REPLACEMENT

The Oregon Big Game Resource:

an economic evaluation

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INTRODUCTION

The main objective of this study was to develop numerical estimates of the gross and net economic values of the Oregon big game resource, based upon the year 1968. For this study, "net economic value" is defined as the value of the resource as measured by willingness of hunters to incur expense to obtain the hunting. The "gross economic value" will include the amount spent on durable equipment items used in big game hunting, and on hunting trip expenses incurred by big game hunters.

Although "net" or "gross" economic values have relevance to the management of publicly owned resources, this investigation should not be viewed as a management study. A complete analysis of the management problem perhaps could best be approached by means of a large simulation model [Anderson and Halter, 1972]. In this type of computer model, information about expected numbers of big game animals under various forage conditions and game management regulations could be considered, along with economic values, in order to increase social and economic benefits from the big game resource. However, the objective of this study, as originally planned, was to focus only on the economic values associated with the Oregon big game resource.

Economic values are only part of the total consideration involved in the management of publicly owned resources. Nevertheless, without some measure of these economic values, it is very difficult for society to make rational decisions on resource use, especially where big game animals may be competitive with commercial timber production, domestic livestock, farming, or other industry. For example, economic returns from cattle grazing and other commercial uses can at least be approximated [Nielsen, et al., 1966], but no comparable figures have been available for Oregon big game. Thus, this study was designed to help supply needed information about the economic value of Oregon big game, an important component of Oregon's natural resources.

REVIEW AND EVALUATION OF METHODS FOR ESTIMATING OUTDOOR RECREATION BENEFITS

Dramatic growth in outdoor recreation demand in recent years, stemming from increases in population, leisure time, income, and mobility, calls for continuous adjustments in resource allocation. The fact that much outdoor recreation is provided by public agencies creates an economic problem, specifically that of measuring the value of a recreational resource which does not have a conventional market price. Due to the absence of a market for outdoor recreation, a number of economists have responded to this challenge by developing methods to quantify the economic benefits accruing to outdoor recreation. These methods, which have proceeded in two directions, are concerned with the estimation of the money that recreationists would be willing to pay for the use of a particular recreational facility. Review and evaluation of these two methods, called "direct" and "indirect" respectively, will be the topic of this section.

The Direct Approach for Estimating Outdoor Recreation Benefits

The "direct" approach of estimating recreational benefits attempts to establish a demand curve by inquiring of the recreationist the most he would be willing to pay for the use of the recreational facility rather than to be excluded [Knetsch and Davis, 1965]. The demand estimates obtained in this fashion are defensible on theoretical grounds, but the practical difficulty with this approach lies in obtaining unbiased and reliable information from recreationists by simply confronting them with "direct", but hypothetical, questions about recreational resources which have traditionally been regarded as "free". The respondents' answers would be subject to many kinds of bias, due to the emotionalism involved, particularly when the questions asked deal with matters of opinion. One such bias is that a recreationist may, unconsciously or deliberately, understate his preference for a recreational facility, hoping that he will thereby avoid being charged as much as he would actually be willing to pay, and thus be able to enjoy the activity at its present cost and level of use. Knetsch and Davis argue that this type of bias can be expected, since recreationists observe uniformed officials at most national parks and thus visualize the possibility of being excluded.

An alternative to this hypothesis (that a recreationist might understate his willingness to pay) is the other possibility that he would overstate his willingness to pay in order to make a case for improving and preserving a recreational resource.

In addition to estimating effective demand by present users, the "direct" method could also be employed to estimate option demands. That is, the "direct" approach allows the possibility of obtaining demand schedules for those persons not presently enjoying the outdoor recreation but who may later decide to participate. However, as mentioned earlier, recreational benefits estimated by this method may not be reliable, due to the hypothetical nature of the questions posed and, consequently, policy recommendations based on such results might be dubious.

The second main development of techniques for estimating recreational benefits is based upon "indirect" evidence. This evidence usually pertains to the travel and related costs incurred by the recreationist.

The Indirect Approach for Estimating Outdoor Recreation Benefits

The "indirect" approach attempts to measure the recreationist's willingness to pay for the use of a particular recreational facility by observing the reaction of recreationists to changes in costs of travel to the recreational site. This procedure does not subject recreationists to hypothetical questions, as is the case for the direct procedure. Nevertheless, it does involve a number of restrictive assumptions that can limit the scope of its applicability, as will be shown next.

The several "indirect" methods which have been employed to estimate recreation benefits appear to have descended from an ingenious suggestion by Hotelling [1949]. In a letter to the U.S. National Park Service,[1/] 1949,

1/ The Hotelling letter to the National Park Service was also reproduced in Brown, et al., [1964].

Hotelling advanced the idea of defining concentric zones around the recreational site, so that the cost of travel to the site from all points in one of these zones would be approximately constant. According to this approach, the travel cost existing within each zone would be used as a proxy for the price variable, which could be related to the number of visitors from each zone to derive a demand function for recreation.

Hotelling's ideas have stimulated many economists to enter the field of recreation research and, certainly, some progress has occurred over the past several years. However, there have also been some dubious methods used to estimate recreation benefits.

One fallacious approach for estimating benefits was the "cost" method employed by the National Park Service [1950]. It was contended as follows: ". . . A reasonable estimate of the benefits arising from a reservoir itself may be normally considered as an amount equal to the specific costs of developing, operating, and maintaining the recommended facilities . . ." The use of costs as a basis for estimating benefits is not valid, since it is almost a perfect example of circular reasoning.

Gross National Product (GNP) concept has also been applied to measure recreational benefits. This approach, which was suggested by Ripley [1958] of the California Department of Fish and Game, attempts to evaluate the contribution of recreation to the gross national product by assuming recreation is a factor of production or something which stimulates production.[2/] He contends that the value of a day spent in recreation can be assumed, on the average, as equal to GNP divided by the product of total population times number of days in the year. As he points out, this method does not permit economic comparison of alternative uses of the same resource. Nevertheless, the relative contribution of different recreation activities (providing varying number of recreation days) to GNP could be compared on this crude basis.

2/ For a detailed appraisal of this method, see Lerner [1962].

This approach can be criticized because it treats recreation as a factor of production, whereas recreation more logically should be classed as a consumer's good (even though it might incidentally increase productivity).

The gross expenditures method is another dubious approach that has been commonly employed to measure recreation benefits. This method has been used by Pelgen [1955], who conducted a study for the California State Department of Fish and Game to establish "economic values of striped bass, salmon, and steelhead sport fishing in California." On occasion, the Corps of Engineers and the Bureau of Reclamation have also used total expenditures as a measure of benefits. The justification underlying this method is that individuals or groups incurring such expenditures must have received values corresponding to the expenditures, or they would not have made them. That is, where people have been free to spend their money on recreational activities, they should have valued it at least as highly as the other things that could have been purchased with the same money. Nevertheless, it is also true that if this recreation were abolished, most of the money would simply be directed toward other goods and services. Economists have contended that loss from this shift, where the recreationists would be forced to some second choice, would not be total expenditures, but some other amount which total expenditures by themselves do not measure. Thus, if gross expenditures were to be used, it would be difficult to compare these gross recreational benefits with the net economic benefits that would be estimated for alternative uses of natural resources. These shortcomings of the gross expenditure method limit its usefulness for measuring recreation benefits.

There have been many other fallacious methods advanced, e.g., Trice and Wood [1958], which are not worth a detailed discussion here since most of these methods have died a natural (and merciful) death. However, Clawson, in 1959, did advance a basically sound approach to the problem of quantifying recreational benefits.

The Clawson Method

Clawson [1959] probably made the most important empirical study of recreational value. By utilizing Hotelling's concentric zone concept, Clawson was able to quantify participation-travel cost relationships for several national parks. He could thus project participation rates for each concentric distance zone for various assumed fee increases by assuming that the park visitors would react to an increase in entrance fees in the same way as to an increase in travel costs. Then, by multiplying projected number of visits times various assumed entrance fees, he was able to estimate the monetary recreational value for each park. Thus, these values could then be compared with other possible uses for these resources.

Hundreds of publications and many research projects in the 1960's traced their origin to the Clawson formulation. However, his approach was not without limitations. One serious deficiency of Clawson's analysis was that he did not consider the non-monetary effects of distance, income, and other important variables. As will be shown later, omission of one or more important variables can lead to a serious bias in the estimate of recreational resource value.

Nevertheless, many empirical studies of recreational benefits have utilized the Clawson approach. The Oregon salmon-steelhead study [Brown, et al., 1964] expanded upon the Clawson method to include incomes and physical distance as explanatory variables. In addition, they used the concept of transfer costs, which was the sum of all variable expenses incurred, including travel costs, food, lodging, bait, lures, etc.

Some economists suggested that the Clawson model would have only limited usefulness until it came to grips with the "quality" of recreation experience. Stevens [1966] approached this problem by further extending the Clawson model to include the quality of the recreational experience, using angling success per unit of angling effort as an explanatory variable.

The Pearse Approach

A different indirect approach for evaluating non-priced recreational resources was presented by Pearse [1968]. He expressed discontent with what he called the "restrictive assumptions" necessary for the estimation of the demand schedule, as proposed by Clawson, and confined his analysis to the recreationists themselves, thus eliminating the assumption concerning the homogeneity of the base population from which recreationists are drawn. Pearse's method entails dividing the sampled recreationists into several income groups and estimating a "consumers' surplus" they receive by finding the difference between each visitor's "fixed" cost[3/] to the recreational site and the fixed cost of the marginal visitor who has the highest fixed cost within that income group.

One limitation of the Pearse approach is the way in which the sample of recreationists was stratified into various income groups, along with the very stringent assumption that all hunters in the East Kootenay (British Columbia) area, who had similar incomes, also had identical preference functions. In economic terms, Pearse is assuming that each participant in an income group would be willing to pay as much as the highest spender in the group in order to continue to "consume" the current quantity taken.

Pearse [p. 96, 1968] denoted the quantity calculated by his procedure as ". . . an aggregate value in the form of consumer surplus. . ." Strangely, no one seems to have challenged Pearse's method of computing consumer surplus. However, a couple of simple numerical examples are sufficient to show that Pearse's computations have no particular relationship whatever to consumer surplus (the area beneath the demand curve, but above the price line), as traditionally defined in classical economic theory.

Suppose that we have a group of recreationists with similar incomes and other characteristics such that the quantity taken by each recreationist is a function solely of his costs that must be incurred to participate in the recreational activity. Then consider two cases, the first where the individual's recreational demand function is given by $q = 1 - 0.01C$. That is, suppose we obtained the following hypothetical sample of 8 hunters, which might represent 1 percent of the total hunters of the area:

3/ Pearse defines fixed cost as the declared cash cost of travel to and from the area, an allowance for the value of time spent in travel, and other expenses such as hunting licenses, game tags, etc., which were reported to have been incurred specifically for East Kootenay hunting.

Cost	Quantity (units of time)
30	0.7
40	0.6
50	0.5
60	0.4
70	0.3
80	0.2
90	0.1
100	0.0

Following the Pearse method, we would obtain an average "Pearse surplus" of 1/8(0 + 10 + 20 + 30 + 40 + 50 + 60 + 70) = 1/8(280) = 35. Multiplying the average "Pearse surplus" by 800, a total "Pearse surplus" of 800(35) = $28,000 is obtained.

How does the "Pearse surplus" for this case compare with the usual consumer surplus, as conventionally defined? We can readily compute the traditional consumer surplus for each of the eight observations. Given our linear demand function $q = 1 - 0.01C$, the consumer surplus for the lowest cost hunter would be equal to 1/2[70(0.7)] = 1/2[49] = 24.5. Summing the individual surpluses for each of the seven hunters, we would obtain a total consumer surplus for our sample equal to 1/2[0 + 1 + 4 + 9 + 16 + 25 + 36 + 49] = 1/2[140] = 70. Blowing up the sampled hunter's consumer surplus by 100, we obtain a total consumer surplus of $7,000. Thus, in this case, "Pearse surplus" of $28,000 overestimates the actual consumer surplus by a factor of four!

Will the Pearse method always overestimate the consumer surplus? Unfortunately, the Pearse method may also underestimate the consumer surplus, as for the following hypothetical sample of eight recreationists.

Cost	Quantity (units of time)
1	7
2	6
3	5
4	4
5	3
6	2
7	1
8	0

Using the Pearse approach, an average "Pearse surplus" of 1/8(1 + 2 + 3 + 4 + 5 + 6 + 7) = 3.5 is obtained, and total sample "Pearse surplus" is 28. However, since the above hypothetical observations fall on the demand function, $q = 8 - C$, the sum of the individual consumer surpluses is equal to 1/2[0 + 1 + 4 + 9 + 16 + 25 + 36 + 49] = $70. In this case, the Pearse approach gives a value of only 4/10 of the actual consumer surplus!

From the preceding two examples, one is inclined to doubt the validity of the Pearse approach, since biased estimates of consumer surplus and the resulting recreational values could easily be obtained by following the Pearse procedure.

Our research indicates that the magnitude and direction of bias resulting from Pearse's method depends upon the numerical coefficients of the true demand function for the recreational experience. However, if one knows or can estimate the underlying demand function, then one could estimate the consumer surplus directly from the estimated demand function, and would not need to employ the Pearse method. Furthermore, our research[4/] indicates that effects of non-monetary cost of distance are very important and need to be incorporated into the demand function in order to properly estimate recreational values.

[4/] See Brown, W. G. and F. H. Nawas [1972].

