2 (16500) .374	41.833	67.667	5.333	1004.7	815.3	28433	200.0	73.667
	20	Deschutes, Crook, Jefferson, Klamath Marion 1 (13500) .626	22.500	10.000	4.250	1635.5	1124.3	11750	170.3	24.250
	21	Deschutes, Crook, Jefferson, Klamath Marion 2 (16500) .374	22.000	19.800	4.000	872.8	450.4	30820	140.8	42.600
John Day	22	Gilliam, Grant, Wheeler, Wasco	11.000	.857	1.857	509.4	102.1	12714	69.6	7.286
	23	Harney, Deschutes, Crook	28.000	10.000	5.400	2956.4	650.8	12992	206.0	25.200
	24	Union Umatilla	39.000	12.667	6.667	308.0	62.3	16000	263.3	50.667
Wahalem	25	Clackamas, Tillamook, Multnomah	45.000	19.000	2.750	185.0	91.3	29900	104.5	35.250
	26	Columbia, Washington	10.500	.500	2.500	2064.5	1711.8	21075	82.5	17.750
	27	Lincoln, Tillamook, Polk, Yamhill 1 (10000) .565	3.500	1.750	.500	76.3	23.3	5615	23.0	.500
	28	Lincoln, Tillamook, Polk, Yamhill 2 (21500) .435	9.857	2.857	2.286	351.4	237.4	16643	89.6	11.571
	29	Marion, Clackamas 1 (16500) .741	13.714	3.286	3.143	318.6	241.0	11857	94.9	8.571
	30	Marion, Clackamas 2 (21500) .259	20.571	22.714	3.900	1929.0	889.7	37671	113.7	41.875
Westucca	31	Multnomah, Jefferson, Wasco	29.000	15.333	5.500	1891.2	1482.0	26850	290.3	58.167
	32	Washington	14.500	2.500	5.500	151.8	93.0	21700	126.3	33.000
	33	Umatilla, Union, Morrow, Gilliam, Sherman	72.000	3.333	15.333	425.3	274.3	29267	616.7	159.667

OREGON STEELHEAD

Zone Raw Data

	Zone	COUNTIES	Trips Obs	Trips Q1	Trips Q2	Trips Q3	Trips Q4	License Q1	License Q2	License Q3	License Q4	Respondents Q1	Respondents Q2	Respondents Q3	Respondents Q4	Total Q1	Total Q2	Total Q3	Total Q4	Σ Trips	Zone Population	Trips/ Capita
Rogue & Illinois	34	Jackson	7	10	0	17	3	5153	13927	21165	22116	17	64	81	16	3031	0	4442	1943	9416	124500	.07563
	35	Josephine Curry 1 (10,000) .565	8	12	1	5	25	1559	4288	6403	6691	15	20	19	16	1247	211	1685	10455	13598	36480	.35338
	36	Josephine Curry 2 (135,000) .435	6	1	0	2	17	1200	3256	4930	5151	14	13	11	17	86	0	896	5151	6133	29620	.20706
	37	Polk Marion Multnomah Clackamas	5	3	0	1	2	41468	112478	170118	177971	97	184	254	126	1293	0	671	2825	4779	1000900	.00477
	38	Deschutes Lane	6	4	1	2	0	16262	44111	66794	--	48	130	179	71	1355	339	746	0	2440	312000	.00782
	39	Klamath	4	2	4	3	0	4012	10883	16480	17220	15	62	80	21	535	702	618	0	1855	58700	.03160
	40	Coos Douglas	5	0	1	3	6	9458	25655	38848	40594	64	108	208	69	0	238	1079	3530	4847	149900	.03235
Trask	41	Yamhill Marion Tillamook	5	16	0	5	3	3811	37463	56727	59276	46	71	82	52	4804	0	3459	1140	9403	257600	.03651
	42	Washington	6	4	8	1	3	9244	25072	37965	39671	15	41	40	11	2465	4892	949	9155	17461	215000	.08121
	43	Multnomah	4	3	6	3	1	20382	55285	83715	87477	51	99	131	60	1199	3351	1917	1458	7925	549000	.01444
Umpqua	44	Douglas Coos 1 (10,000) .565	5	7	9	7	2	5344	14495	21949	22036	21	46	32	23	1781	2836	4801	1994	11412	84130	.13565
	45	Douglas Coos 2 (21,500) .299	9	18	11	1	5	2828	7671	11615	12138	32	53	58	37	1591	1592	200	1640	5023	44520	.11283
	46	Douglas Coos 3 (49,800) .136	6	5	2	7	0	1286	3489	5283	5521	11	9	16	9	584	775	2311	0	3670	20250	.18127
	47	Lane Benton	5	1	5	5	0	14963	40587	61458	64220	34	76	130	53	1320	2670	2364	0	6354	332100	.01913
Wilson	48	Marion Clackamas Multnomah Hood River 1 (13500) .626	4	19	0	1	0	25677	69643	105460	110199	46	85	96	44	10606	0	1099	0	11705	608100	.01925
	49	Marion Clackamas Multnomah Hood River 2 (16500) .374	7	10	8	3	0	15340	41609	63006	65837	51	118	161	85	2894	2821	1174	0	6889	363300	.01896
	50	Columbia Washington 1 (16500) .741	4	2	1	1	1	8143	22806	33443	34946	18	64	28	8	905	345	1194	4368	6812	184660	.03689
	51	Columbia Washington 2 (21500) .259	5	5	8	1	3	2846	7719	11689	12214	20	27	26	14	712	2287	450	2403	5852	64540	.09067
	52	Tillamook	4	23	0	0	0	1187	--	--	--	17	--	--	--	1606	0	0	0	1606	20000	.08030
Salmon	53	Lincoln Marion Yamhill	6	6	1	4	2	14506	39349	59583	62260	51	77	89	66	1707	511	2678	1887	6783	268600	.02525
	54	Multnomah Jefferson Clackamas	4	6	2	4	0	30487	82693	125217	130844	69	176	217	86	2651	940	2308	0	5899	779200	.00757
Sandy	55	Clackamas Columbia	5	6	1	1	2	11211	30408	46045	48114	37	90	71	37	1818	338	649	2601	5406	254200	.02127
	56	Multnomah 1 (16500) .741	5	15	0	8	0	15303	40966	62033	64820	32	59	67	37	7080	0	7407	0	14487	406800	.03561
	57	Multnomah 2 (21500) .259	5	6	4	2	0	5279	14319	21682	22657	19	40	64	23	1667	1432	678	0	3777	142190	.02656
Siletz	58	Benton Linn 1 (13500) .626	5	17	2	0	0	4704	12760	19322	20190	7	24	15	15	1424	1063	0	0	12487	98340	.12598
	59	Benton Linn 2 (16500) .374	4	7	1	0	0	2811	7624	11544	12063	13	10	26	16	1514	762	0	0	2276	58760	.03873
	60	Wasco Clackamas Multnomah Deschutes	4	3	0	1	0	34894	94648	143325	149766	103	245	261	129	1016	0	549	0	1565	820810	.01907
	61	Lincoln Polk 1 (13500) .626	5	65	1	0	1	2128	5774	8743	9135	14	17	13	12	9880	340	0	761	10981	47650	.23130
	62	Lincoln Polk 2 (16500) .374	4	14	3	0	0	1272	3449	5223	5458	14	10	15	11	1272	1035	0	0	2307	28350	.08138
Siuslaw	63	Lane	6	9	2	0	1	12238	33195	50269	52524	25	62	119	40	4405	1071	0	1313	6789	262300	.02588