It would appear to be very difficult to estimate such non-monetary effects of distance, using the Pearse approach, and we therefore recommend that an adequately specified statistical demand function be estimated by procedures outlined in our aforementioned paper.[5/]

Although we recommend against use of the Pearse method for estimating consumer surplus and economic value of recreational resources, it is evident that he made a contribution with his proposition that inferences from the sampled recreationists should refer to the population of recreationists only, not to the general population of all people. Before his article, all studies (with which we are familiar) tried to make inferences back to the general population, as did Clawson [1959] in his original study. However, due to Pearse's research, more recent formulations of recreational demand have more properly confined the analysis to the population of participants, as advanced by Edwards and co-workers [1971].

The Edwards, Gibbs, Guedry, and Stoevener Formulation

To avoid some of the restrictive assumptions underlying the indirect approach presented in this section, Edwards _et al_ [1971] developed a new procedure that does not utilize "distance zone averages" or other aggregations of the data, but focuses, instead, on the individual recreationist. Their work also indicates that a more realistic explanation of the consumer's behavior may be possible by dividing the transfer costs into two components: (1) the cost of reaching the recreational site, and (2) the costs expended at the site. The price variable in their theoretical demand model for the individual recreationist is the on-site costs such as lodging, camping fees, equipment rentals, meals, and other miscellaneous expenses incurred at the site. The quantity variable in their demand model is the number of days a recreationist spends at a particular site. Thus, the average individual's demand curve was defined and the economic value per visit was computed, using the concept of the consumer surplus. To determine the total value of a site, they multiplied the per-visit values by the total number of visits.

5/ Ibid.

The limitations of their approach were noted by Gibbs [1969]. The most crucial problems concerned the "critical" travel cost (the maximum amount that a consumer is willing to pay for travel costs) and the "critical" price of recreation (the recreationist's maximum willingness to pay the variable on-site costs). The critical values were assumed to be equal to that of the highest spender of the income group, similar in this respect to the procedure used by Pearse. Some difficulty was also encountered in determining the proper blow-up factor to use for multiplying economic value per visit to arrive at the total value for the site. However, despite these minor problems, their study was the first to properly utilize individual observations to estimate the statistical demand function for the recreational resource. Thus, their study marked a major advance over previous studies which had relied upon distance zones or other aggregations of the data. Also, their specification of the demand equation was more consistent than earlier models with the economic theory of consumer behavior.

Before discussing the statistical and economic models used in this study, a description of the questionnaires and procedures used in the survey of Oregon big game hunters should first be presented.

EXPENDITURES BY OREGON BIG GAME HUNTERS

Sampling Procedures

The Oregon State Game Commission supplied the names and mailing addresses of about 17,000 Oregon licensed hunters, which were grouped into six blocks according to the last two digits of hunting licenses sold in 1966. These six blocks constituted the sample for their survey, "Annual Hunting Inventory", which had been conducted since 1950 to secure a gross measure of all types of hunting. They had selected randomly six two-digit numbers between 1 and 100, namely 10, 34, 38, 66, 78, and 94. All hunting licenses sold in 1966 and ending with 10 formed Block #1, those ending with 34 formed Block #2, etc.

Block #1 and part of Block #2 were selected randomly to form our sample for the Oregon Big Game Study. Our sample was about 3,000, or roughly 1 percent of the licensed big game hunters in the state. This sample necessarily excluded hunters who started hunting in 1967 or 1968. Some bias may result from this procedure, but the 1966 address cards were the only ones available for sampling.

Two questionnaires were mailed to hunters in 1968. The first concerned the investment by the hunter and his family in hunting and associated equipment. This questionnaire was mailed early in August 1968. The second questionnaire was a big game hunting trip record, in which the hunter was asked to record his hunting trip expenses for all his 1968 big game hunting trips. This record was dispatched in the fall hunting season to all hunters who indicated on the first questionnaire that they were planning to hunt big game in 1968. Both questionnaires are reproduced in the Appendix.

Identical "follow-up" procedures were used in both questionnaires. First and second reminders were mailed if the earlier questionnaires were not returned. Furthermore, a decision was made to contact by telephone a randomly selected sample from the nonrespondents who failed to return the original or either of the two reminder questionnaires. An attempt was made to telephone 100 nonrespondents to the first questionnaire and an equivalent number of nonrespondents to the second questionnaire. A professional research firm was retained for this purpose to minimize possible bias.

Design of Questionnaires and Hunter Response

The investment questionnaire consisted of two parts. On the first part hunters were asked to list any expenditures made during the past twelve months for equipment used by their families in big game hunting. Since some of the investment items purchased were not used exclusively for big game hunting, hunters were asked to circle the appropriate percentage of the cost which should be allocated to the big game hunting activity.

On the second part of the investment questionnaire, hunters were asked to list and allocate major expenditures for hunting equipment which were made more than twelve months before receipt of the questionnaire. Additional information was also obtained on family income, occupation, and number of years hunted by the head of the household.

Hunters were asked to record their 1968 big game hunting trip expenses on a later questionnaire. Expenses included the amount spent on food, transportation, lodging, ammunition, and all other expenses incurred on each hunting trip. Other information included the number of days spent on the hunting trip, number of family members who went and hunted on the trip, number of big game animals bagged, the area hunted, and miles traveled. On the back of the trip record, hunters were asked to list all 1968 Oregon big game tags or licenses purchased by members of their families residing at home.

As can be seen in Table 1, the response to the two questionnaires was good. Overall return rates were 71 and 72 percent respectively for the investment questionnaire and the hunting trip record. Responses of this magnitude to fairly complex questionnaires indicate that big game hunters take a real interest in management of these resources. However, Table 1 overstates the actual hunter response, since the 2,140 "responses" included 131 undelivered questionnaires returned by the post office, and 57 returned by people who refused to cooperate. These questionnaires should not have been classified as "responses", even though returned.

Table 1. Summary of Responses to Questionnaires

	Investment questionnaire		Hunting trip record	
	Number	% of total	Number	% of total
Initial Return........	1110	36.8	344	23.2
First Reminder........	749	24.8	469	31.7
Second Reminder.......	281	9.4	259	17.5
Total Response........	2140	71.0	1072	72.4
Nonresponse...........	877	29.0	408	27.6
Total Questionnaires Mailed.........	3017	100.0	1480	100.0

Expenditures for Hunting and Related Equipment

The overall response of 71 percent to the investment questionnaire was quite good; nevertheless, some method or assumption had to be adopted to deal with the 29 percent nonresponse to estimate total equipment expenditures. We attempted to deal with this problem by conducting a telephone survey of the nonrespondents. Unfortunately, it was possible to complete only 31 investment questionnaires out of 100 hunters called. Many hunters had either moved or did not have listed telephones. Consequently, we did not think that the telephone survey provided sufficient information and, therefore, assumed that the nonrespondents had spent the same as those families who answered the second reminder, $148.47, as shown in Table 2.

Although the above procedure for estimating expenditures by the nonrespondents can be criticized, there is no approved statistical procedure for handling this situation, other than by a thorough follow-up survey of a sample of the nonrespondents. Although the $148.47 assumed for nonrespondents could be either too high or too low, it was fairly close to the mean estimated from the small telephone survey. In addition to possible serious bias from nonresponse, another very serious bias in our estimated expenditures may have resulted from the necessity to discard about 600 incomplete questionnaires.

Table 2. Summary of Responses to Investment Questionnaire, and Average Expenditure Per Family for Hunting and Related Equipment in 1968

	Questionnaires returned a/	Usable questionnaires	Average investment made per family ($\overline{X}_i$) in 1968
Initial Questionnaire.....	1057	589	\$288.69
First Reminder..........	686	351	\$300.50
Second Reminder..........	260	115	\$148.47
Nonrespondents[b/] (789)..........	--	--	\$148.47
TOTAL.............	2003	1055	\$238.91[c/]

a/ The number of responses was adjusted, using sample data, to exclude upland bird hunters. These non-big game hunters amounted to 7.46% of the total number of responses.

b/ Usable data were obtained for only 31 of the 100 nonrespondents sampled by phone. Therefore, the nonrespondents were assumed to have spent the same as those who responded to the second reminder.

c/ The weighted mean value was computed as follows:

$$\overline{X} = \sum_i \frac{(n_i)}{\Sigma n_i} \quad (\overline{X}_i)$$

$$= \frac{1057}{2792}(288.69) + \frac{686}{2792}(300.50) + \frac{1049}{2792}(148.47) = \$238.91.$$

The 95 percent confidence interval about the mean was estimated to be $238.91 ± 25.60.[6/] Therefore, the average investment per hunter-family is expected to lie between $213 and $265.

Oregon Game Commission data indicate that there were 363,000 licensed hunters in Oregon in 1968. Based upon additional research, our sample indicates that 4.4 percent of the licensed hunters were non-big game hunters; thus, estimated numbers of big game hunters in Oregon in 1968 were:

$$363{,}000 \times 95.6\% = 347{,}000.$$

Furthermore, our data indicate an average of 1.86 hunters per family, which would make the number of hunting families in Oregon equal to 186,600.

Thus, our sample data indicate a total investment in hunting and associated equipment by Oregon big game hunters of approximately $44.6 million in 1968. Confidence limits on this revised estimate have also been computed. The 95 percent confidence interval about the total would be:

$$\$44{,}600{,}000 \pm \$4{,}800{,}000.$$

This confidence interval estimate assumes that the blow-up factor is measured without error, which is not very realistic. Nevertheless, total investment made by licensed Oregon big game hunters in 1968 is thought to lie between $39.8 and $49.4 million.

The preceding estimate is thought to be biased downward, in some respects at least. For example, the people in our sample who were eliminated because they did not plan to hunt in 1968 averaged about $101.70 per family on hunting and associated equipment. Their expenditures should also be attributed to big game but, thus far, we do not have sufficient information about the total number of these people who spent money for big game equipment but who, for one reason or another, did not plan to hunt during 1968.

The sample data were also used to divide total investment among the major types of equipment listed on the questionnaire (Table 3). An interesting aspect

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[6/] Estimation of the variances followed the procedure given by Cochran [1963], pp. 328-330.

Table 3. Allocation of Total Investment in 1968 by Type of Equipment

Classification	Items	% of total	Investment
Hunting equipment	Rifles, including scopes and sights................	14.62	$ 6,524,000
	Bows, arrows, etc.........	.95	423,000
	Other hunting equipment, knives, etc..............	5.23	2,332,000
Special clothing	Boots, coats, hats, etc...	5.81	2,591,000
Camping equipment	Tents, tarps, sleeping bags......................	2.99	1,333,000
	House trailers............	13.78	6,145,000
	Campers...................	12.92	5,762,000
	Pickups, jeeps............	36.96	16,484,000
	Other camping equipment...	6.74	3,006,000
	TOTAL.........	100.00	$44,600,000

of these data is the relatively high proportion of investment expenditures that were incurred for pickups and jeeps, house trailers, and campers. These three items together accounted for nearly two-thirds of the total investment.

In Table 4, average expenditures during 1968 for hunting and associated equipment have been related to the number of years hunted before 1968 by the head of the household. In general, there appears to be a correlation between hunting experience and expenditures for equipment, with the more experienced hunters spending considerably more. For example, where the head of the household had 16 to 20, or 21 to 25 years of hunting experience, these families made equipment expenditures which were 40 percent above the average.

As might have been expected, the families headed by hunters with less experience spent a larger proportion of their money on hunting equipment, such as rifles, scopes, etc., whereas the families headed by more experienced hunters spent a larger proportion on camping equipment and special clothing. These

Table 4. Average Expenditure for Hunting and Associated Equipment in 1968, Related to Number of Years that Head of Household Had Hunted Big Game

Number of years before 1968 head of household hunted big game	Number of observations	Average investment during 1968 for hunting and associated equipment
0	33	$179.79
1	15	86.49
2	28	99.03
3	25	149.60
4	20	490.20
5	24	221.45
6	16	46.76
7	18	116.69
8	27	192.96
9	8	321.07
10	71	172.74
11-15	148	330.53
16-20	202	336.87
21-25	117	365.51
26-30	121	291.56
31 and over	183	250.41

relationships can be observed from the average expenditures presented in Table 5, listed by number of years hunted by head of household.

We have also tabulated Oregon big game hunters according to their incomes in Table 6. The most common income class for the hunting families was the $7,001 to $10,000 bracket, which included about one-third of all the families. Correspondingly, this income group made about one-third of the total expenditures for hunting and associated equipment in 1968. Next most numerous were the $5,001 to $7,000 and the $10,001 to $15,000 groups, each with about 22 percent of the hunting families. The three income groups ranging from $5,001 to $15,000 comprised over 77 percent of the families in the sample, and their expenditures accounted for almost 81 percent of the total amount spent for hunting and associated equipment.

Table 5. Allocation of Expenditures for Hunting and Associated Equipment, According to Years of Hunting Experience

Number of years before 1968 head of household hunted big game	Number of observations	Average investment during 1968 for hunting and associated equipment: Hunting equipment a/	Special clothing b/	Camping equipment c/
0	23	$80.66	$11.10	$166.22
1 - 5	112	52.10	11.30	141.37
6 - 10	140	51.87	10.40	101.27
11 - 15	148	62.59	17.25	250.69
16 - 20	202	57.51	17.81	261.55
21 - 25	117	52.63	19.08	293.80
26 - 30	121	68.96	18.90	203.70
31 and over	183	57.71	18.33	174.37

a/ Includes rifles, scopes, hunting knives, bows, arrows, etc.

b/ Boots, hats, coats, and other clothing for hunting.

c/ Campers, pickups, jeeps, house trailers, tents, tarps, sleeping bags, and other camping equipment.

Table 6. Oregon Big Game Hunters' Expenditures for Hunting and Associated Equipment in 1968, by Income Groups

Group No.	Income level	Percent of big game hunters	Average expenditure per family	Estimated total expenditure by income groups	Percent of total expenditure
1	Under $3,000......	6.34	$ 72.65	$ 740,360	1.66
2	$ 3,001 - $ 5,000.	8.88	176.48	2,519,900	5.65
3	$ 5,001 - $ 7,000.	20.49	234.62	7,733,640	17.34
4	$ 7,001 - $10,000.	34.24	257.16	14,169,420	31.77
5	$10,001 - $15,000.	23.61	373.29	14,182,800	31.80
6	$15,001 - $20,000.	3.41	446.28	2,453,000	5.50
7	Over $20,000......	3.03	575.06	2,800,880	6.28
	Average over all reported income groups............		277.16		
	TOTAL........	100.00	--	$44,600,000	100.00

As one might expect, average expenditure and income were positively correlated. The highest income groups, "$15,001 to $20,000" and "Over $20,000", (each with about 3 percent of the hunting families), incurred average expenditures of nearly $450 and $600, respectively. Although the average expenditures of the two highest income groups are substantially greater than that of other income groups, their total expenditure was slightly less than 12 percent of the total amount spent for hunting and associated equipment in 1968. This result occurs because the above two highest income groups represent only 6.4 percent of all hunting families.

Average income of the hunting families was about $9,000 per year, which is not far from the Oregon average, being higher than the average personal disposable income per family, but lower than total personal income per family, Statistical Abstract of the U.S.: 1969.[7/] [8/]

Oregon big game hunters and their expenditures for hunting and associated equipment, by occupation, are given in Table 7. It can be seen that Oregon hunters consisted of substantial numbers from each major occupational grouping. The most common occupation for the head of household of hunting families was "Craftsmen, Foremen", which included about one-fourth of all families, and their expenditures also accounted for about one-fourth of the total amount spent.

Expenses Incurred on Hunting Trips

Hunters were requested to keep an account of all expenses incurred on their big game hunting trips. A specially designed "hunting trip record" for this purpose was mailed to the hunters before the 1968 hunting season.

A summary of the response to the Hunting Trip record can be found in Table 8. As for the Investment questionnaire, those hunters responding early in the

7/ Average investment per family in Table 6 was $277.16, as compared to only $238.91 in Table 2. Average investment in Table 2 was lower, primarily because 789 nonresponding families were given assumed investments of only $148.47. Similar differences occur for Table 7.

8/ Population figures were obtained from the Bureau of Business and Economic Research, Oregon Economic Statistics, 1969, University of Oregon, Eugene.

Table 7. Oregon Big Game Hunters' Expenditures for Hunting and Associated Equipment in 1968 by Occupation

Group No.	Occupation	Percent of big game hunters	Average expenditure per family	Estimated total expenditure for hunting & associated equipment	Percent of total expenditure
1	Professional, technical.......	12.68	$272.72	$ 5,566,080	12.48
2	Farmer & farm managers........	5.48	269.35	2,377,180	5.33
3	Managers, officials, & proprietors........	11.72	335.26	6,333,200	14.20
4	Clerical........	3.17	310.56	1,587,760	3.56
5	Sales workers...	4.61	321.89	2,386,100	5.35
6	Craftsmen, foremen.............	23.15	289.68	10,793,200	24.20
7	Machine operators, & related workers.........	8.74	265.82	3,746,400	8.40
8	Service workers.	4.80	327.79	2,542,200	5.70
9	Farm laborers...	0.77	81.00	102,580	0.23
10	Laborers, excluding farm laborers.............	16.14	277.91	7,225,200	16.20
11	Others: Retired, housewives, students........	8.07	122.45	1,592,220	3.57
12	Unemployed......	0.19	227.25	71,360	0.16
13	Armed Forces....	0.48	357.46	276,520	0.62
	Average over all reported occupations...........		276.85		
	TOTAL.......	100.00	—	$44,600,000	100.00

Table 8. Summary of Responses to Hunting Trip Record

	Questionnaires returned	Usable questionnaires	Average hunting trip expenses per family in 1968	Average number of trips per hunter-family	Average expenses per hunting trip
Initial Questionnaire..........	344	307	$143.71	3.61	$39.81
First Reminder..............	469	353	114.11	3.03	37.66
Second Reminder..............	259	197	98.96	2.66	37.20
Nonresponse...........	408	35	115.46[b]	4.29	26.91
TOTAL	1,480	892	$118.70[a]	3.38	$35.10

a/ A weighted mean value was computed as follows:

$$\bar{\bar{X}}_1 = \sum_i \left(\frac{n_i}{\Sigma n_i}\right) \bar{X}_{1i} = \frac{344}{1480}(143.71) + \frac{469}{1480}(114.11) + \frac{259}{1480}(98.96) + \frac{408}{1480}(115.46) = 118.80$$

$$\bar{\bar{X}}_2 = \sum_i \left(\frac{n_i}{\Sigma n_i}\right) \bar{X}_{2i} = \frac{344}{1480}(39.81) + \frac{469}{1480}(37.66) + \frac{259}{1480}(37.20) + \frac{408}{1480}(26.91) = 35.10.$$

b/ Obtained from 35 telephone and personal interviews of a random sample of the nonresponse. Average hunting trip expenses per family vary in later tables, where the nonresponse was not included and where information was lacking in some questionnaires for certain classifications.

survey incurred more variable expenditure per family and per trip than those who responded later. The mean variable expenditure per hunter family for the entire sample was estimated at about \$118.70 for the year 1968. The 95 percent confidence interval for the average variable expenditure was:

$$\$118.70 \pm 10.35.$$

This amounts to saying that average variable expenditure per hunter-family probably ranged between \$108 and \$129.

Furthermore, our sample data indicate that the average number of trips undertaken by Oregon big game hunter-families in 1968 was about 3.38. This implies that the average variable expenditure per trip was:

$$\$118.70 \div 3.38 = \$35.10.$$

As mentioned earlier in the report, the number of big game hunter-families in Oregon in 1968 was estimated at 186,600. Our additional research indicates that around 84.16 percent of the licensed hunters went hunting for big game in 1968. Thus, the number of families hunting big game would be:

$$186{,}600 \times .8416 \doteq 157{,}000.$$

Thus, total variable expenditures incurred by Oregon big game hunters in 1968 were estimated to be \$18.6 million. (157,000 x 118.70 = \$18.6 million.)

The 95 percent confidence interval for total variable expenditures would be:

$$\$18.6 \pm \$1.6 \text{ million.}$$

Therefore, we conclude that total variable expenditures incurred by Oregon big game hunters in 1968 probably ranged from \$17.0 to \$20.2 million. This estimate of confidence interval assumes that the blow-up factors were measured without error.

The sample data were also used to allocate the estimate of total variable expenditure to the various categories listed on the Hunting Trip Record questionnaire (Table 9). It is interesting to note that transportation costs accounted for over 30 percent, while transportation costs combined with expenditures on food and beverages accounted for almost 60 percent of the total

Table 9. Allocation of Total Variable Expenditure in 1968 by Type of Expenditure Items

	Type of expenditure	Cost in dollars	Percentage
1	Transportation...........	\$ 5,840,000[a/]	31.4
2	Motels, hotels, camping or private hunting fees.....................	409,000	2.2
3	Ammunition, arrows, and broadheads...............	1,358,000	7.3
4	Food, beverages, and liquor on hunting trip...	5,245,000	28.2
5	Guide service and rental of horses, airplanes, or other vehicles...........	75,000	0.4
6	Cutting and wrapping meat, tanning hides......	874,000	4.7
7	Other expenses incurred on hunting trip..........	2,455,000	13.2
8	Cost of tags.............	2,344,000	12.6
	TOTAL........	\$18,600,000	100.0

a/ Transportation cost was computed at 5 cents per mile traveled.

variable expenditure. Cost of tags was almost 13 percent of the total variable expenditures, representing almost exactly $1 out of every $8 spent.

In a manner similar to that for equipment expenditures, expenses incurred by Oregon hunters on their hunting trips were tabulated by income groups (Table 10). As was the case for equipment expenditures, the $7,001 to $10,000 income group, which included about one-third of all families, incurred over one-third of the total trip expenses in 1968. The next two most numerous groups, $5,001 to $7,000 and $10,001 to $15,000, incurred about 44 percent of the total trip expenses. The three income groups ranging from $5,001 to $15,000 included over 79 percent of the hunters, and incurred almost 81 percent of the total amount spent. Interestingly, the two highest income groups, $15,001 to $20,000 and over $20,000 spent less than 8 percent of the total expended on hunting trips, as compared to the 12 percent they spent on equipment. Fewer hunting trips were made by these two highest income groups, as shown in Table 11. Average number of trips in Table 11 reached a maximum for the $7,001 to $10,000 income group, and then declined at the higher income levels.

Oregon big game hunters' total trip expenses, by occupation of the head of household, are given in Table 12. Again, as for equipment expenditures, the most common occupation for the head of household of hunting families was "Craftsmen, Foremen", which included about one-fourth of all families. Their trip expenses accounted for about one-fourth of the total, just as their expenditures for equipment had represented about one-fourth of the total, as mentioned earlier.

Hunting Trip Expenses for the Various Game Management Units

Data in Table 13 show that about 48 percent of the 1968 Oregon big game hunters limited their hunting to a single game management unit. It can also be seen that most of the hunters (about 93 percent) hunted in three or fewer game management units, and accounted for almost 85 percent of total trip expenses. Increases in average trip expenses were probably due to greater transportation costs and more days hunted as number of game management units hunted increased.

Table 10. Oregon Big Game Hunters' Trip Expenses in 1968 by Income Groups

Group No.	Income level	Percent of big game hunters[a]	Trip expenses per family	Estimated trip expenses by income groups	Percent of total expenditure
1	Under $3,000.......	6.19	$ 62.15	$ 589,620	3.17
2	$ 3,001 - $ 5,000..	8.94	131.50	1,804,200	9.70
3	$ 5,001 - $ 7,000..	21.46	106.87	3,519,120	18.92
4	$ 7,001 - $10,000..	33.98	126.44	6,589,980	35.43
5	$10,001 - $15,000..	23.79	128.70	4,698,360	25.26
6	$15,001 - $20,000..	2.89	197.86	876,060	4.71
7	Over $20,000.......	2.75	123.92	522,660	2.81
	Average over all reported income groups.............		121.24		
	TOTAL.......	100.00	---	$18,600,000	100.00

[a] These percentages differ from those in Table 6 because some of the people included in Table 6 did not make any hunting trips.

Table 11. Average Number of Hunting Trips by Oregon Big Game Hunters in Relation to Family Income Level

Group No.	Family income level	No. of observations	Total hunting trips	Average number of trips
1	Under $3,000........	41	107	2.61
2	$ 3,001 - $ 5,000...	62	199	3.21
3	$ 5,001 - $ 7,000...	151	494	3.27
4	$ 7,001 - $10,000...	240	858	3.58
5	$10,001 - $15,000...	163	475	2.91
6	$15,001 - $20,000...	21	59	2.81
7	Over $20,000........	17	33	1.94
	TOTAL......	695	2,225	3.20

Table 12. Oregon Big Game Hunters' Trip Expenses in 1968 by Occupation

Group No.	Occupation	Percent of big game hunters	Trip expenses per family	Estimated trip expenses by occupation	Percent of total expenditure
1	Professional, technical.........	11.60	$112.71	$ 2,040,420	10.97
2	Farmers & farm managers..........	5.73	105.01	948,600	5.10
3	Managers, officials, & proprietors..............	11.46	121.96	2,181,780	11.73
4	Clerical..........	2.80	120.24	524,520	2.82
5	Sales workers.....	4.67	163.49	1,190,400	6.40
6	Craftsmen, foremen...........	22.93	133.26	4,770,900	25.65
7	Machine operators & related workers.	9.60	110.76	1,660,980	8.93
8	Service workers...	4.67	138.30	1,008,120	5.42
9	Farm laborers.....	0.53	69.66	55,800	0.30
10	Laborers, excluding farm laborers.	17.60	115.34	3,167,580	17.03
11	Others: Retired, housewives, students.............	7.87	80.65	991,380	5.33
12	Unemployed........	0.27	86.03	35,340	0.19
13	Armed Forces......	0.27	58.63	24,180	0.13
	Average over all reported occupations.............		119.12		
	TOTAL........	100.00	---	$18,600,000	100.00

Table 13. Oregon Big Game Hunters' Trip Expenses in 1968 by Number of Game Management Units Hunted

No. of Oregon game management units hunted	Number[a] of sample observations	Trip expenses per family	Estimated total trip expenditures by no. of game management units hunted	Percent of total expenditure
1	269	$ 92.38	$ 6,126,840	32.94
2	175	145.90	6,296,100	33.85
3	76	177.79	3,331,260	17.91
4	25	281.90	1,737,240	9.34
5 - 10	16	281.45	1,108,560	5.96
Average, where game management units were reported		134.49	---	---
TOTAL	561	---	$18,600,000	100.00

a/ Only about one-half of the responding hunters were able to give the name of the game management unit hunted.

Total hunting trip expenses, by Oregon game management units, are presented in Table 14. The figures in the table show the variation in hunters' trip expenses according to game management units hunted. Average trip expenses ranged from a low of $25 (Sherman) to a high of $293 (Minam). Similarly, percentages of total trip expenses varied considerably, ranging from a low of 0.1 percent to a high of 4.5 percent. This variation in total trip expenses can be caused by variation in average trip expenses, as well as by the number of hunters hunting in the various management units.

Some care should be taken in interpreting the figures of Table 14. For example, trip expenses per family often represent more than one trip.