OREGON STEELHEAD

Zone Raw Data

	Zone	COUNTIES	Travel Cost ATSAL	Destina. Cost AUSAL	Travel Time ATHOSL	All Fish. Equipment ATREQ	S-S Fish. Equipment ATRSEQ	INC	Miles AMLSSAL	Opportun. Cost of Ic ZOPTCSTA
	34	Jackson	12.429	12.857	2.000	1168.1	1299.3	24014	72.3	22.429
	35	Josephine Curry 1 (10,000) .565	4.750	2.625	1.125	1594.1	485.9	6110	36.6	1.125
	36	Josephine Curry 2 (135,000) .435	6.667	3.167	1.333	1274.3	969.3	23217	62.2	6.000
	37	Polk Marion Multnomah Clackamas	55.000	102.600	11.000	504.6	342.6	29520	401.4	99.800
	38	Deschutes Lane	87.000	24.250	15.500	2430.0	814.8	32775	590.0	102.250
	39	Klamath	32.600	13.800	7.000	3291.8	1279.8	11692	250.2	30.200
	40	Coos Douglas	16.800	4.200	3.400	1635.4	1367.6	27520	127.2	45.400
	41	Yamhill Marion Tillamook	11.833	3.500	2.000	1463.7	1035.7	19050	82.7	17.167
	42	Washington	15.000	1.125	3.250	283.3	168.8	28475	129.0	41.750
	43	Multnomah	22.800	22.600	3.600	923.0	741.6	25160	136.6	43.800
	44	Douglas Coos 1 (10,000) .565	6.889	2.000	1.667	289.4	118.8	8444	64.2	4.333
	45	Douglas Coos 2 (21,500) .299	6.833	.167	.833	514.5	315.8	19833	28.5	11.167
	46	Douglas Coos 3 (69,800) .136	4.200	1.000	1.000	582.8	295.2	49800	35.2	9.800
	47	Lane Benton	20.400	12.400	3.200	1006.0	560.2	17860	121.6	9.600
	48	Marion Clackamas Multnomah Hood River 1 (13500) .626	25.250	12.750	3.750	657.5	313.0	11750	135.0	14.250
Wilson	49	Marion Clackamas Multnomah Hood River 2 (16500) .374	24.143	6.571	4.714	511.6	301.1	31486	179.1	72.000
	50	Columbia Washington 1 (16500) .741	14.000	16.750	2.250	267.8	148.5	10590	71.5	6.750
	51	Columbia Washington 2 (21500) .259	10.000	1.200	2.200	859.0	737.8	27160	83.6	23.400
	52	Tillamook	1.500	2.000	.250	1135.8	1069.3	19565	8.5	3.000
Coho Salmon	53	Lincoln Marion Yamhill	8.000	2.167	1.500	522.7	129.7	19467	55.7	8.167
	54	Multnomah Jefferson Clackamas	24.750	8.750	4.250	836.3	242.8	12500	157.8	21.500
Sandy	55	Clackamas Columbia	5.800	2.400	.800	721.8	502.6	14400	34.8	5.400
	56	Multnomah 1 (16500) .74	9.600	11.600	1.400	1731.6	1443.8	14000	44.0	2.800
	57	Multnomah 2 (21500) .259	6.600	2.000	1.200	185.8	69.8	44140	42.0	21800
	58	Benton Linn 1 (13500) .626	8.200	8.200	1.800	456.2	196.2	8600	72.4	5.000
Siletz	59	Benton Linn 2 (16500) .374	11.500	1.000	3.000	1288.0	1135.3	19000	110.3	21.250
	60	Wasco Clackamas Multnomah Deschutes	17.750	4.500	8.000	208.3	99.3	33650	290.0	90.250
	61	Lincoln Polk 1 (13500) .626	6.200	4.400	1.000	916.4	798.6	7892	46.4	1.000
	62	Lincoln Polk 2 (16500) .374	12.250	3.000	1.500	361.3	180.0	28575	47.0	14.500
Siuslaw	63	Lane	11.833	4.000	2.167	237.8	78.0	15583	71.7	13.500

WASHINGTON OCEAN SALMON

ZONE	COUNTIES	O & S	Sal Trips/ Zone	Lic Zone	Resp/ Zone	E Trip /Zone	Popn/ Zone	Trips/ Capita	ATCSAL	ATOSAL	ATHSAL	ATREQ	ATRSEQ	ATRC	ANRSAL	ANRCSH
1	Mason Lewis Thurston Clark Cowlitz Grays Harbor	8	14	89440	149	8404	453360	.018537	27125	65750	7125	16076	13618	19725	2640	55750
2	Franklin Whitman Walla Walla	7	8	4423	37	956	111010	.008612	130286	242714	23142	13193	4621	32200	8323	116714
3	Snohomish	8	19	35660	46	6977	264200	.026408	52875	179250	8125	15668	10116	22532	3121	92375
4	Clallam 1 (10,000)	6	8	7200	12	4800	19010	.25250	9500	12334	2000	3502	2262	6660	759	3333
5	Clallam 2 (13,500)	5	40	4610	4	28813	12160	2.36949	2800	11400	1000	19200	12192	15390	192	1500
6	Clallam 3 (21,000)	12	12	2090	22	3040	9210	.330076	6750	21250	917	6169	1180	30933	361	2250
7	Spokane 1 (13,500)	7	8	8250	15	4400	236480	.0186062	108714	176143	19714	18233	12906	10500	2415	42321
8	Spokane 2 (16,500)	8	14	2430	29	1173	69860	.0167907	117375	116000	20375	18493	6689	27335	7619	19167
9	King 1 (13,500)	11	16	112070	27	49809	882000	.056473	31000	60909	6909	13139	3721	10630	2003	14333
10	King 2 (16,500)	9	19	13270	39	6465	104440	.061902	36333	56556	8222	8861	6376	16500	3056	36778
11	King 3 (21,500) *2/3	9	24	9150	44	4490	69610	.071665	29222	35889	7667	26830	20560	21500	2750	61667
12	King 4 (21,500 + 49,800) *1/3 + 1/3	5+5	20	6610	47	2813	54430	.051681	28400	99900	6500	11245	8690	35650	3370	48400
13	King 5 (49,800) *2/3	10	17	4070	49	1612	32050	.044056	309000	124300	8700	29051	20717	49800	3334	134000
14	Pierce	1	9	60190	62	8737	415710	.021017	46857	133000	9000	3794	2757	30772	3515	118095
15	Chelan Okanogan Douglas Whatcom Skagit	10	8	26786	73	2935	230900	.012711	53500	129500	10500	23135	3318	28675	3988	91875
16	Benton	7	7	6092	17	2508	77370	.032415	42714	51143	9714	9127	180	40076	4176	122143
17	Yakima Grant	7	8	13180	49	2197	200500	.010976	60571	68571	8857	26733	22040	13423	6819	86619
18	Kitsap Island 1 (16,500)	7	14	27690	28	13845	128740	.107542	25429	36571	7571	16070	12131	13714	2890	95571
19	Kitsap Island 2 (21,500)	7	14	4380	37	1657	20370	.081345	29571	66318	5444	8842	711	31832	1959	33015
20	Lincoln Adams	7	6	1168	8	876	22840	.038354	55000	100333	14667	39227	8922	22633	3647	98667
21	Benton, Franklin, Walla Walla	7	13	9430	49	2502	147960	.01691	44286	113429	15429	10503	116	28980	6013	137857
22	Snohomish, Whatcom, Skagit 1 (16500)	7	19	46,640	29	4474	351600	.041166	51571	92205	8714	3041	1748	10209	3158	28000
23	Snohomish, Whatcom, Skagit 2 (21500)	7	18	7180	42	3161	55640	.056848	32286	84286	10286	10190	3390	33629	5190	125000
24	Pierce 1 (16500)	6	14	51970	24	30316	358910	.084467	17000	68333	5167	4223	973	14917	2093	10667
25	Pierce 2 (21500)	8	14	8220	38	3028	56800	.053310	43625	150000	5500	2433	1648	39188	2013	45750
26	King 1 (13500)	12	17	112070	43	44306	882000	.052336	20167	86167	5750	8034	4050	9827	2555	21333
27	King 2 (16500)	8	8	13280	23	4619	104440	.044226	36875	70750	8000	6258	3276	16500	3150	60375
28	King 3 (21500)* .25	7	8	3430	16	1715	27010	.063495	29429	170429	6714	7226	4384	21500	2557	32200
29	King 4 (21500)* .25	7	8	3430	17	1614	27010	.057556	27142	147571	6429	17494	12110	21500	2377	60286
30	King 5 (21500)* .25	6	27	3430	16	1500	27010	.055535	24000	135499	6501	15508	4717	21500	2367	63000