Relation of Hunting Trip Expenses to Hunting Trips and Days Taken

As shown in Table 15, almost 52 percent of the Oregon big game hunters made only one or two hunting trips during the 1968 season, and accounted for about 42 percent of total expenses. Almost 80 percent of the hunters made four or fewer

Table 14. Oregon Big Game Hunters' Total Trip Expenses in 1968 by Oregon Game Management Units

No.	Game management unit hunted	No. of observations	Trip expenses per family	Estimated total trip expenditures by game management units hunted	Percent of total expenditure
1	Alsea...........	30	$109.27	$ 558,000	3.00
2	Applegate........	5	78.42	65,100	0.35
3	Baker............	20	123.72	390,600	2.10
4	Beulah...........	7	210.32	228,780	1.23
5	Catherine Creek..	8	126.94	186,000	1.00
6	Chesnimus........	14	191.83	427,800	2.30
7	Chetco...........	3	188.85	93,000	0.50
8	Clatsop..........	24	141.63	558,000	3.00
9	Columbia.........	2	119.23	39,060	0.21
10	Deschutes........	16	91.17	226,920	1.22
11	Desolation.......	22	154.10	558,000	3.00
12	Dixon............	14	57.22	186,000	1.00
13	Elkton...........	7	95.10	111,600	0.60
14	Evans Creek......	4	82.36	55,800	0.30
15	Fort Rock........	26	147.62	597,060	3.21
16	Grizzly..........	6	181.12	186,000	1.00
17	Hart Mountain....	1	58.40	18,600	0.10
18	Heppner..........	28	158.39	744,000	4.00
19	Hood River.......	2	85.63	29,760	0.16
20	Imnaha...........	8	221.04	279,000	1.50
21	Interstate.......	15	131.93	306,900	1.65
22	Juniper..........	0	---	---	--
23	Keating..........	7	67.06	74,400	0.40
24	Keno.............	4	225.31	186,000	1.00
25	Klamath..........	13	207.12	46,500	0.25
26	Lookout Mountain.	5	182.78	186,000	1.00
27	Malheur River....	8	134.49	186,000	1.00
28	Maupin...........	1	106.80	18,600	0.10
29	Maury............	5	125.54	186,000	1.00
30	McKenzie.........	34	107.14	59,520	0.32
31	Melrose..........	6	37.08	40,920	0.22
32	Metolius.........	7	178.22	186,000	1.00
33	Minam............	11	292.58	558,000	3.00
34	Murderers Creek..	18	205.53	576,600	3.10
35	Nestucca.........	1	101.90	18,600	0.10
36	Northside........	23	207.24	744,000	4.00
37	Ochoco...........	34	157.35	837,000	4.50
38	Owyhee...........	0	---	---	--
39	Paulina..........	16	158.22	394,320	2.12
40	Polk.............	9	127.92	186,000	1.00
41	Powers...........	5	133.56	186,000	1.00
42	Rogue............	17	89.52	241,800	1.30
43	Santiam..........	29	158.36	744,000	4.00

(Continued)

Table 14. (Continued)

No.	Game management unit hunted	No. of observations	Trip expenses per family	Estimated total trip expenditures by game management units hunted	Percent of total expenditure
44	Sherman...........	2	$ 24.70	$ 18,600	0.10
45	Silver Lake.......	25	97.47	372,000	2.00
46	Silvies..........	13	148.31	372,000	2.00
47	Siuslaw...........	5	117.42	93,000	0.50
48	Sixes.............	11	118.50	204,600	1.10
49	Sled Springs......	15	253.16	591,480	3.18
50	Snake River.......	13	177.28	372,000	2.00
51	Sprague...........	15	126.29	297,600	1.60
52	Starkey...........	17	179.83	483,600	2.60
53	Steens Mountain...	3	102.22	55,800	0.30
54	Tioga.............	19	153.10	451,980	2.43
55	Trask.............	20	128.71	409,200	2.20
56	Ukiah.............	29	180.77	818,400	4.40
57	Umatilla..........	18	174.72	489,180	2.63
58	Wagontire.........	2	153.50	55,800	0.30
59	Walla Walla.......	3	164.27	76,260	0.41
60	Warner............	3	123.83	57,660	0.31
61	Wasco.............	9	61.41	93,000	0.50
62	Wenaha............	17	215.51	576,600	3.10
63	Wheeler...........	28	166.95	744,000	4.00
64	White Horse.......	0	---	---	--
65	Willamette........	11	119.75	204,600	1.10
66	Wilson............	16	101.02	260,400	1.40
	Average over all management units..		147.75	---	--
	TOTAL.......	809	---	$18,600,000	100.00

Table 15. Oregon Big Game Hunters' Trip Expenses in 1968 by Hunting Trips

No. of hunting trips	No. of observations	Trip expenses per family	Estimated total trip expenditures by hunting trips	Percent of total expenditure
1	249	$ 85.75	$ 3,850,200	20.70
2	176	124.45	3,950,640	21.24
3	128	132.26	3,054,120	16.42
4	101	130.53	2,378,940	12.79
5	61	161.61	1,778,160	9.56
6	38	155.20	1,063,920	5.72
7	20	231.81	837,000	4.50
8	15	195.66	530,100	2.85
9	11	199.11	394,320	2.12
10	9	161.77	262,260	1.41
11 - 17	15	184.25	500,340	2.69
Average over all trips		125.29		
TOTAL	823	---	$18,600,000	100.00

trips, and accounted for 71 percent of total trip expenses. The remaining 20 percent of the hunters, who made between 5 and 17 trips, incurred 29 percent of the total trip expenses. The fact that hunters with 5 or more trips spent almost 50 percent more is not surprising, since trip expenses per family are expected to increase as the number of hunting trips rises.

Table 16 presents hunters' trip expenses by days hunted. It can be seen, as expected, that hunting expenses per family rise steadily as the number of days hunted increases. Family hunting trip expenses ranged from $20 (only one day of hunting) to about $322 (for 21-50 days of hunting). Approximately 62 percent of total trip expenses were incurred by families who hunted between 1 and 12 days. However, families hunting more than 20 days made only about 11 percent of the total trip expenditures, because these 30 families represented only about 4.5 percent of the total number of hunting families in the sample.

Hunting Trip Expenses by Species and Game Management Units

In Table 17, big game hunters' trip expenses have been tabulated according to species hunted. Mule deer accounted for over one-half of total expenditures on hunting trips, almost 52 percent. Next highest percent of hunting trip expenses was for Rocky Mountain elk, with about 26 percent of the total. Black-tailed deer accounted for about 15 percent of total hunting trip expenditures, and Roosevelt elk for around 6 percent. Other species, such as antelope and bear, accounted for less than 1 percent of total hunting trip expenditures; however, it should be cautioned that this last estimate for antelope and bear is based upon only three antelope and two bear hunting families, as shown in Table 17.

Of the major species hunted (deer and elk), highest expenditures per trip were made for Rocky Mountain elk. However, when hunting expenditures are put on a daily basis, average hunting expense per day is about the same for Roosevelt elk, mule deer, and Rocky Mountain elk, as shown in the next-to-last column in Table 17. The higher expenditure per trip for Rocky Mountain elk is partly due to the longer duration of the Rocky Mountain elk hunting trips, about 3.8 days as compared to about 2.6 days for mule deer hunting trips and only 1.8 days for Roosevelt elk, as shown in Table 18.

Table 16. Oregon Big Game Hunters' Trip Expenses in 1968 by Days Hunted

No. of days hunted (sum for all trips)	No. of families	Hunting expenses per family	Estimated total trip expenses by days hunted	Percent of total expenditure
1	25	$ 19.64	$ 104,160	0.56
2	58	43.49	539,400	2.90
3	61	52.78	688,200	3.70
4	81	73.76	1,275,960	6.86
5	45	102.79	985,800	5.30
6	57	102.82	1,249,920	6.72
7 - 9	116	135.23	3,355,440	18.04
10 - 12	92	172.75	3,398,220	18.27
13 - 15	46	206.84	2,031,120	10.92
16 - 20	54	252.36	2,912,760	15.66
21 - 50	30	321.59	2,059,020	11.07
Average over all days		130.92	---	--
TOTAL	665	---	$18,600,000	100.00

Table 17. Oregon Big Game Hunters' Trip Expenses in 1968 by Species of Big Game Animals

Species	Number of observations (sample)	Total variable expenditure (sample)	Ave. variable expenditure per season	Ave. variable expenditure per trip	Ave. variable expenditure per day	Percent of total variable expenditure
Black-tailed deer.	216	$11,362.63	$ 52.60	$ 17.44	$ 13.83	15.13
Mule deer.........	387	38,926.18	100.58	51.18	19.35	51.83
Roosevelt elk.....	72	4,760.35	66.12	36.62	36.62	6.34
Rocky Mountain elk.........	187	19,646.65	105.06	73.58	19.49	26.16
Antelope..........	3	349.00	116.33	116.33	19.39	0.47
Bear..............	2	54.80	27.40	27.40	27.40	0.07
TOTAL.....	867	$75,099.61	$ --	$ --	$ --	100.00

Table 18. Average Number of Hunting Trips and Number of Hunting Days in 1968 by Species of Big Game Animals

Species	Number of observations (sample)	Average number hunting trips per season	Average number hunting days per season	Average number of days per hunting trip
Black-tailed deer...........	216	2.99	3.75	1.25
Mule deer..................	387	1.95	5.17	2.65
Roosevelt elk..............	72	1.81	3.25	1.80
Rocky Mountain elk..........	187	1.43	5.39	3.77
Antelope....................	3	1.00	6.00	6.00
Bear.......................	2	1.00	1.00	1.00

Black-tailed deer hunting trips averaged less than 1.3 days per hunting trip. Doubtlessly, the fact that black-tailed deer and Roosevelt elk are located in western Oregon, close to population centers, accounts for the greater number of one-day hunting trips for these species.

In Table 19, hunting trip expenses have been tabulated by game management unit. Average expenditure per season and average expenditure per trip are listed for each unit hunted. The average expenditure per season represents only part of a hunter's trip expense if he also hunted in one or more of the other units. Thus, average expenditure per season for the units tends to be less than average expenditure per hunting family.

Highest average expenditures per season and per trip tended to be for those big game management units located in eastern Oregon. Total hunting trip expenditures for deer were highest in the Northside, Wheeler, Heppner, Murderer's Creek, and Ochoco units.

Highest hunting trip expenditures per season were made by elk hunters in the Sled Springs unit. In this unit, 16 elk hunters averaged $187.25 for the season, and $149.80 per hunting trip.

Investment in Hunting and Related Equipment by Species and Game Management Units

Expenditures for hunting and associated equipment have been allocated among the various big game species in Table 20. Expenditures were allocated to each species according to the number of days hunted. For example, if a family hunted mule deer for seven days and Roosevelt elk for three days, 70 percent of their investment in hunting and related equipment was allocated to mule deer and 30 percent to Roosevelt elk.

As was the case for hunting trip expenses, mule deer were again most important, with over 59 percent of total investment. Rocky Mountain elk were second with over 17 percent, followed closely by black-tailed deer with almost 16 percent. Roosevelt elk accounted for less than 6 percent; bear and antelope together were less than 2 percent.

Table 19. Oregon Big Game Hunters' Trip Expenses in 1968 by Species and Game Management Units

Unit hunted	Species	Number of observations (sample)	Total variable expenditure (sample)	Ave. variable expenditure per season	Ave. variable expenditure per trip	Ave. variable expenditure per day
Alsea..............	Deer	25	711.90	28.48	10.63	9.62
	Elk	3	118.15	39.38	29.54	13.13
Applegate..........	Deer	4	46.35	11.59	9.27	11.59
	Elk	1	16.50	16.50	16.50	16.50
Baker..............	Deer	19	1,141.90	60.10	34.60	18.13
	Elk	9	625.40	69.49	29.78	23.16
Beulah.............	Deer	8	836.85	104.61	83.69	18.60
	Elk	1	57.00	57.00	57.00	14.25
Catherine Creek.....	Deer	6	187.65	31.28	14.43	20.85
	Elk	8	599.10	74.89	39.94	15.77
Chesnimus..........	Deer	8	840.45	105.56	105.56	24.72
	Elk	10	813.95	81.40	81.40	15.65
Chetco.............	Deer	3	114.25	38.08	8.79	8.79
Clatsop............	Deer	12	553.85	46.15	22.15	20.51
	Elk	18	1,369.15	76.06	52.66	28.52
Columbia...........	Deer	6	335.00	55.83	30.45	23.93
Deschutes..........	Deer	21	831.20	39.58	21.31	10.26
	Elk	2	133.40	66.70	66.70	19.06
Desolation.........	Deer	11	1,933.10	175.74	101.74	35.15
	Elk	17	1,730.35	101.79	78.65	20.12
Dixon..............	Deer	14	566.85	40.49	18.90	15.75
	Elk	1	26.25	26.25	13.12	26.25
Elkton.............	Deer	7	327.80	46.83	23.41	27.32
	Elk	6	238.45	39.74	39.74	21.68
Evans Creek........	Deer	4	122.00	30.50	30.50	20.33

(Continued)

Table 19. (Continued)

Unit hunted	Species	Number of observations (sample)	Total variable expenditure (sample)	Ave. variable expenditure per season	Ave. variable expenditure per trip	Ave. variable expenditure per day
Fort Rock..........	Deer	27	2,100.10	77.78	42.86	16.54
	Elk	1	121.15	121.15	60.58	40.38
Grizzley...........	Deer	6	315.80	52.63	45.11	18.57
	Elk	2	51.83	25.83	17.22	25.83
Hart Mountain......	Deer	3	159.10	53.03	53.03	12.24
Heppner............	Deer	26	2,300.40	88.48	58.98	26.75
	Elk	6	225.00	37.50	22.50	13.24
Hood River.........	Deer	2	74.35	37.18	24.78	18.59
Imnaha.............	Deer	4	281.45	70.36	56.29	21.65
	Elk	7	698.05	99.72	87.26	33.24
Interstate.........	Deer	21	1,492.05	71.05	53.29	19.89
Juniper............	--	--	--	--	--	--
Keating............	Deer	6	266.30	44.38	33.29	22.19
	Elk	1	35.45	35.45	17.73	17.73
Keno...............	Deer	5	477.75	95.55	31.85	19.11
	Elk	1	28.75	28.75	28.75	28.75
Klamath............	Deer	21	1,227.75	58.46	29.23	15.35
Lookout Mountain...	Deer	5	475.85	95.17	79.31	36.60
	Elk	1	151.10	151.10	151.10	37.78
Malheur River......	Deer	8	681.95	85.24	56.83	15.50
	Elk	1	55.50	55.50	55.50	18.50
Maupin.............	Deer	1	19.05	19.05	19.05	19.05
Maury..............	Deer	4	261.70	65.43	43.62	20.13
McKenzie...........	Deer	34	1,206.00	35.47	16.08	14.36
	Elk	5	291.50	58.30	29.15	58.30

(Continued)

Table 19. (Continued)

Unit hunted	Species	Number of observations (sample)	Total variable expenditure (sample)	Ave. variable expenditure per season	Ave. variable expenditure per trip	Ave. variable expenditure per day
Melrose...........	Deer	7	234.50	33.50	11.73	18.04
Metolius..........	Deer	9	371.40	41.27	28.57	20.63
Minam.............	Deer	7	510.65	72.95	63.83	36.48
	Elk	8	1,154.20	144.28	115.42	20.99
Murderer's Creek...	Deer	18	2,139.50	118.86	97.25	19.10
	Elk	5	654.05	130.81	59.46	19.24
	Antelope	1	101.50	101.50	101.50	33.83
Nestucca..........	Deer	1	11.50	11.50	11.50	5.75
	Elk	1	44.50	44.50	44.50	8.90
Northside.........	Deer	31	3,179.35	102.56	67.65	23.73
	Elk	5	376.80	75.36	75.36	15.07
Ochoco............	Deer	32	2,405.60	75.18	54.67	21.48
	Elk	3	158.50	52.83	39.63	17.61
Owyhee............	--	--	--	--	--	--
Paulina...........	Deer	21	1,539.90	73.33	44.00	16.04
	Antelope	1	62.50	62.50	62.50	12.50
Polk..............	Deer	11	322.25	29.30	14.65	5.56
	Elk	2	41.25	20.63	20.63	13.75
Powers............	Deer	7	321.70	45.96	18.92	22.98
	Elk	1	2.50	2.50	2.50	2.50
Rogue.............	Deer	19	852.90	44.89	18.95	10.03
	Elk	1	50.50	50.50	50.50	5.05
Santiam...........	Deer	33	1,919.65	58.17	23.13	19.01
	Bear	1	41.90	41.90	41.90	41.90
Sherman...........	Deer	4	101.25	25.31	14.46	10.13
Silver Lake.......	Deer	30	1,976.25	65.88	50.67	17.65
	Elk	1	15.60	15.60	15.60	15.60

(Continued)

Table 19. (Continued)

Unit hunted	Species	Number of observations (sample)	Total variable expenditure (sample)	Ave. variable expenditure per season	Ave. variable expenditure per trip	Ave. variable expenditure per day
Silvies...........	Deer	16	936.20	58.51	44.58	19.92
	Elk	1	46.50	46.50	23.25	11.63
Siuslaw...........	Deer	5	162.00	32.40	9.53	8.53
	Elk	2	90.50	45.25	45.25	15.08
Sixes.............	Deer	11	428.80	38.98	20.42	19.49
	Elk	2	114.25	57.13	38.08	22.85
Sled Springs.......	Deer	19	1,436.00	75.58	55.23	16.32
	Elk	16	2,996.00	187.25	149.80	25.39
Snake River........	Deer	9	1,062.70	118.08	106.27	17.42
	Elk	6	757.20	126.20	126.20	18.93
Sprague...........	Deer	17	1,600.20	94.13	72.74	17.78
Starkey...........	Deer	3	152.45	50.82	50.82	21.78
	Elk	21	2,431.40	115.78	93.52	16.54
Steens Mountain....	Deer	7	503.95	71.99	71.99	24.00
Tioga.............	Deer	10	234.45	23.45	10.19	9.77
	Elk	13	1,363.70	104.90	30.99	19.48
	Bear	1	12.90	12.90	12.90	12.90
Trask.............	Deer	21	978.85	46.61	16.59	17.48
	Elk	4	223.00	55.75	55.75	17.15
Ukiah.............	Deer	14	1,085.70	77.55	49.35	18.40
	Elk	21	2,065.20	98.34	73.76	18.95
Umatilla..........	Deer	8	412.15	51.52	27.48	15.26
	Elk	17	1,271.75	74.81	50.87	17.66
Wagontire.........	Deer	4	182.50	45.63	45.63	13.04
Walla Walla........	Deer	3	192.90	64.30	32.15	27.56
	Elk	8	642.45	80.31	71.38	17.85

(Continued)

Table 19. (Continued)

Unit hunted	Species	Number of observations (sample)	Total variable expenditure (sample)	Ave. variable expenditure per season	Ave. variable expenditure per trip	Ave. variable expenditure per day
Warner.............	Deer	3	285.75	95.25	95.25	25.98
Wasco..............	Deer	16	688.60	43.04	20.25	10.93
	Elk	1	35.50	35.50	11.83	11.83
Wenaha.............	Deer	7	379.95	54.28	52.22	15.57
	Elk	18	1,922.05	106.78	83.57	20.45
Wheeler............	Deer	30	2,593.80	86.46	49.88	19.07
	Elk	2	112.40	56.20	37.47	14.05
Whitehorse.........	Antelope	1	185.00	185.00	185.00	18.50
Willamette.........	Deer	11	289.00	26.27	13.14	14.45
Wilson.............	Deer	11	526.95	47.90	17.57	11.21
	Elk	10	451.35	45.14	30.09	14.10
High Cascade[e/].....	Deer	9	380.75	42.31	29.29	15.23
TOTAL......		1,060	75,099.61	---	---	---
AVERAGE....		15.82[a/]	---	70.86[b/]	41.40[c/]	18.34[d/]

a/ Divided by 67, the number of units.

b/ Total expenditure divided by 1,060. Note that 1,060 is more than the number of hunting families, 867, since some hunters hunted in more than one unit.

c/ Total expenditure divided by 1,801, observed number of hunting trips.

d/ Total expenditure divided by 4,070, observed number of hunting days.

e/ Some hunters indicated that they hunted in the high Cascades, which could not be placed in any single big game management unit.

Table 20. Allocation of Investment in Hunting and Associated Equipment in 1968 by Species[a/]

Species	Number of observations (sample)	Total investment (sample)	Average investment per season	Average investment per trip	Average investment per day	Percent of total investment
Black-tailed deer......	216	$19,319.37	$ 89.44	$ 29.68	$ 23.53	15.80
Mule deer..............	387	72,657.83	187.75	95.48	36.11	59.41
Roosevelt elk..........	72	6,817.04	94.68	52.44	29.13	5.57
Rocky Mountain elk.....	187	21,179.55	113.26	79.32	21.01	17.32
Antelope...............	3	2,255.24	751.75	751.75	125.29	1.84
Bear...................	2	68.10	34.05	34.05	34.05	.06
TOTAL.......	867	$122,297.13	--	--	--	100.00

a/ Allocation was made to each species according to the number of days hunted. For example, if a hunting family spent $1,000 on equipment, and hunted 6 days for mule deer and 4 days for Rocky Mountain elk, mule deer would be allocated $600 and Rocky Mountain elk $400.

Of course, the preceding method of allocation may not be entirely accurate, since some equipment purchases might be made primarily for hunting some prized species, such as elk, even though the hunting family in that case might spend more total days hunting for deer. However, we had no information for allocating on any basis other than using days hunted per species.

In a similar manner, the 1968 investment in hunting and associated equipment was allocated to both species and big game management units in Table 21. Thus, in Table 21 the hunters' investment in equipment has been credited to the areas hunted.

Greatest total investment in equipment for any area was the Fort Rock game management unit, with over $8,000 invested by deer hunters. However, these investment figures per game management unit should be taken with some caution, since they are much more variable than hunting trip expenditures. For example, the 28 hunting families in our sample who hunted in the Fort Rock unit apparently made a number of large purchases in 1968, whereas the 35 hunting families of the Sled Springs unit invested only $4,600 in 1968. Nevertheless, the Sled Springs hunters may have had as much or more total value of equipment as the Fort Rock hunters, but may have purchased most of it prior to 1968. (Some of the large purchases for Fort Rock may have been related to the special "black powder" hunt in this area.)

At any rate, the high variability of investment, by species and unit, can be seen from the average investment figures in Table 21. Average investment ranged from 0 to $406 per day hunted.

In Table 22, hunting trip expenses and investment in equipment have been combined and allocated among the various species. Again, mule deer accounted for the largest part of the total expenditures, with over 56 percent; Rocky Mountain elk were second with nearly 21 percent, followed by black-tailed deer with over 15 percent. About 6 percent of total expenditures were made by Roosevelt elk hunters, followed by antelope hunters with 1.3 percent of total expenditures.

Table 21. Allocation of 1968 Investment in Hunting and Associated Equipment by Species and Game Management Units

Area hunted	Species	Number of observations (sample)	Total investment (sample)	Average investment per season	Average investment per trip	Average investment per day
Alsea................	Deer	25	$1,407.07	$ 56.28	$ 21.00	$ 19.01
	Elk	3	174.80	58.27	43.70	19.42
Applegate............	Deer	4	194.98	48.75	39.00	48.75
	Elk	1	0.17	0.17	0.17	0.17
Baker................	Deer	19	660.45	34.76	20.01	10.48
	Elk	9	423.36	47.04	20.16	15.68
Beulah...............	Deer	8	1,257.69	157.21	125.77	27.95
	Elk	1	--	--	--	--
Catherine Creek.......	Deer	6	645.76	107.63	49.67	71.75
	Elk	8	323.35	40.42	21.56	8.51
Chesnimus............	Deer	8	886.32	110.79	110.79	26.07
	Elk	10	685.19	68.52	68.52	13.18
Chetco...............	Deer	3	283.70	94.57	21.82	21.82
Clatsop..............	Deer	12	959.90	79.99	38.40	35.55
	Elk	18	354.56	19.70	13.64	7.39
Columbia.............	Deer	6	332.46	55.41	30.22	23.75
Deschutes............	Deer	21	4,279.18	203.77	109.72	52.83
	Elk	2	--	--	--	--
Desolation...........	Deer	11	3,624.36	329.49	190.76	65.90
	Elk	17	1,581.55	93.03	71.89	18.39
Dixon................	Deer	14	450.00	32.14	15.00	12.50
	Elk	1	406.20	406.20	203.10	406.20
Elkton...............	Deer	7	769.94	109.99	55.00	64.16
	Elk	6	434.16	72.36	72.36	39.47
Evans Creek..........	Deer	4	122.54	30.65	30.64	20.42

(Continued)

Table 21. (Continued)

Area hunted	Species	Number of observations (sample)	Total investment (sample)	Average investment per season	Average investment per trip	Average investment per day
Fort Rock.............	Deer	27	8,020.54	297.06	163.68	63.15
	Elk	1	212.10	212.10	106.05	70.70
Grizzly...............	Deer	6	448.45	74.74	64.06	26.38
	Elk	2	--	--	--	--
Hart Mountain.........	Deer	3	195.10	65.03	65.03	15.01
Heppner...............	Deer	26	4,599.18	176.89	117.93	53.48
	Elk	6	1,235.69	205.95	123.57	72.69
Hood River............	Deer	2	32.00	16.00	10.67	8.00
Imnaha................	Deer	4	481.56	120.39	96.31	37.04
	Elk	7	502.69	71.81	62.84	23.94
Interstate............	Deer	21	2,192.71	104.41	78.31	29.24
Juniper...............	--	--	--	--	--	--
Keating...............	Deer	6	50.00	8.33	6.25	4.17
	Elk	1	--	--	--	--
Keno..................	Deer	5	575.82	115.16	38.39	23.03
	Elk	1	406.20	406.20	406.20	406.20
Klamath...............	Deer	21	3,433.75	163.51	81.76	42.92
Lookout Mountain......	Deer	5	55.19	11.04	9.20	4.25
	Elk	1	101.26	101.26	101.26	25.32
Malheur River.........	Deer	8	462.90	57.86	38.58	10.52
	Elk	1	18.00	18.00	18.00	6.00
Maupin................	Deer	1	--	--	--	--
Maury.................	Deer	4	2,129.00	532.25	354.83	163.77
McKenzie..............	Deer	34	2,739.82	80.58	36.53	32.62
	Elk	5	263.78	52.76	26.38	52.76

(Continued)

Table 21. (Continued)

Area hunted	Species	Number of observations (sample)	Total investment (sample)	Average investment per season	Average investment per trip	Average investment per day
Melrose	Deer	7	760.86	108.69	38.04	58.53
Metolius	Deer	9	621.03	69.00	47.77	34.50
Minam	Deer	7	228.84	32.69	28.61	16.35
	Elk	8	946.32	118.29	94.63	17.21
Murderer's Creek	Deer	18	3,040.61	168.92	138.21	27.15
	Elk	5	854.58	170.92	77.69	25.13
	Antelope	1	45.80	45.80	45.80	15.27
Nestucca	Deer	1	7.14	7.14	7.14	3.57
	Elk	1	443.64	443.64	443.64	88.73
Northside	Deer	31	5,348.54	172.53	113.80	39.91
	Elk	5	43.17	8.63	8.63	1.73
Ochoco	Deer	32	4,851.68	151.62	110.27	43.32
	Elk	3	274.80	91.60	68.70	30.53
Owyhee	--	--	--	--	--	--
Paulina	Deer	21	734.24	34.96	20.98	7.65
	Antelope	1	1,799.44	1,799.44	1,799.44	359.89
Polk	Deer	11	159.26	14.48	7.24	2.75
	Elk	2	36.62	18.31	18.31	12.21
Powers	Deer	7	429.09	61.30	25.24	30.65
	Elk	1	165.00	165.00	165.00	165.00
Rogue	Deer	19	2,721.78	143.25	60.48	32.02
	Elk	1	294.58	294.58	294.58	29.46
Santiam	Deer	33	1,581.81	47.93	19.06	15.66
	Bear	1	1.43	1.43	1.43	1.43
Sherman	Deer	4	82.00	20.50	11.71	8.20