WASHINGTON OCEAN SALMON

ZONE	COUNTIES	O&S	Sal Trips/ Zone	Lic Zone	Resp/ Zone	Σ Trips /Zone	Popn/ Zone	Trips/ Capita	ATCSAL	ATDSAL	ATHSAL	ATREQ	ATRSEQ	AINC	AMLSSAL	AOPYCSTM
31	King 6 (21500)* .25	7	18	3430	17	3632	27010	.1344687	47571	101714	7000	4186	2949	21500	2771	60000
32	King 7 (49800)* .5	9	17	3050	37	1401	24040	.0582778	40444	192222	8429	23497	19564	49800	2488	99333
33	King 8 (49800)* .5	9	25	3050	37	2061	24040	.085732	23000	117111	7000	9744	7683	49800	2715	73333
34	Grays Harbor	7	53	12990	15	15588	61340	.254125	3571	20143	1429	2886	1320	21043	546	8000
35	Yakima 1 (16500)	6	7	9750	19	3592	134270	.026752	73833	81833	11167	3912	780	12250	4333	45333
36	Yakima 2 (21500)	8	11	1540	20	847	21250	.0398588	62500	168750	14000	16964	5508	25038	5200	137125
37	Chelan	8	11	6481	30	2376	40600	.058522	71375	197500	12125	14451	3361	23763	4600	93250
38	Thurston, Mason, Pacific 1 (16500)	5	17	23990	26	6459	114340	.056489	7400	31800	3400	9946	3822	12600	1304	6000
39	Thurston, Mason, Pacific 2 (21500)	5	14	3800	22	2418	18090	.133665	31800	51400	3400	7714	5824	32820	1400	42400
40	Spokane, Adams, Stevens, Lincoln 1 (21500)	8	9	11620	38	2752	336870	.0081693	113000	136375	16125	11790	1354	15250	7138	99125
41	Spokane, Adams, Stevens, Lincoln 2 (49800)	6	6	510	15	204	14800	.0137838	49167	96667	16833	51672	20603	49800	6517	162500
42	Kittitas, Grant, Douglas	9	16	26170	69	6068	163290	.0371607	49556	124000	13667	3268	1479	22013	5178	53889
43	Lewis	7	13	8320	24	4507	49500	.0910505	11714	55429	4143	4559	3747	17752	1600	26286
44	Clark, Cowlitz	4	22	44090	70	7558	3779	.0166827	4375	785	58125	31655	2885	25781	22625	24625
45	King, Snohomish	10	24	180830	252	17222	1406750	.0122424	16500	88200	6600	8408	4034	34500	2750	75000
46	Chelan, Klickitat, Franklin, Douglas	8	18	10130	71	2568	101320	.025345	70750	157375	14125	23555	17573	28363	5380	47875
47	Yakima	6	8	11290	39	2316	155520	.0148920	67833	125833	12833	10668	8170	26267	5017	66667
48	Whitman 1 (21500) Spokane, Pend Oreille, Ferry, Walla Walla Whitman 2 (49800)	8	8	13460	45	2393	384640	.0062214	102875	129375	24500	6880	1960	14813	9063	93125
49	Spokane, Pend Oreille, Ferry, Walla Walla	6	7	590	18	229	16900	.0135503	103500	244167	21667	19662	3545	49800	8217	435333
50	Clark, Cowlitz 1 (16500)	8	21	38060	33	24220	195570	.123843	25000	101375	4750	17828	12951	34135	3835	17000
51	Clark, Cowlitz 2 (21500)	8	29	6020	37	3091	30950	.0998707	81250	113125	5500	12653	5615	35650	2012	66875
52	Lewis, Pelrce 1 (16500)	7	11	59150	41	15870	401640	.039513	82714	45286	5143	1247	714	13714	1960	22714
53	Lewis, Pierce 2 (21500)	4	14	9360	45	2212	63560	.0458150	14750	111750	5000	50023	46658	35050	1975	59750
54	Pacific, Thurston	5	18	23140	41	10159	108900	.0932874	10400	15400	2400	11196	9614	26560	988	16000

Note: Zone 1-20 Includes Port 01- Juan de Fuca, LaPush, Neah Bay, Sekiu

Zone 21-44 Includes Port 02- Westport Grays Harbor Coast

Zone 45-54 Illwaco

WASHINGTON FRESH WATER SALMON AFSALW

	Zone	Counties	Obs.	Sal Trips /zone	Lic/ Zone	Resp/ Zone	ETrips Zone	Popn/ Zone	Trips/ Capita	ATSAL	ADSAL	ATMSAL	ATREQ	ATRSEQ	AINC	AMLS-SAL	AOPYCSM	Predicted TRPSCPI	Predicted Trips	Consumer Surplus	Sub tot By river
	1	Clark	6	24	26703	42	15259	164,000	.09304	10.167	19.667	2.667	1859.3	1318.2	17800	82.5	24.500	.04156	6815	281660	
	2	Skamania, Yakima	7	12	12823	42	3664	161,800	.02265	9.837	11.143	4.129	781.1	195.9	14994	149.4	10.714	.04189	6778	283070	
Columbia	3	Klickitat, Benton, Franklin	5	8	9291	46	1616	128,500	.01257	3.000	7.800	.600	2796.8	1746.2	35880	32.0	4.400	.04938	6340	264790	
	4	Pacific, Cowlitz	7	46	21029	36	26870	89,200	.30123	7.286	28.751	.571	1390.9	992.0	20686	25.0	5.000	.04453	3972	165890	
	5	Chelan, Douglas, Spokane, Okanogan	5	10	19109	92	2077	398,000	.00522	93.000	43.400	11.200	527.4	437.0	10900	411.6	78.400	.00572	2277	95080	1,093,490
Cowlitz	6	Cowlitz, Clark	6	26	44088	70	16376	237,200	.06904	3.333	23.000	1.333	1381.8	1097.0	23350	44.8	20.333	.04898	11611	484920	
	7	Thruston, Pierce, Lewis	6	13	88010	119	9615	574,000	.01675	4.500	5.000	1.500	613.3	553.0	20800	63.0	17.167	.04760	27322	1,141,100	1,626,020
Lewis	8	Clark	5	14	26703	42	8901	164,000	.05427	1.400	1.800	1.000	658.6	229.2	23960	27.8	4.000	.05127	8408	351,170	351,170
																			73,523	3,070,680	3,070,680

Average benefit per predicted trips: 3070 680/73523 = $41.76

Estimated number of trips to other rivers: 455095/830 x 128 = 70,183 trips

Total estimated consumer surplus: (70,183 x $41.76) + (3070 6801 = $6,001,520

PUGET SOUND, SAN JUAN ISLAND, HOODS CANAL

ZONE	COUNTIES	OBS	Sal Trips/Zone	Lic Zone	Resp/Zone	L Trips/Zone	Popn/Zone	Trips/Capita	ATCSAL	ATDSAL	ATHSAL	ATREQ	ATRSEQ	AINC	ADJSSAL	ADJCSTH
1	King 1 (13,500) .77196	14	40	112066	159	28192	898860	.03136	11.856	30.214	1.000	471.0	381.1	9673	44.1	2.643
2	King 2 (16,500, 21,500) 1/3	9	37	8378	12	25832	67200	.38440	6.000	16.444	1.667	1706.7	542.9	21500	62.8	16.111
3	King 3 (16,500), 21,500) 1/3	10	30	9309	13	21482	74670	.28769	5.500	36.100	1.000	802.5	241.0	21000	39.5	2.400
4	King 4 (16,500, 21500)) 1/3	10	20	9309	13	14321	74670	.19179	9.700	31.800	1.300	2516.4	1792.4	21000	55.8	5.200
5	King 5 (49,800) 1/3	8	55	1860	3	34467	14000	2.4619	5.750	27.000	.500	3939.4	3138.6	49800	25.5	9.875
6	King 6 (49,800) 1/3	9	20	2115	3	14100	17500	.80571	6.111	47.444	1.667	1012.5	612.0	49800	66.2	22.000
7	King 7 (49,800)	9	33	2115	3	23265	17500	1.3294	7.333	17.889	1.000	3485.4	2940.9	49800	51.7	6.111
8	Snohomish 1 (16,500)	10	48	30788	40	36946	240190	.15382	8.000	24.600	1.300	1149.0	831.8	14300	47.0	4.500
9	Nohomish 2 (21,500)	14	60	4872	6	48720	38010	1.2818	3.714	14.429	.643	2152.5	1851.9	31607	23.6	6.857
10	Yakima, Cowlitz, Lewis, Clark	8	12	39602	133	3573	295900	.01208	38.250	23.000	7.875	2966.3	830.5	21950	298.8	68.375
11	Chelan, Kittitas, Grant, Benton, Franklin	11	16	17245	83	3324	227600	.01460	38.364	26.454	8.545	2770.3	1123.6	24718	319.5	89.691
12	Pierce 1 0-21500 (5/11)	11	40	54556	56	38969	382840	.10179	10.000	17.182	.636	694.7	530.0	17000	26.8	2.636
13	Pierce 2 21,500-49,800 (6/11)	12	81	5637	6	76099	39560	1.9236	2.583	8.833	.333	1681.0	1697.7	35650	14.6	4.083
14	Thurston, Jefferson, Mason, Clallam	12	103	43087	80	55474	179300	.30939	1.750 4.909	23.250 9.182	.750 1.000	5191.3 1852.8	4820.9 1238.9	31317 9496	25.8 38.1	2.063 2.091
15	Kitsap 1 (16,500)	11	41	20581	41	20581	109040	.18875								
16	Kitsap 2 (21,500)	10	25	2254	4	14087	11940	1.1798	4.100	20.600	.800	1636.4	1104.4	21500	34.9	8.100
17	Kitsap 3 (49,800)	7	23	1003	2	11534	5310	2.1721	3.857	11.286	.286	1427.6	850.1	49800	22.0	5.250
18	Island, San Juan, Skagit, Whatcom	10	90	27315	45	54630	200630	.27229	5.100	12.700	.600	1340.1	1208.5	32100	32.0	10.600