(Continued)

Table 21. (Continued)

Area hunted	Species	Number of observations (sample)	Total investment (sample)	Average investment per season	Average investment per trip	Average investment per day
Silver Lake..........	Deer	30	6,879.60	229.32	176.40	61.43
	Elk	1	12.50	12.50	12.50	12.50
Silvies..............	Deer	16	1,996.54	127.78	95.07	42.48
	Elk	1	122.80	122.80	61.40	30.70
Siuslaw..............	Deer	5	1,248.41	249.68	73.44	65.71
	Elk	2	353.85	176.93	176.93	58.98
Sixes................	Deer	11	1,089.51	99.05	51.88	49.52
	Elk	2	679.67	339.84	226.56	135.93
Sled Springs.........	Deer	19	2,087.28	109.86	80.28	23.72
	Elk	16	2,510.60	156.91	125.53	21.28
Snake River..........	Deer	9	689.34	76.59	68.93	11.30
	Elk	6	332.43	55.41	55.41	8.31
Sprague..............	Deer	17	1,548.38	91.08	70.38	17.20
Starkey..............	Deer	3	73.00	24.33	24.33	10.43
	Elk	21	3,302.55	157.26	127.02	22.47
Steens Mountain.......	Deer	7	714.28	102.04	102.04	34.01
Tioga................	Deer	10	1,173.88	117.39	51.04	48.91
	Elk	13	2,091.45	160.88	47.53	29.88
	Bear	1	66.67	66.67	66.67	66.67
Trask................	Deer	21	710.26	33.82	12.04	12.68
	Elk	4	340.50	85.13	85.13	26.19
Ukiah................	Deer	14	832.44	59.46	37.84	14.11
	Elk	21	2,914.59	138.79	104.09	26.74
Umatilla.............	Deer	8	563.12	70.39	37.54	20.86
	Elk	17	2,257.62	132.80	90.30	31.36
Wagontire............	Deer	4	584.57	146.14	146.14	41.76

(Continued)

Table 21. (Continued)

Area hunted	Species	Number of observations (sample)	Total investment (sample)	Average investment per season	Average investment per trip	Average investment per day
Walla Walla...........	Deer	3	238.67	79.56	39.78	34.10
	Elk	8	1,155.64	144.46	128.40	32.10
Warner................	Deer	3	236.43	78.81	78.81	21.49
Wasco.................	Deer	16	701.45	43.84	20.63	11.13
	Elk	1	0.38	0.38	0.13	0.13
Wenaha................	Deer	7	508.16	72.59	56.46	18.15
	Elk	18	1,514.61	84.15	65.85	16.11
Wheeler...............	Deer	30	6,518.47	217.28	125.36	47.93
	Elk	2	66.25	33.13	22.08	8.28
Whitehorse............	Antelope	1	410.00	410.00	410.00	41.00
Willamette............	Deer	11	291.74	26.52	13.26	14.59
Wilson................	Deer	11	382.40	34.76	12.75	8.14
	Elk	10	159.38	15.94	10.63	4.98
High Cascades.........	Deer	9	1,052.02	116.89	80.92	42.08
TOTAL........		1,060	$122,297.13	$ --	$ --	$ --
AVERAGE......		--	--	$115.37	$ 67.42	$ 29.86

Table 22. Allocation of Oregon Big Game Hunters' Total Expenditures in 1968 by Species

Species	Number of observations (sample)	Total investment (sample)	Total var. expenditure (sample)	Gross expenditure	Average expenditure per season	Average expenditure per trip	Average expenditure per day	Percent of total expenditures
Black-tailed deer.	216	$19,319.37	$11,362.00	$ 30,682.00	$142.05	$ 47.13	$ 37.37	15.54
Mule deer.........	387	72,657.83	38,926.18	111,584.01	288.33	146.63	55.46	56.53
Roosevelt elk.....	72	6,817.04	4,760.35	11,577.39	160.80	89.06	49.48	5.87
Rocky Mountain elk.........	187	21,179.55	19,646.65	40,826.20	218.32	152.91	40.50	20.68
Antelope..........	3	2,255.24	349.00	2,604.24	868.08	868.08	144.68	1.32
Bear..............	2	68.10	54.80	122.90	61.45	61.45	61.45	.06
TOTAL.......	867	$122,297.13	$75,099.61	$197,396.74	$ ---	$ ---	$ ---	100.00

Total Expenditures by Oregon Big Game Hunters

The preceding cost data were classified as (1) the investment in durable equipment items for big game hunting, and (2) the expenses incurred on hunting trips. Thus, total expenditures by Oregon big game hunters are obtained by adding investment in hunting and related equipment and hunting trip expenses:

Investment in hunting and associated equipment	=	$44.6 million
Hunting trip expenses........................	=	18.6 million
		$63.2 million

Thus, total expenditures, or "gross economic value" of the Oregon big game resource in 1968 was estimated to be over $63 million. Of course, certain assumptions with regard to the nonresponse and blow-up factors were necessary to arrive at the above figures, as was discussed earlier. Disregarding the complication of nonresponse, an approximation of the variance of total expenditures was calculated.[9/] Using these estimates, the 95 percent confidence interval for the average annual expenditure per hunting family was computed:

Average annual expenditure per family............	$357.61
Standard error..................................	$ 15.15
95 percent confidence interval..................	$357.61 ± 29.67

Using the above confidence limits, it is estimated that total expenditures by big game hunters in Oregon probably ranged between $58.0 and $68.4 million.

Impact of Big Game Hunters' Expenditures on the Oregon Economy

The money spent by hunters on investment items and trip expenses will generate additional output within the state through a "multiplier" effect. Sales of rifles by sporting goods stores, for example, will cause the stores to purchase additional inputs in the form of labor, more rifles, and other items. The size of this multiplier is highly dependent on "leakages" from the state or local economy and on the types of expenditures by hunters. If the sporting

9/ Details of the procedures followed are given by Farid Nawas [1972].

goods stores in the above example purchase their rifles from out-of-state, the economic impact within Oregon is less than would be the case if the rifles were manufactured in Oregon.

Output multipliers from six different areas are shown in Table 23. A rough pattern can be detected by comparing the multipliers, each of which reflects the change in sales of all sectors of an economy when sales of a particular sector are changed by one dollar. The most noticeable feature is that the multipliers are larger for Oregon and California than for the four counties, and are larger for Klamath County than for the other three smaller counties. This is to be expected; some of the "leakages" from Grant County, for example, are captured by the rest of Oregon. A second feature is that, dollar for dollar, trip expenses generate more additional output than do investment expenditures. This is due to the fact that the purchase of campers, pickups, jeeps, and house trailers accounts for two-thirds of the investment by hunters. The output multiplier for these expenditures is relatively low, since Oregon dealers purchase many of these items from out-of-state. Trip expenses for lodging and food in stores, cafes, and taverns, on the other hand, tend to draw relatively more on local inputs.

A rough estimate of the total impact on sales of goods and services in Oregon can thus be derived from the output multipliers for the State of Oregon. For investment items, the total impact in 1968 would be $44.6 million times a multiplier of 1.28, or $57.1 million. For trip expenses, the impact would be $18.6 million times a multiplier of 1.5, or $27.9 million.[10/] Re-spending of money spent by hunters then generates the sales of $21.8 million of goods and services in addition to the $63.2 million sold directly to hunters.

10/ Either the Oregon multiplier of 1.38 or the California multiplier of 1.39 would probably give an underestimate of the true effect of hunter expenditures, due to the gross nature of a state-wide "Retail and Wholesale Trade" sector. The Klamath County data suggest that hunter expenditures would tend to be concentrated in those portions of retail and wholesale trade which have relatively large multipliers (for example, grocery stores, cafes, and taverns); therefore, a multiplier of 1.50 was arbitrarily selected as an approximation to the true value.

Table 23. Output Multipliers Relating to the Pattern of Expenditures by Oregon Big Game Hunters

County & State	Population	Sector	Output multipliers	Allocation (among sectors) of the expenditures pattern of Oregon big game hunters: Investment	Trip expenses[b]
Elko[a] (Nevada) (1965)	13,790	Trade	1.10	100%	66.9%
		Services	1.27	---	5.1%
		Lodging	1.27	---	2.2%
		Weighted Output Multiplier[c]		1.10	1.12
Grand[d] (Colorado) (1960)	3,557	Automotive	1.11	64%	31.4%
		Lodging	1.42	---	2.2%
		Products[e]	1.07	36%	21.4%
		Eating & Drinking[e]	1.27	---	14.1%
		Services	1.18	---	5.1%
		Weighted Output Multiplier		1.10	1.14
Grant[f] (Oregon) (1965)	7,600	Automotive	1.19	64%	31.4%
		Lodging	1.52	---	2.2%
		Products[e]	1.08	36%	21.4%
		Services	1.12	---	5.1%
		Cafes & Taverns[e]	1.60	---	14.1%
		Weighted Output Multiplier		1.15	1.24
Klamath[g] (Oregon) (1967)	48,300	Products	1.18	36%	7.3%
		Services	1.22	---	5.1%
		Grocery[e]	1.51	---	14.1%
		Auto sales	1.13	64%	---
		Cafes & Taverns[e]	1.70	---	14.1%
		Service Stations	1.20	---	31.4%
		Lodging	1.46	---	2.2%
		Weighted Output Multiplier		1.15	1.36
State of Oregon[h]	---	Motor vehicles	1.23	64%	---
		Retail & wholesale trade	1.38	36%	66.9%
		Hotels & personal services	1.31	---	2.6%
		Business services	1.47	---	4.7%
		Weighted Output Multiplier		1.28	1.38

(Continued)

Table 23. (Continued)

County & State	Population	Sector	Output multipliers	Allocation (among sectors) of the expenditures pattern of Oregon big game hunters: Investment	Trip expenses b/
California i/	---	Trade & Transportation e/	1.32	36%	52.8%
		Selected services e/	1.56	---	21.4%
		Fabricated metals j/	1.61	64%	---
		Weighted Output Multiplier		1.50	1.39

a/ Malone and Detering [1969].

b/ Other expenses (13.2%) and cost of tags (12.6%) were excluded.

c/ The weighted output multipliers show what the effect on total output would be if hunters had purchased investment items and made trip expenses according to the state-wide distribution shown in Tables 3 and 9. These expenditures would have been distributed among sectors as shown in the two right-hand columns.

d/ Rhody and Lovegrove [1970].

e/ Expenditures on food, beverages, and liquor were assumed to be equally divided between on-premise and off-premise consumption.

f/ Bromley, et al. [1968].

g/ Reiling [1971].

h/ Watson and Allen [1969].

i/ Martin and Carter [1962].

j/ Includes the manufacture of motor vehicles and related equipment.

A note of caution should be attached to the above; if the Oregon big game resource ceased to exist, total output of goods and services in Oregon would not decline by $85 million. Most (if not all) of the money would be spent for other goods and services. This change in pattern of spending would vitally affect certain industries, of course, and certain areas within the state. The hunters themselves would also suffer a substantial loss; this will be shown later through the estimates of net economic value of the resource.

The impact of hunter expenditures can also be approximated for areas smaller than the State of Oregon. Grant County is used here as an example, since recent estimates of output multipliers are available for that county (Table 23). In addition, there are three game management units (Desolation, Northside, and Murderer's Creek) located within Grant County.[11/] These units accounted for 20 and 11 percent of total hunter days for deer and elk, respectively, in the Northeast region. Total trip expenses by hunters in these units amounted to $1,878,600 in 1968 (Table 14). At first glance, this would seem to contribute a substantial impact on the Grant County economy. Other studies have shown, however, that hunters often spend only a small percentage of their total trip outlays in the county in which they hunt. Hunters in the present study were not asked where they spent their money, but a recent study in Grand County, Colorado, can be used as a guide. That study indicated that Colorado hunters who hunted in Grand County incurred about 33 percent of their total trip expenses in that county, although the exact percentage varied by type of expense. These figures were used as an approximation to the percentages spent locally by hunters in Grant County, Oregon.[12/]

11/ The Heppner unit also overlaps into four counties, including Grant County. Hunters from the lower Willamette Valley, however, would be more likely to buy supplies in Condon or Heppner than in John Day.

12/ Rhody and Lovegrove [1970]. The validity of our procedure is open to question, since Grand County, Colorado, is about twice as far from major population centers as Grant County, Oregon (250 versus 125 miles). Since more distance has to be traversed to get to the latter, hunters would have more opportunity to stop for gas, lodging, and food enroute. On the other hand, hunters who travel a greater distance are more likely to stay longer in the hunting area, and thus increase their reliance on the local economy. Data to support either contention were not available from this or the Colorado study. The Grand County data seem to be a good approximation, since (a) travel to either county would not normally involve overnight lodging, (b) both counties have about the same population and array of services, and (c) the overall spending patterns of both sets of hunters were very similar.

By using data on the Grand County, Colorado, trip expenses, together with the output multipliers for Grant County, Oregon, it was possible to get a rough estimate of the total impact of hunting trip expenses on the Grant County economy (Table 24). The amount spent directly by hunters would have been about \$537,455. These expenditures would have generated the output of an additional \$125,674 of goods and services by Grant County firms. The total impact on local output of \$663,129 constitutes about 1.2 percent of all goods and services produced by businesses in the county, while the direct sales to hunters (\$537,455) are about 2.1 percent of the total output of the five sectors from which hunters make purchases.

The impact of hunting trip expenses can also be viewed in terms of the effects on household incomes, as well as business sales. An unpublished updating of the Grant County study makes Table 25 a more accurate and informative portrayal of the effects on local incomes. Based on the coefficients from the up-dated study, \$129,585 of household income was generated by hunting trip expenses in 1968. This constitutes about two-thirds of one percent of total household income in Grant County.

Judging by either product sales or incomes generated, then, one would have to conclude that big game hunting is not a vital element of the Grant County economy. It does, however, provide for the equivalent of about 20 man-years of employment each year to a rural economy which will continue to face problems of under-employment of its work force.

Limitations of the above analysis should, of course, be recognized. First, the percentages spent in Grant County by visiting hunters may differ from those used above. The Grand County, Colorado, study, however, should be useful as a first approximation. Second, firms in Grant County, Oregon, may also sell goods and services to hunters who are en route to other areas. This is probably more than offset by the assumption that <u>all</u> of the trip expenses in the three Grant County units were made by visiting hunters. Third, the impact of expenditures for investment items by local residents may be quite important to Grant County firms. For example, the state-wide data on expenditures for hunting equipment were used to estimate total investments of \$637,780 by Grant County

Table 24. Impact of Hunting Trip Expenses on the Grant County Economy (Desolation, Murderer's Creek, and Northside Game Management Units)

Type of expenditure (trip expenses)	Percent of total trip expenses a/	Total amount spent by hunters	Estimated percent spent in Grant County b/	Amount spent by hunters in Grant County	Grant County output multiplier and sector c/	Total impact on sales of Grant County goods & services
Transportation.........	31.4	$ 589,880	35.3	$208,228	1.19 (auto)	$247,791
Motels, hotels, etc....	2.2	41,329	41.0	16,945	1.52 (lodging)	25,756
Ammunition, etc........	7.3	137,138	20.4	27,976	1.08 (products)	30,214
Food & beverages d/						
On-premises.......	14.1	264,882	36.5	96,682	1.60 (cafes)	154,691
Off-premises......	14.1	264,882	36.5	96,682	1.08 (products)	104,417
Guide service, etc.....	0.4	7,514	29.2	2,194	1.12 (services)	2,457
Cutting & wrapping, etc.	4.7	88,294	10.2	9,006	1.12 (services)	10,087
Other expenses e/	13.2					
Products..........		137,487	29.0	39.871	1.08 (products)	43,060
Services..........		137,487	29.0	39,871	1.12 (services)	44,656
Tags f/	12.6	236,704	--	--		--
TOTAL.......	100.0	$1,878,600	32.8	$537,455	--	$663,129

a/ SOURCE: Table 9. This assumes that the spending pattern by those who hunted in Grant County was the same as the state-wide pattern.

b/ Data derived from Table 1 in Rhody and Lovegrove [1970].

c/ For data source, see Table 23.

d/ Expenditures on food, beverages, and liquor were assumed to be equally divided between on-premise and off-premise consumption.

e/ Assumed to be divided equally between products and services.

f/ Tag sales were assumed to have no direct impact on Grant County output.

Table 25. Impact of Hunting Trip Expenses on Household Incomes in Grant County

Sector	Sales to hunters[a]	Household income per dollar of sales[b]	Household incomes
Automotive...........	$208,228	0.15	$ 31,234
Lodging..............	16,945	0.35	5,931
Cafes & Taverns......	96,682	0.46	44,474
Products.............	164.529	0.13	21,389
Services.............	51,071	0.52	26,557
TOTAL............	$537,455		$129,585

Number of deer and elk hunters (Desolation, Murderer's Creek, and Northside)...........	18,400
Number of deer and elk harvested...........	9,572
Household income generated per hunter......	$7.04[c]
Household income generated per animal harvested..........................	$13.53

a/ From Table 24.

b/ These values reflect the total change in local household incomes when the sales by a particular sector change by one dollar.

SOURCE: Haroldsen, Ancel and Russell Youmans, Grant County, Oregon: Structure of the County Economy. Oregon State University Extension Service Special Report 358, May 1972.

c/ Not adjusted to account for those hunters who hunted in more than one of the units.

residents in 1968. If over half of these expenditures were made within the county, then the impact of spending by local residents could exceed that by visiting hunters. The expenditures by visitors, however, constitute "new revenue" for local firms, whereas one type of spending by local residents would most likely just replace another type of spending.

ANALYTICAL ISSUES IN THE ESTIMATION OF OUTDOOR RECREATION DEMAND FUNCTIONS

In the preceding section, estimated total expenditures provide an indication of the gross economic value or the economic activity generated by the Oregon big game resource. However, estimation of the net economic value requires a more sophisticated theoretical and statistical analysis. A review and evaluation of various proposed methods for estimating net economic benefits of publicly owned recreational resources was presented in an earlier section. In essence, to properly estimate the economic value of these recreational resources, it is necessary to obtain accurate estimates of the underlying demand relationships for the recreational activity.

Once the basic demand relationship has been quantified, then net economic values can be derived. However, in the past there have been two main measures used for defining "net economic value". One definition states that net economic value of the resource should be the amount of revenue that a single owner could obtain by charging a single price. However, others have argued that this definition is too conservative, since some people would be willing to pay more than the single revenue-maximizing price. Also, in the absence of any substantial charges for the use of publicly-owned resources, even people who place lower values on the recreation would still be obtaining a positive benefit which would not be measured by using the single revenue-maximizing price approach.

The preceding objections have encouraged the adoption of another definition of net economic benefits. This second definition states that the net economic value to an individual is equal to the maximum amount that he would be willing to pay for the use of the resource, over and above the actual transfer cost that he must incur in order to participate in the recreational activity. As might be expected, this second definition results in a value two to three times higher than the first.

The first definition is commonly referred to as the "non-discriminating monopolist" approach, and the second as "consumer surplus". We will compute both measures, with the understanding that the non-discriminating monopolist approach provides a minimum or conservative estimate of net economic value, whereas the consumer surplus approach provides a full or maximum estimate of net economic value. However, to estimate either measure of net economic value, the underlying demand relationship must be known or approximated. Therefore, the specification and estimation of the basic demand relationship is crucial for the quantification of net economic benefits.

Improving the Estimation and Specification of Outdoor Recreation Demand

Although a demand relationship can sometimes be computed in a simple tabular form, as was the case for Clawson's original study [1959], this tabular approach has certain limitations. For one thing, no estimate of the statistical reliability, or lack thereof, can be obtained by using a tabular approach. Even more importantly, it is difficult or impossible to measure the important effects of other variables which influence the demand, unless one estimates the demand function by statistical techniques.

One very important factor which does not lend itself to a tabular analysis of demand would be the effect of distance or travel time upon the price-quantity relationship for outdoor recreation. Increased travel time, with increased distance, tends to result in an underestimate of value for a particular outdoor attraction if the Clawson tabular approach is used, as noted by Knetsch [1963] and recently reiterated by Cesario and Knetch [1970, p. 703]:

> "Perhaps the most serious difficulty of the travel cost method, as it has been applied in the past, is a consistent bias in the derived demand curve. This difficulty results from the basic assumption that the disutility of overcoming distance is a function only of money cost. This assumption is not correct. The effect of distance is likely to be a function of the time involved in making the trip, as well as the monetary cost . . ."

Along with the increased travel time required as distance increases, Clawson and Knetsch [1966] have noted that alternative recreational opportunities become relatively cheaper in travel and related transfer costs required as distance increases. Thus, one would expect a strong negative bias to result from the complicating factor of increased travel time.

Thus, most empirically estimated recreational demand functions have usually been poorly specified.[13/] It would, therefore, seem highly desirable to eliminate or reduce this bias, if possible, in the model specification and demand estimation procedures.

Given the importance of increased distance on the negative factors of travel time and alternative recreational opportunities, the inclusion of a separate variable, such as travel time per distance zone, would appear to be needed. Thus, visit rate could be expressed as a function of both money and time cost. However, as pointed out by Cesario and Knetsch [1970], the difficulty has been that travel costs in monetary outlay and time are usually highly correlated, making it very difficult to separate the effect of one from the other.

An attempt to separate monetary from time costs was made by Brown, et al. [1964], where days of fishing was expressed as a function of transfer costs, family income, and average distance traveled per zone. However, the standard error for the coefficient of the distance traveled variable was large, indicating an unreliable estimate of the effect of this variable. Furthermore, including average distance traveled tended to inflate the variance of the transfer cost variable because of the high intercorrelation between the two variables. Therefore, most researchers have simply omitted variables such as hours or miles traveled, perhaps not being properly concerned about the resulting specification bias.

What should the researcher do when confronted by the dilemma of multicollinearity on one hand and specification bias on the other? Cesario and Knetsch [1970] suggested an ingenious method for combining transfer costs and travel time into a single interacting variable. Unfortunately, a disadvantage of their proposal is that the researcher must assume one or more specific trade-offs between monetary cost and time by the participants; however, it is this tradeoff that we would, ideally, like to estimate directly from our sample information.

13/ Danger of bias resulting from omission of one or more relevant variables in economic research was noted by Theil [1957]. A good, more recent statement of this problem is given by Malinvaud [1966, pp. 263-266].

Fortunately, it appears that this problem can be solved, in most cases, simply by using a more efficient estimating procedure.

Comparison of Estimating Procedures

It might be instructive to briefly review the "zone average" type of estimating technique traditionally used in analyzing expenditure data, first applied in the pioneering research of Clawson [1959]. For illustration, suppose we had a small sample of 18 recreationists, say hunters or anglers, who had originated from three distance zones. Let us further assume that the quantity of recreation days taken by the i^{th} individual recreationist, Y_i, has been generated by the following demand function:

$$Y_i = \beta_o + \beta_1 X_{1i} + \beta_2 X_{2i} + u_i,$$

where X_{1i} denoted the transfer cost incurred by the i^{th} recreationist, X_{2i} denoted the average distance traveled in each zone, and u_i represents deviations from the general function due to individual differences in tastes, income, age, background, and other unmeasured variables. (For simplicity, we will assume u_i has zero mean, constant variance equal to σ^2, and is independently distributed.)

The Traditional "Zone Average" Estimation

Using the traditional procedures for the data in Table 26, we would take zone averages of all the variables, which would yield the following three averaged observations:

X_1	X_2	Z
4	50	Z_1
8	150	Z_2
12	220	Z_3

For the preceding averaged observations, Z_1 denotes the average of the quantities taken by the sampled recreationists from the nearest distance zone,

Table 26. Hypothesized Transfer Costs and Average Distances Traveled by 18 Recreationists in Three Distance Zones

Transfer costs incurred	Average distance traveled in zone	Quantity taken by each recreationist
2	50	Y_1
2	50	Y_2
4	50	Y_3
4	50	Y_4
6	50	Y_5
6	50	Y_6
6	150	Y_7
6	150	Y_8
8	150	Y_9
8	150	Y_{10}
10	150	Y_{11}
10	150	Y_{12}
10	220	Y_{13}
10	220	Y_{14}
12	220	Y_{15}
12	220	Y_{16}
14	220	Y_{17}
14	220	Y_{18}

Z_2 denotes the average quantity taken by the second distance zone, etc. Thus, Z_1, Z_2, and Z_3 each represents the average of 6 individual observations. To simplify the variances in the following analysis, assume that each zone had an equal population.

Denote the estimated parameters from the above averaged observations as β_1^* and β_2^*. Then, from the main elements of the inverse matrix, the magnitude of the variances of β_1^* and β_2^* can be inferred from the following:

$$\text{Var}\ (\beta_1^*) = \sigma^2/6\ (3.041667) \doteq 0.51\ \sigma^2 \qquad \text{and}$$

$$\text{Var}\ (\beta_2^*) = \sigma^2/6\ (0.00666667) \doteq 0.0011\ \sigma^2.$$

(The variances of β_1^* and β_2^* are equal to $\sigma^2/6$ times their corresponding main inverse matrix elements, since the variance of an average is σ^2/n.) It will next be shown that the variances of these estimators, based upon averages, are needlessly large compared to the variances of estimators based upon the individual observations.

Estimation Based Upon Individual Observations

Instead of using the average values for each zone, we recommend that the information given by the individual observations in Table 26 should be used, as by Gillespie and Brewer [1968], and Edwards and co-workers [1971]. (We have been unable to find where anyone analyzing expenditure data has compared the efficiency resulting from use of individual observations versus zone averages when statistically estimating per capita demand functions.) By using all 18 observations and the resulting inverse matrix, we obtain the variances of the ordinary least squares estimators, $\hat{\beta}_1$ and $\hat{\beta}_2$:

$$\text{Var}\ (\hat{\beta}_1) \doteq 0.020011\ \sigma^2$$

$$\text{Var}\ (\hat{\beta}_2) \doteq 0.0000548246\ \sigma^2.$$

Comparison of Efficiency

Therefore, for the preceding illustrative data of Table 26:

$$\frac{\text{Var}(\beta_1^*)}{\text{Var}(\hat{\beta}_1)} \doteq \frac{.50694}{.02001} \doteq 25.3$$

and

$$\frac{\text{Var}(\beta_2^*)}{\text{Var}(\hat{\beta}_2)} \doteq \frac{.00111111}{.00005482} \doteq 20.3.$$

Thus, in the simple example considered, using the traditional "zone average" procedure produces an efficiency of estimation of only about 5 percent of that possible by using information from all the individual observations! Another way of interpreting this result is that one would need about 20 times as many sample observations to approach the same precision of estimation possible from using the individual observations.