APPENDIX V

QUESTIONNAIRES AND LETTERS SENT TO OREGON AND WASHINGTON ANGLERS

OREGON STATE UNIVERSITY
CORVALLIS, OREGON 97331

in cooperation with

OREGON DEPARTMENT OF
FISH AND WILDLIFE

Dear Oregon Angler:

You have been selected to help us establish the economic importance of fishing in Oregon. Your response to the enclosed questionnaire is a vital part of our sample, and there is no way we can substitute for the answers you can give us.

Your information will be used to help justify and establish policies for protecting and enhancing Oregon fishing. Please be assured that your answers will be treated confidentially and will be used for estimating patterns of fishing and the economic importance of fishing in Oregon.

Please fill out the entire questionnaire. If you did not fish during the months of January, February, March, please answer the questions on pages 1 and 4 of the questionnaire and return the entire questionnaire in the self-addressed envelope provided. No stamp is necessary.

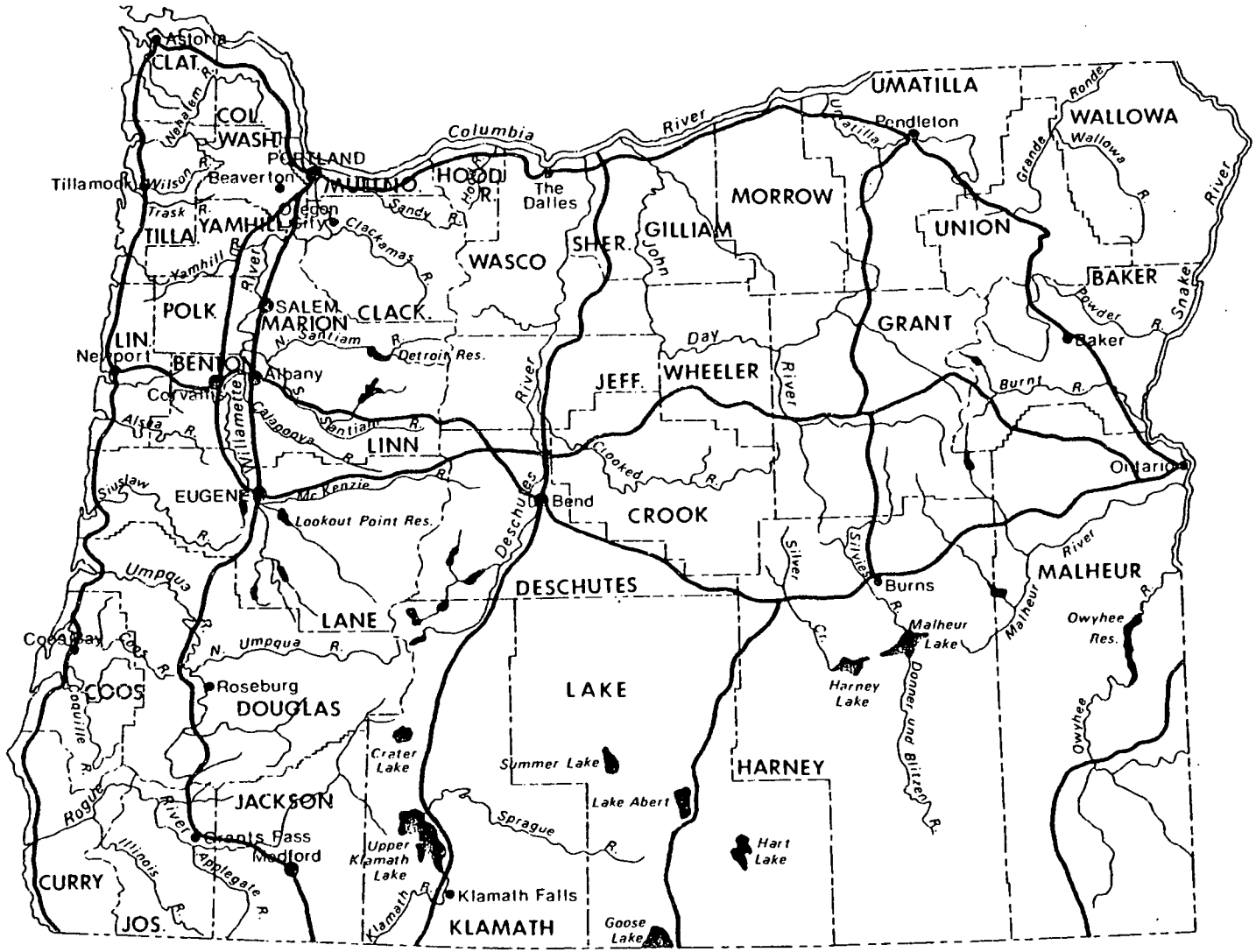
If you have any questions, please call (collect) either Bill Brown or Ken Gibbs. We would be glad to receive any comments you care to make.

Sincerely,

William G. Brown Kenneth C. Gibbs

WILLIAM G. BROWN
Dept. of Agricultural &
Resource Economics
PH. (503) 754-2942

KENNETH C. GIBBS
Dept. of Resource Recreation
Management
PH. (503) 754-2043


Astoria
CLAT.
COL.
WASH.
PORTLAND
Columbia River
Tillamook
Wilson R.
Beaverton
MULTNO.
HOOD R.
The Dalles
Trask R.
Oregon City
Sandy R.
Clackamas R.
YAMHILL
TILLA.
Yamhill R.
Yamhill River
WASCO
SHER.
GILLIAM
MORROW
UMATILLA
Umatilla
Pendleton
Grande Ronde
WALLOWA
Wallowa R.
Wallowa River
UNION
BAKER
Powder R.
Snake River
POLK
SALEM
MARION
CLACK.
GRANT
Baker
LIN.
Newport
N. Santiam R.
Detroit Res.
BENTON
Albany
Corvallis
Willamette River
JEFF.
WHEELER
Day
John River
Burnt R.
Alsea R.
Calapooya R.
Santiam R.
LINN
Crooked R.
Ontario
Siuslaw R.
EUGENE
McKenzie R.
Lookout Point Res.
Deschutes R.
Bend
CROOK
Umpqua R.
DESCHUTES
Silver Cr.
Silver R.
Burns
MALHEUR
Malheur River
Malheur R.
Owyhee Res.
LANE
Coos Bay
Coos R.
N. Umpqua R.
Malheur Lake
Harney Lake
Donner und Blitzen R.
Owyhee R.
COOS
Roseburg
DOUGLAS
LAKE
Coquille R.
Crater Lake
Summer Lake
HARNEY
Rogue River
JACKSON
Grants Pass
Medford
Lake Abert
Sprague R.
Illinois R.
Applegate R.
Upper Klamath Lake
Hart Lake
CURRY
Klamath R.
Klamath Falls
JOS.
KLAMATH
Goose Lake

OREGON STATE UNIVERSITY
CORVALLIS, OREGON 97331

in cooperation with

OREGON DEPARTMENT OF
FISH AND WILDLIFE

Dear Oregon Angler:

A few days ago we asked you to help us by completing an itemized list of your fishing expenditures for the months of January, February, and March. Your response to our survey is a vital part of our sample, and there is no substitute for the answers that only you can give us. Your information will be used to obtain better protection and management for our salmon and steelhead in the years ahead.

Since we have not heard from you, we would appreciate it if you would fill out the enclosed questionnaire and mail it in the attached envelope today. Please fill out the entire questionnaire. If you did not fish during the months of January, February, and March, please answer the questions on pages 1 and 4 of the questionnaire and return the entire questionnaire in the self-addressed envelope provided. No stamp is necessary.

If you have any questions, please call (collect) either Bill Brown or Ken Gibbs. We would be glad to receive any comments you care to make.

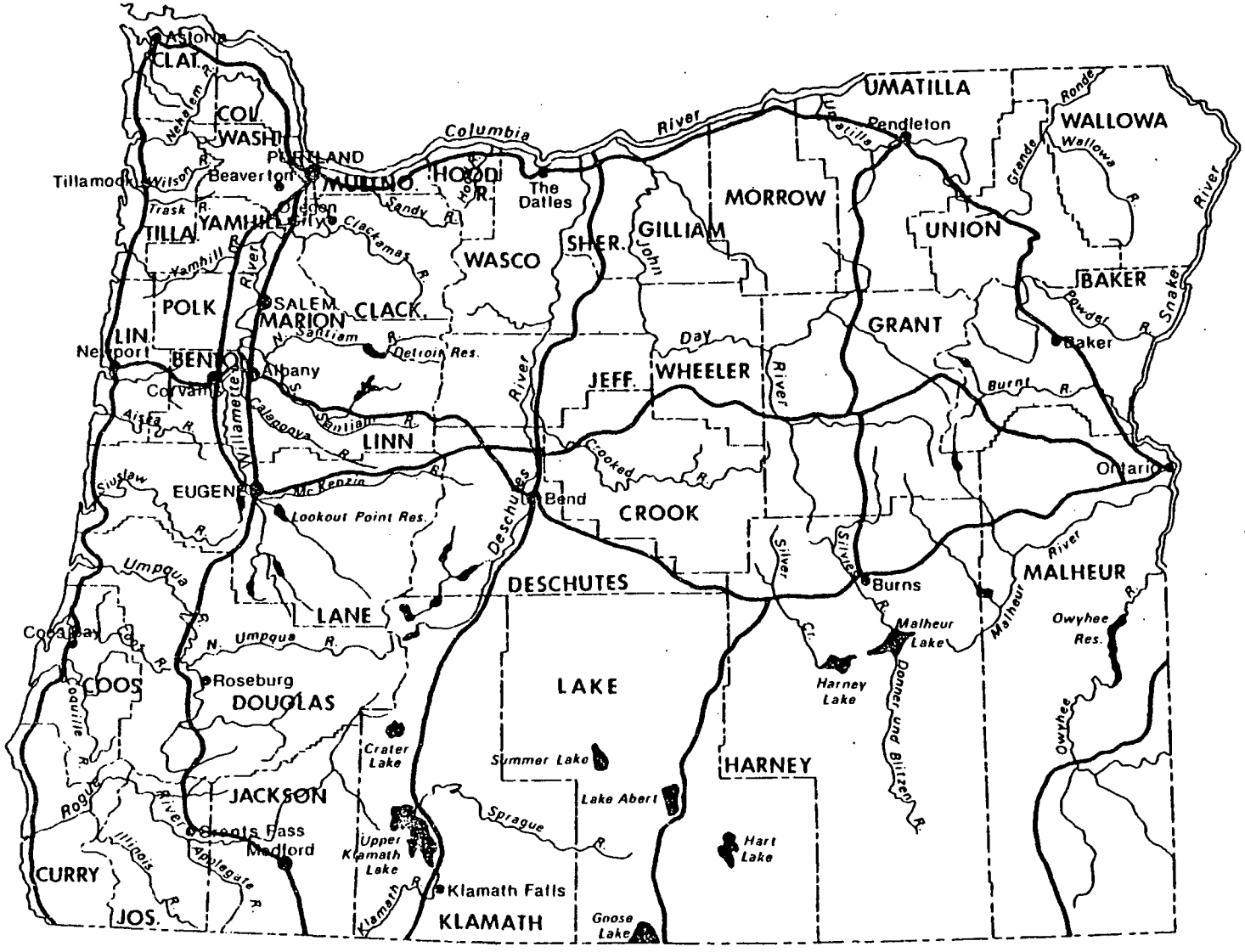
Sincerely,

William G. Brown Kenneth C. Gibbs

WILLIAM G. BROWN
Dept. of Agricultural &
Resource Economics
PH: (503) 754-2942

KENNETH C. GIBBS
Dept. of Resource Recreation
Management
PH: (503) 754-2043

arb
Attachment


Astoria
CLAT.
COL.
WASH.
PORTLAND
MULTNO.
HOOD R.
Columbia River
The Dalles
UMATILLA
Pendleton
WALLOWA
Grande Ronde
Wallowa R.
Snake River
Tillamook
Wilson R.
Beaverton
Trask R.
Oregon City
Sandy R.
TILLA.
YAMHILL
Yamhill R.
Clackamas R.
WASCO
SHER.
GILLIAM
MORROW
UNION
BAKER
Powder R.
Baker
POLK
SALEM
MARION
CLACK.
Santiam R.
Detroit Res.
LIN.
Newport
BENTON
Albany
Corvallis
Willamette River
Calapooya R.
Day
JEFF.
WHEELER
GRANT
Burnt R.
Aiata R.
LINN
Crooked R.
Ontario
Siuslaw R.
EUGENE
McKenzie R.
Lookout Point Res.
Bend
CROOK
Deschutes River
Umpqua R.
DESCHUTES
Silver
Silvies R.
Burns
MALHEUR
Malheur R.
Owyhee Res.
Owyhee R.
LANE
Coos Bay
N. Umpqua R.
Malheur Lake
Harney Lake
Donner und Blitzen R.
COOS
Roseburg
DOUGLAS
LAKE
Coquille R.
Crater Lake
Summer Lake
HARNEY
JACKSON
Rogue River
Grants Pass
Medford
Applegate R.
Lake Abert
Sprague R.
Upper Klamath Lake
Hart Lake
CURRY
Illinois R.
Klamath R.
Klamath Falls
JOS.
KLAMATH
Goose Lake

OREGON FISHING ACTIVITIES QUESTIONNAIRE

1. Did you, yourself, go fishing *in Oregon* any time during the last 3 months (January-March 1977), or not?
   ____ Yes, fished. (Go to Question 2) ____ No, did not fish. (Go to Question 5)

2. How many times did you go fishing from January through March 1977? ____ Number.

3. Of these trips, how many were intended primarily as fishing trips, as contrasted to trips taken mainly for other reasons (but where some fishing was done)? ____ Number.

4. Of all your fishing trips, how many were primarily for steelhead? ____ Number.
   How many were primarily for salmon fishing? ____ Number.
   How many for resident trout? ____ Number.
   How many for any other species? (Please specify _____) _____ Number.

5. What type of fishing license(s) did you, yourself, purchase for 1977? (Please check all that apply.)

   - ☐ Resident Combination
   - ☐ Resident Combination with bow
   - ☐ Resident Angler
   - ☐ Juvenile Angler
   - ☐ Nonresident Angler
   - ☐ 10-day Angler
   - ☐ 1-day Angler
   - ☐ 2-day Angler
   - ☐ 3-day Angler
   - ☐ Pioneer Angler
   - ☐ Disabled Vet Angler
   - ☐ Senior Citizen Angler

6. In addition, did you purchase a salmon-steedhead tag? ____ Yes ____ No

7. What is *your* approximate age?

   - ☐ Under 21
   - ☐ 21-29
   - ☐ 30-39
   - ☐ 40-49
   - ☐ 50-59
   - ☐ 60-69
   - ☐ 70 years or over

8. How many people, including yourself, are in your household and living at home at the present time? ____ Number.

9. Please indicate the average number of hours, if any, you were working for pay during the last three months. Please check if you are retired or are a student.

   ____ Number of hours worked per week.
   ____ Retired.
   ____ Student.

10. Which of the following categories most closely corresponds to the combined yeerly income, before taxes, for *all* members of your household for 1976?

    - ☐ Under $3,000
    - ☐ $3,000-$ 4,999
    - ☐ $ 5,000-$ 7,999
    - ☐ $ 8,000-$11,999
    - ☐ $12,000-$14,999
    - ☐ $15,000-$17,999
    - ☐ $18,000-$ 24,999
    - ☐ $25,000-$ 34,999
    - ☐ $35,000-$ 49,999
    - ☐ $50,000-$100,000
    - ☐ Over $100,000

(PLEASE TURN TO PAGE 2 IF YOU FISHED IN JANUARY-MARCH 1977:
PLEASE TURN TO PAGE 4 IF YOU DID NOT)

PLEASE ANSWER THE FOLLOWING QUESTIONS (11-21) ABOUT YOUR LAST 3 *OREGO*
IF YOU TOOK LESS THAN 3 TRIPS, PLEASE FILL IN ONLY THE QUEST

11. Write name of river, stream, or name of lake (or ocean) where this fishing trip took place .....

12. In what county was this port, river, lake, or stream where you fished? (See map on back of introductory letter) .....

13. How many miles did you travel, one way, on your fishing trip? .....

14. Did you make this trip in an automobile or a pickup without a camper?
Circle YES or NO .....

15. Did you make this trip in a motor home, auto with camper, or a pickup camper?
Circle YES or NO .....

16. How many hours (or days) did you spend at your destination? .....

17. When you were developing your plans for this trip, what was the shortest length of time you would have considered staying at your destination, in hours (or days)? .....

18. How many *hours* did you actually fish? (If for more than one species, divide the time among species):
STEELHEAD .....
SALMON .....
RESIDENT TROUT .....
SEA-RUN CUTTHROAT .....
WARM WATER GAME FISH .....
OTHER .....

19. How many fish of each species did you, yourself, catch?
STEELHEAD .....
SALMON .....
RESIDENT TROUT .....
SEA-RUN CUTTHROAT .....
WARM WATER GAME FISH .....
OTHER .....

20. How many people went with you on this trip? .....

21. Approximately how much did you *and your group* spend for the following items? (Just your best estimate)
(a) Food, drink (including liquor), bought in resteurants, bars, or taverns, while traveling to and from your destination .....
(b) Food and drink bought in restaurants, bars, and taverns while at your destination .....
(c) Total amount spent for camping fees, lodging in motels and hotels, while traveling to and from your destination .....
(d) Amount spent for camping fees and lodging while at your destination .....
(e) Guide service, bait, and lures .....
(f) Rental of fishing tackle, equipment, boat, and/or motor .....
(g) Boat launching fees .....
(h) Gallons of gas used in your boat (do not include rental boats and motors) .....
(i) Other *rental* items (Specify) _____ .....
_____ .....
(j) Miscelleneous expenses (Specify) _____ .....
_____ .....

)N FISHING TRIPS DURING THE PERIOD JANUARY THROUGH MARCH 1977.
IONS REFERRING TO THE NUMBER OF TRIPS YOU TOOK.

	TRIP 1	TRIP 2	TRIP 3
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	YES _____ _____ NO	YES _____ _____ NO	YES _____ _____ NO
	YES _____ _____ NO	YES _____ _____ NO	YES _____ _____ NO
	_____ _____ hours days	_____ _____ hours days	_____ _____ hours days
	_____ _____ hours days	_____ _____ hours days	_____ _____ hours days
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____
	_____ gals.	_____ gals.	_____ gals.
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____
	$ _____	$ _____	$ _____

PLEASE GO ON TO NEXT PAGE

22. Listed below are items often used by fishermen. Please record your expenditures for equipment, regardless of when purchased, that you still use in your Oregon fishing activities. To see how to complete percents for the last two columns, please refer to the following example:

EXAMPLE: Assume you purchased a boat, and use it a total of 100 hours per year. Of this 100 hours, 50 hours were used for all angling, of which 25 hours were for salmon and steelhead angling. In this case, 50% should be allocated to *all* angling, and 25% should be allocated to salmon and steelhead fishing.

Item	Purchase price	Year(s) in which purchased	State in which purchase was made	Replacement cost today	Percent of time item is used for all fishing	Percent of time item is used for salmon and steelhead fishing
	dollars			*dollars*	%	%
Tackle:						
Rod(s)	$			$	100	
	$			$	100	
	$			$	100	
Reel(s)	$			$	100	
	$			$	100	
	$			$	100	
Creel(s)	$			$	100	
Tackle box(es)	$			$	100	
Landing net(s)	$			$	100	
Any other tackle	$			$	100	
Boating equipment:						
Boat(s)	$			$		
Boat trailer(s)	$			$		
Outboard motor(s)	$			$		
Any other	$			$		
Special clothing:						
Waders, Hipboots	$			$		
Fishing vest(s)	$			$		
Coat(s)	$			$		
Rainwear	$			$		
Any other	$			$		
Camping equipment:						
Tent(s)	$			$		
House trailer	$			$		
Camper(s)	$			$		
Pickup truck(s)	$			$		
Sleeping bags	$			$		
Lantern(s)	$			$		
Stove(s)	$			$		
Any other	$			$		
Other equipment expenditures not listed above; (specify):						
_____	$			$		
_____	$			$		

Is there anything else you would like to say about fishing in Oregon? Please return questionnaire and any comments you would like to make in envelope provided.

THANK YOU FOR YOUR COOPERATION.

Washington State University
Pullman, Washington 99164

in cooperation with

Department of Fisheries
State of Washington
and
Oregon State University

Dear Washington Angler:

You have been selected to help us establish the economic importance of fishing in Washington. Your response to the enclosed questionnaire is a vital part of our sample, and there is no way we can substitute for the answers you can give us.

Your information will be used to help justify and establish policies for protecting and enhancing Washington fishing. Please be assured that your answers will be treated confidentially and will be used for estimating patterns of fishing and the economic importance of fishing in Washington.

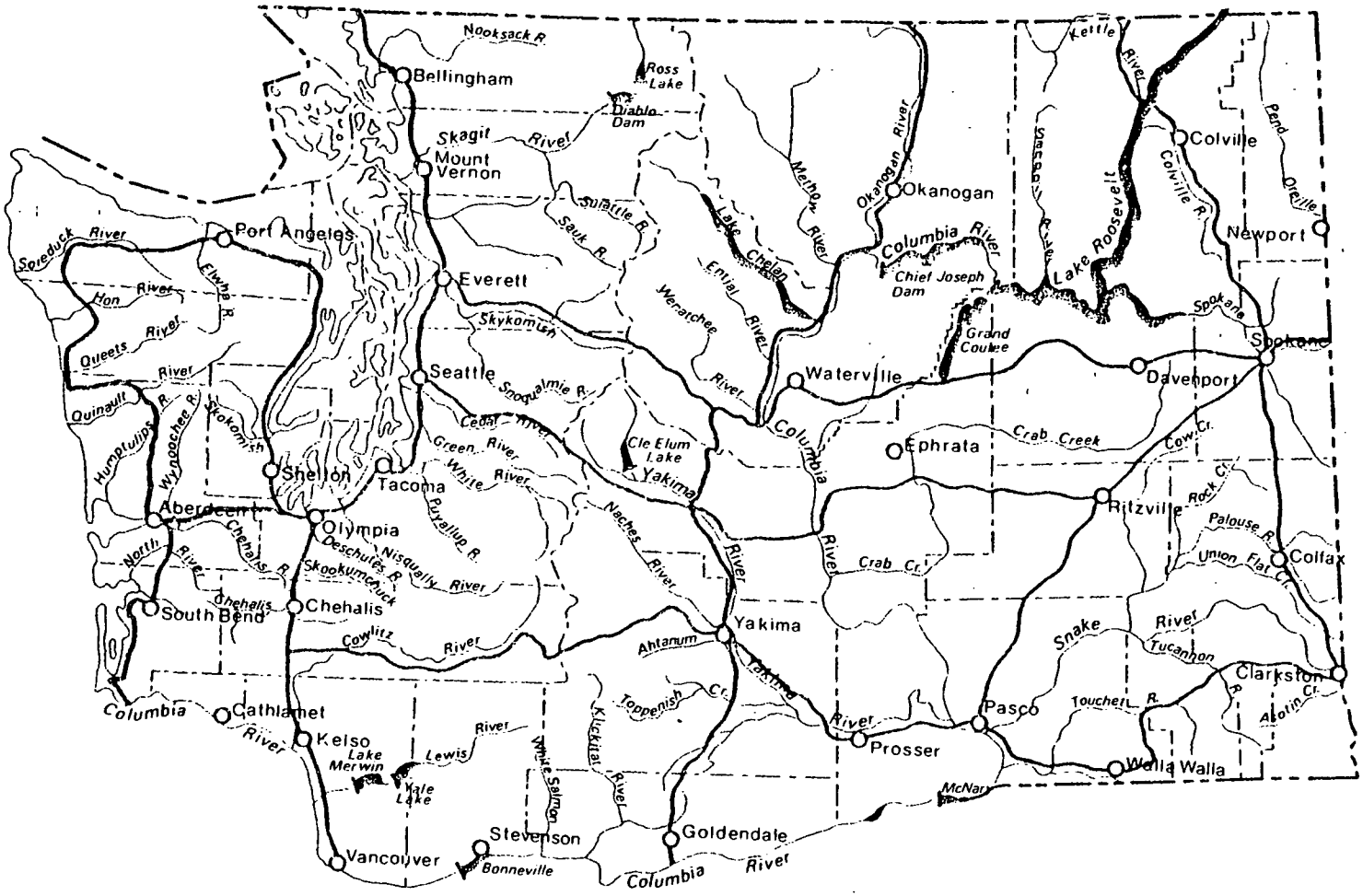
Please fill out the entire questionnaire.If you did not fish during the months of June, July, August, or September, please answer the questions on pages 1 and 4 of the questionnaire and return the entire questionnaire in the self-addressed envelope provided. No stamp is necessary.

If you have any questions, please advise me accordingly. I would be glad to receive any comments you care to make.

Sincerely,

Glenn H. Petry

Glenn H. Petry
College of Economics & Business


Nooksack R.
Bellingham
Ross Lake
Diablo Dam
Skagit River
Mount Vernon
Suiattle R.
Sauk R.
Lake Chelan
Methow River
Okanogan River
Okanogan
Kettle River
Colville
Colville R.
Pend Oreille
Newport
Columbia River
Chief Joseph Dam
Lake Roosevelt
Spokane
Sequim
Port Angeles
Sooes River
Elwha R.
Hoh River
Queets River
Everett
Skykomish
Wenatchee
Entiat River
Grand Coulee
Spokane
Davenport
Waterville
Quinault R.
Humptulips R.
Wynoochee R.
Skokomish
Seattle
Snoqualmie R.
Cedar River
Green River
White River
Cle Elum Lake
Yakima
Columbia River
Ephrata
Crab Creek
Cow Cr.
Shelton
Tacoma
Aberdeen
Olympia
Puyallup R.
Naches River
Ritzville
Rock Cr.
Palouse R.
Colfax
Union Flat Cr.
North River
Chehalis R.
Deschutes R.
Nisqually River
Skookumchuck
Crab Cr.
Chehalis
South Bend
Yakima
Cowlitz River
Ahtanum
Snake River
Tucannon
Clarkston
Touchet R.
Alkalin Cr.
Columbia River
Cathlamet
Kelso
Lake Merwin
Yale Lake
Lewis River
Toppenish Cr.
Yakima River
Pasco
Prosser
Walla Walla
McNary
White Salmon
Klickitat River
Stevenson
Bonneville
Vancouver
Goldendale
Columbia River

Washington State University
Pullman, Washington 99164

in cooperation with

Department of Fisheries
State of Washington
and
Oregon State University

Dear Washington Angler:

A few days ago we asked you to help us by completing an itemized list of your fishing expenditures for the months of June, July, August, and September. Your response to our survey is a vital part of our sample, and there is no substitute for the answers that only you can give us. Your information will be used to obtain better protection and management for our salmon in the years ahead.

Since we have not heard from you, we would appreciate it if you would fill out the enclosed questionnaire and mail it in the attached envelope today. Please fill out the entire questionnaire. If you did not fish during the months of June, July, August, or September, please answer the questions on Pages 1 and 4 of the questionnaire and return the entire questionnaire in the self-addressed envelope provided.No stamp is necessary.

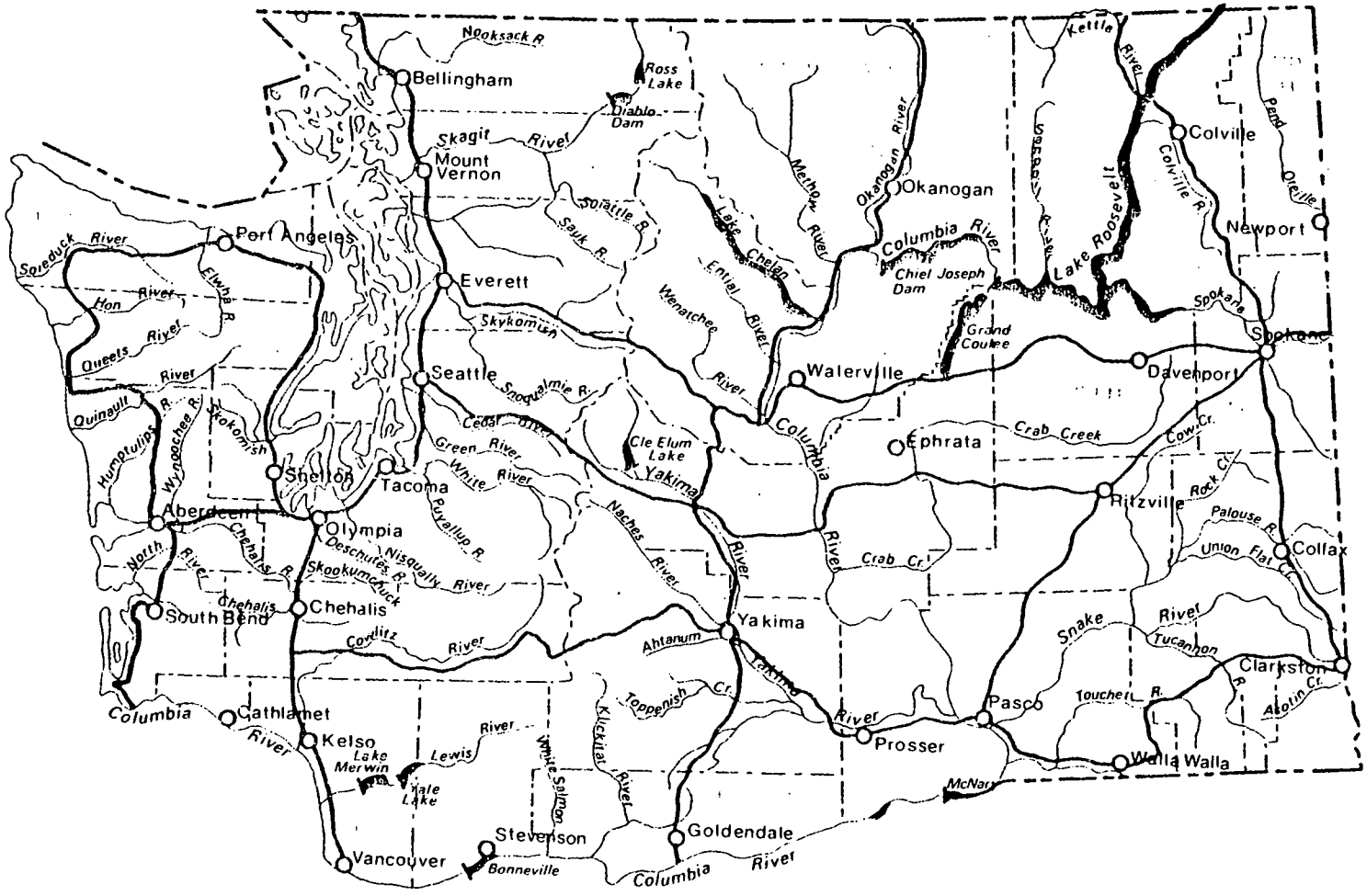
If you have any questions, please advise me accordingly. I would be glad to receive any comments you care to make.

Sincerely,

Glenn H Petry

Glenn H. Petry
College of Economics & Business

arb
Attachment


Nooksack R.
Bellingham
Ross Lake
Diablo Dam
Skagit River
Mount Vernon
Okanogan River
Okanogan
Kettle River
Colville
Pend Oreille
Colville R.
Newport
Sauk R.
Methow River
Lake Chelan
Columbia River
Chief Joseph Dam
Lake Roosevelt
Spokane R.
Spokane
Port Angeles
Sooes River
Elwha R.
Hoh River
Everett
Entiat River
Wenatchee River
Grand Coulee
Queets River
Skykomish
Seattle
Snoqualmie R.
Walerville
Davenport
Quinault R.
Wynoochee R.
Skokomish
Cedar River
Cle Elum Lake
Ephrata
Crab Creek
Cow Cr.
Humptulips R.
Shelton
Tacoma
Green River
White River
Yakima
Columbia
Ritzville
Rock Cr.
Aberdeen
Olympia
Puyallup R.
Naches River
Palouse R.
Collax
North River
Chehalis R.
Deschutes R.
Nisqually River
Skookumchuck
Crab Cr.
Union Flat Cr.
Chehalis
South Bend
Chehalis
Yakima
Snake River
Tucannon R.
Clarkston
Cowlitz River
Ahtanum
Touchet R.
Alpowa Cr.
Columbia
Cathlamet
Toppenish Cr.
Pasco
Kelso
Lewis River
Klickitat River
Prosser
Walla Walla
Lake Merwin
Yale Lake
White Salmon
McNary
Stevenson
Goldendale
Vancouver
Bonneville
Columbia River

WASHINGTON FISHING ACTIVITIES QUESTIONNAIRE

1. Did you, yourself, go fishing in *Washington* any time during the last 4 months (June-September, 1977), or not?
   _____ Yes, fished. (Go to Question 2) _____ No, did not fish. (Go to Question 5)

2. How many times did you go fishing from June through September 1977? _____ Number.

3. Of these trips, how many were intended primarily as fishing trips, as contrasted to trips taken mainly for other reasons (but where some fishing was done)? _____ Number.

4. Of all your fishing trips, how many were primarily for Salmon? _____ Number.

   How many were primarily for steelhead fishing? _____ Number.

   How many for resident trout? _____ Number.

   How many for any other species? (Please specify _____) _____ Number.

5. What type of fishing license(s) did you purchase for yourself in 1977? (Please check all that apply.)
   - ☐ State Res. Hunt and Fish
   - ☐ State Res. Fish
   - ☐ County Res. Hunt and Fish
   - ☐ County Res. Fish
   - ☐ 7-day Non-Res. Fish
   - ☐ State Non-Res. Fish
   - ☐ Complimentary Fishing

6. How many punch cards did you, yourself, obtain for 1977? _____ Number.

7. What is your approximate age?.
   - ☐ Under 21
   - ☐ 21-29
   - ☐ 30-39
   - ☐ 40-49
   - ☐ 50-59
   - ☐ 60-69
   - ☐ 70 years or over

8. How many people, including yourself, are in your household and living at home at the present time? _____ Number.

9. Please indicate the average number of hours, if any, you were working for pay during the last three months. Please check if you are retired or are a student.

   _____ Number of hours *worked per week.* _____ Retired. _____ Student.

10. Which of the following categories most closely corresponds to the combined yearly income, before taxes, for *all* members of your household for 1976?
    - ☐ Under $3,000
    - ☐ $ 3,000-$ 4,999
    - ☐ $ 5,000-$ 7,999
    - ☐ $ 8,000-$11,999
    - ☐ $12,000-$14,999
    - ☐ $15,000-$17,999
    - ☐ $18,000-$ 24,999
    - ☐ $25,000-$ 34,999
    - ☐ $35,000-$ 49,999
    - ☐ $50,000-$100,000
    - ☐ Over $100,000

(PLEASE TURN TO PAGES 2 AND 3 IF YOU FISHED IN JUNE-SEPTEMBER 1977:
PLEASE TURN TO PAGE 4 IF YOU DID NOT)

PLEASE ANSWER THE FOLLOWING QUESTIONS (11-21) ABOUT YOUR LAST 3 WAS
IF YOU TOOK LESS THAN 3 TRIPS, PLEASE FILL IN ONLY THE Q

11. Write name of river, stream, or name of lake (or ocean) where this fishing trip took place .....

12. In what county was this port, river, lake, or stream where you fished? (See map on back of introductory letter) .....

13. How many miles did you travel, one way, on your fishing trip? .....

14. Did you make this trip in an automobile or a pickup without a camper?
Circle YES or NO .....

15. Did you make this trip in a motor home, auto with camper, or a pickup camper?
Circle YES or NO .....

16. How many hours (or days) did you spend at your destination? .....

17. When you were developing your plans for this trip, what was the shortest length of time you would have considered staying at your de tion, in hours (or days)? .....

18. How many *hours* did you actually fish? (If for more than one species, divide the time among species):
SALMON .....
STEELHEAD .....
RESIDENT TROUT .....
SEA-RUN CUTTHROAT .....
WARM WATER GAME FISH .....
OTHER .....

19. How many fish of each species did you, yourself, catch?
SALMON .....
STEELHEAD .....
RESIDENT TROUT .....
SEA-RUN CUTTHROAT .....
WARM WATER GAME FISH .....
OTHER .....

20. How many people went with you on this trip? .....

21. Approximately how much did you *and your group* spend for the following items? (Just your best estimate)
(a) Food, drink (including liquor), bought in restaurants, bars, or taverns, while traveling to and from your destinatcn .....
(b) Food and drink bought in restaurants, bars, and taverns while at your destination .....
(c) Total amount spent for camping fees, lodging in motels and hotels, whiie traveling to and from your destination .....
(d) Amount spent for camping fees and lodging while at your destination .....
(e) Guide service, bait, and lures .....
(f) Rental of fishing tackle, equipment, boat, and/or motor .....
(g) Boat launching fees .....
(h) Gallons of gas used in your boat (do not include rental boats and motors) .....
(i) Other *rental* items (Specify) .....
.....
(j) Miscellaneous expenses (Specify) .....
.....

HINGTON FISHING TRIP DURING THE PERIOD JUNE THROUGH SEPTEMBER 1977.
UESTIONS REFEERING TO THE NUMBER OF TRIPS YOU TOOK.

	TRIP 1	TRIP 2	TRIP 3
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....?	YES _____ _____ NO	YES _____ _____ NO	YES _____ _____ NO
.....	YES _____ _____ NO	YES _____ _____ NO	YES _____ _____ NO
.....	_____ _____ hours days	_____ _____ hours days	_____ _____ hours days
stina-	_____ _____ hours days	_____ _____ hours days	_____ _____ hours days
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	_____	_____	_____
.....	$_____	$_____	$_____
.....y	$_____	$_____	$_____
.....	$_____	$_____	$_____
.....	$_____	$_____	$_____
.....	$_____	$_____	$_____
.....	$_____	$_____	$_____
.....	$_____	$_____	$_____
.....	_____ gals.	_____ gals.	_____ gals.
.....	$_____	$_____	$_____
.....	$_____	$_____	$_____
.....	$_____	$_____	$_____
.....	$_____	$_____	$_____

PLEASE GO ON TO NEXT PAGE

22. Listed below are items often used by fishermen. Please record your expenditures for equipment, regardless of when purchased, that you still use in your Washington fishing activities. To see how to complete percents for the last two columns, please refer to the following example:

EXAMPLE: Assume you purchased a boat, and use it a total of 100 hours per year. Of this 100 hours, 50 hours were used for all angling, of which 25 hours were for salmon angling. In this case, 50% should be allocated to *all* angling, and 25% should be allocated to salmon fishing.

Item	Purchase price	Year(s) in which purchased	State in which purchase was made	Replacement cost today	Percent of time item is used for all fishing	Percent of time item is used for salmon fishing
	dollars			*dollars*	%	%
Tackle:						
Rod(s)	$			$	100	
	$			$	100	
	$			$	100	
Reel(s)	$			$	100	
	$			$	100	
	$			$	100	
Creel(s)	$			$	100	
Tackle box(es)	$			$	100	
Landing net(s)	$			$	100	
Any other tackle	$			$	100	
Boating equipment:						
Boat(s)	$			$		
Boat trailer(s)	$			$		
Outboard motor(s)	$			$		
Any other	$			$		
Special clothing:						
Waders, Hipboots	$			$		
Fishing vest(s)	$			$		
Coat(s)	$			$		
Rainwear	$			$		
Any other	$			$		
Camping equipment:						
Tent(s)	$			$		
House trailer	$			$		
Camper(s)	$			$		
Pickup truck(s)	$			$		
Sleeping bags	$			$		
Lantern(s)	$			$		
Stove(s)	$			$		
Any other	$			$		
Other equipment expenditures not listed above; (specify):						
_____	$			$		
_____	$			$		

Is there anything else you would like to say about fishing in Washington Please return questionnaire and any comments you would like to make in envelope provided.

THANK YOU FOR YOUR COOPERATION.