Reason for Increased Efficiency

Chief reason that the traditional "zone average" regression analysis gives such poor results in the above example is the greatly increased correlation between the two explanatory variables, X_1 and X_2. Using individual observations, the correlation is only 0.88982, as compared to 0.99485 for the zone average analysis. Naturally, as the intercorrelation tends toward one, precision of coefficient estimation is drastically reduced because of the inflated main diagonal elements of the inverse matrix. (Also, there is a small loss of variation in the range of X_1, which adds to the inefficiency of the traditional "zone average" analysis.)

Critics may respond at this point that the preceding over-simplified example really proves nothing, since actual empirical cases involve many more observations, zones, and other complications. It is true, of course, that the numerical example of Table 26 was deliberately oversimplified for purposes of exposition. Nevertheless, in the actual estimation of demand for Oregon big game which follows, a similar result was observed.

ESTIMATION OF DEMAND FUNCTIONS FOR OREGON BIG GAME

Many possible algebraic forms could be hypothesized for big game demand relationships. The simplest form is the linear demand model, the results of which will be presented first.

The Linear Demand Function

Before presenting the estimated linear demand equations, it should be noted that the data were grouped into five geographical areas, which corresponded to the administrative regions of the Oregon Game Commission. The location of these five administrative regions, and the game management units within each region, are shown in Figure 1.

The grouping by these five regions was appropriate for the demand analysis because each region was reasonably homogeneous, and the regions were large enough to supply sufficient observations for the statistical analysis. Results for the most important hunting region, Northeast Oregon, will be presented first.

Region IV, Northeast Oregon

The Northeast Oregon region, Figure 1, has some of the finest hunting in Oregon and the United States. During the 1968 hunting season, over 45,000 mule deer were harvested in Region IV, and almost 6,000 Rocky Mountain elk, according to the 1969 Annual Report of the Oregon State Game Commission.

There were 248 families in our sample who hunted in the Northeast Oregon region. Factors, which were first hypothesized to be important in determining the average number of trips per hunter, included average hunting expenses per trip, family income, hunting success, number of licensed hunters in the family, years of hunting experience, and an index of distance traveled per trip. However, family income and years of hunting experience were usually not statistically significant and did not exert a significant influence on the coefficients

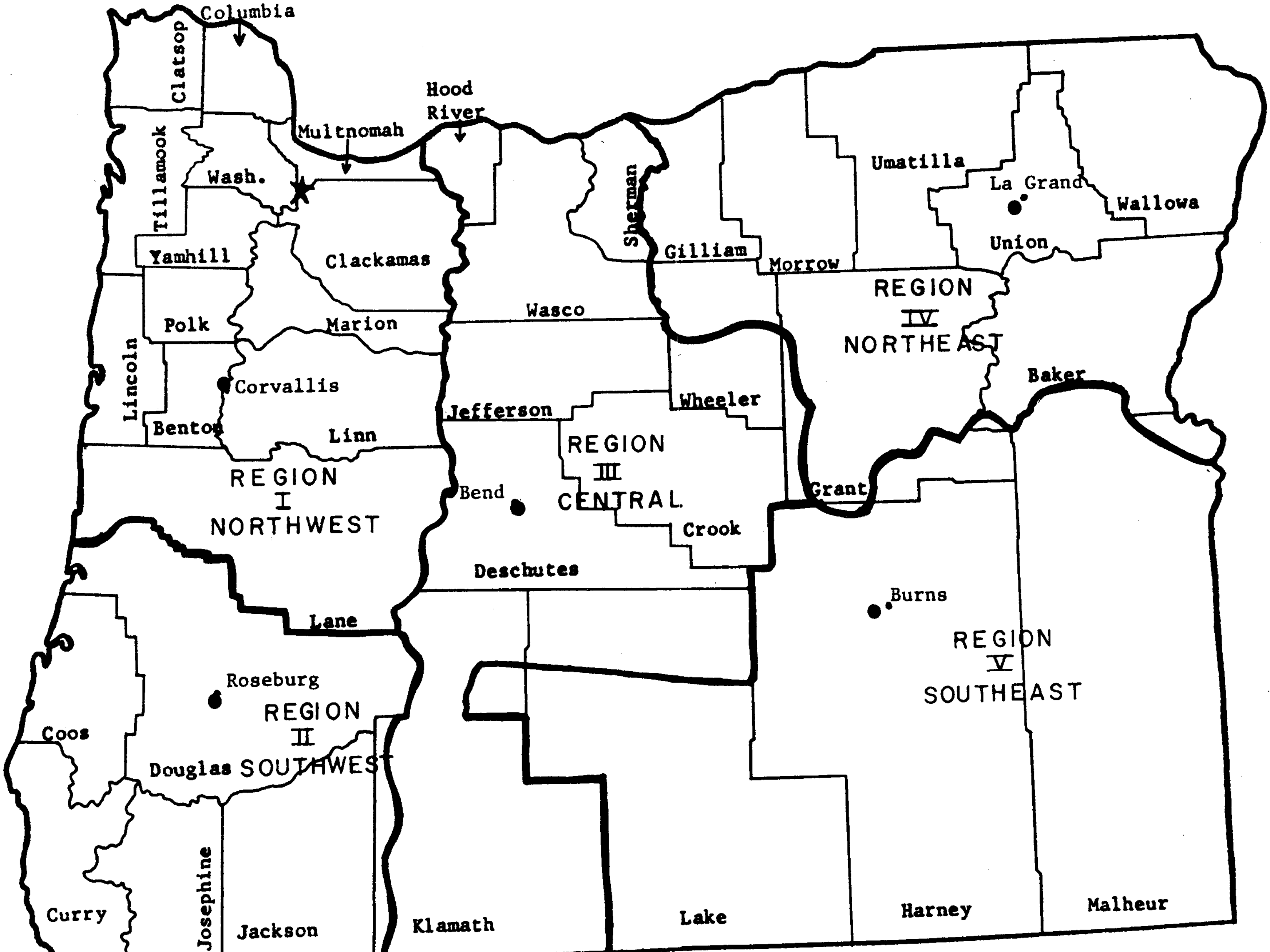

FIGURE I. OREGON GAME COMMISSION ADMINISTRATIVE REGIONS of the other independent variables. Regression results are presented first for the traditional "zone average" estimation procedure.

Traditional zone average estimate. The 242 hunting family observations were divided into 31 distance zones, with 6 to 9 observations per zone. Reason for averaging about 8 observations per zone was to make the zones small enough to obtain a good geographical dispersion of distance zones throughout the state. In contrast to the Southwest and Northwest Oregon hunting areas, most of the families who hunted in the Northeast region came from other parts of the state, since Northeast Oregon has a low population concentration but excellent big game hunting. Of the 31 distance zones, only 5 zones were located within Northeast Oregon.

As mentioned earlier, non-monetary costs of distance are hypothesized to be an important shifter of the outdoor recreational demand function [Cesario and Knetsch, 1970]. Consequently, one reason for constructing the distance zones was to obtain a measurement of the important distance effect. To reduce multicollinearity between variable cost and distance as much as possible, we computed the average one-way highway distance traveled by the hunting families to the nearest edge of the Northeast Oregon hunting region. This procedure gave somewhat better results than using the average distance traveled by the hunters of each zone.

The five distance zones within the Northeast region were assigned distance values of zero. Measured distances for the other 26 zones ranged from 37 to 269 miles.

For the metropolitan areas, there were enough observations to subdivide these areas into more than one zone. These subdivisions were made by placing the lowest income families in one zone, the second lowest incomes in the second zone, etc. However, one limitation of the distance zone approach is the arbitrary nature of the zone delineation and construction.

Fitting the data by ordinary least squares, the following equation was obtained:

(1) $$\hat{Y}_j = 2.4141 - \underset{(.006960)}{0.008712}\, X_{1j} - \underset{(.002119)}{0.007943}\, X_{2j}$$

$$R^2 = 0.604$$

$$n = 31$$

Numbers in parentheses below coefficients are standard errors. In Equation (1), $\hat{Y}_j$ denotes the average number of hunter trips per family in distance zone j;

X_{1j} is the average cost incurred per hunting trip for distance zone j (costs included transportation, food, lodging, ammunition, licenses and tags);

X_{2j} is the average measured one-way distance of the hunters in distance zone j to the Northeast Oregon hunting region.

In addition to the preceding two independent variables, four other variables were included but were not statistically significant, and had little effect on the variable cost and distance coefficients. These additional variables were the following:

X_{3j} was an index of hunting success (animals taken, divided by hunter trips for distance zone j);

X_{4j} was average number of licensed hunters per family in distance zone j;

X_{5j} was an index of hunting experience (number of years hunted by head of household);

X_{6j} was average family income in distance zone j.

As was usually the case for the traditional zone average method, the estimate of the important variable cost coefficient in (1) was not precise, partly because of the high correlation between variable cost and distance, $r = 0.695$. The standard error of the regression coefficient for the cost variable, X_{1j}, is nearly as large as the coefficient. This result is definitely inferior to that obtained from using all observations, as will next be shown.

Estimates based upon individual observations. All variables are defined in the same way as for Equation (1), except that the individual hunting family is the observational unit, rather than the distance zone average. Hence, there are 242 observations fitted in Equation (2), rather than the 31 as for Equation (1). For comparison, Equation (2) was restricted to the same two independent variables used in (1).

(2)
$$\hat{Y}_i = 2.3906 - \underset{(.001997)}{0.009218}\, X_{1i} - \underset{(.001056)}{0.006932}\, X_{2j}$$
$$R^2 = 0.321$$
$$n = 242$$

In the preceding equation, $\hat{Y}_i$ denotes the predicted number of hunter trips to be taken by the i^{th} hunting family in the j^{th} distance zone; X_{1i} denotes the variable transfer costs per hunter trip of the i^{th} family of the j^{th} zone; and X_{2j} denotes the distance in miles of the j^{th} distance zone to the Northeast Oregon hunting area. Numbers in brackets below the coefficients are again the standard errors.

In contrast to the unreliable estimate (as indicated by its standard error) of the important variable cost coefficient in Equation (1), the standard error in (2) is only about one-fourth the coefficient value, indicating fairly good precision of estimation. Although the R^2 value in (2) is much smaller than for (1), the R^2 for (1) is a misleading statistic, according to Freund [1971], and therefore has to be interpreted with caution. In any case, we are much more concerned with the estimate of the structural parameters, the coefficients for X_{1j} and X_{2j}. The importance of these coefficients upon the estimated net economic value of the resource will become apparent in a later section.

In addition to the two independent variables used in Equations (1) and (2), the other four variables mentioned previously were also tried. In contrast to the zone average results, two of these other four variables were statistically significant at the 5 percent level. The more complete model was the following:

(3)
$$\hat{Y}_i = 1.6939 - \underset{(.001952)}{0.006660}\, X_{1i} - \underset{(.001001)}{0.007128}\, X_{2j} - \underset{(.1916)}{0.4548}\, X_{3i} + \underset{(.07613)}{0.3783}\, X_{4i}$$
$$R^2 = 0.395$$
$$n = 242$$

The important coefficients for cost and distance, X_{1i} and X_{2j}, remain fairly stable in comparing Equations (2) and (3). Similarly, their standard errors remain relatively unchanged with the addition of X_{3i} and X_{4i}.

At first thought, one might not expect the negative coefficient for X_{3i}, an index of hunting success. However, this coefficient should be negative since the family is much less apt to go hunting a second time if all licensed hunters in the family succeed in obtaining their deer on the first trip. (Game regulations permit only one deer on the general deer tag, but an additional deer can sometimes be taken during controlled deer seasons.)

Number of licensed hunters in the family residing at home, X_{4i}, has the expected positive sign. Years of hunting experience by the head of the household, X_{5i}, did not have a significant effect on the number of hunting trips taken. Furthermore, in contrast to salmon-steelhead fishing [Brown, et al., 1964], family income, X_{6i}, was not statistically significant, and resulted in a slightly higher standard deviation for the regression. In fact, income had no significant effect in any of the hunting regions, even though several transformations and measures of income were tried in the regression analysis.

Because of the better estimates resulting from the regressions based upon individual observations, we will not present the less reliable results from the zone average method for the remaining regions.

Region III, Central Oregon

The Central Oregon hunting area was similar to Northeast Oregon in that many hunters came to hunt from outside the area, especially from Northwest Oregon. We had 144 families in our sample who hunted in the Central region. From these 144 observations, 19 distance zones were constructed, with an average of about eight observations per zone.

Only 33 of the 144 hunting families resided within the Central Oregon area. Although the regression based upon individual observations gave the best results, distance zones were still used to define the measured distance to the hunting area. (It might have been better to have used the measured distance for each observation, although in most cases the distance would have been the same, or nearly so.)

Hunters harvested 26,640 deer in the Central Oregon region, which placed it third among the five regions of the state. The Central region was surpassed only by the Northeast Oregon area, with 45,000 deer taken, and by the Northwest area, with 36,000, according to the Annual Report [1969]. However, very few elk were taken in the Central area as compared to Northeast or Northwest Oregon.

Presenting only the more reliable results based upon the individual observations, the following regression was obtained:

$$(4) \quad \hat{Y}_i = 0.7819 - \underset{(.001850)}{0.004328}\, X_{1i} - \underset{(.001028)}{0.005358}\, X_{2j} - \underset{(.1071)}{0.2357}\, X_{3i} + \underset{(.04286)}{0.1012}\, X_{4i}$$

$$R^2 = 0.337$$

$$n = 144$$

In Equation (4), fairly reliable estimates are indicated for the important variables, X_{1i} (variable cost) and X_{2j} (distance). (All variables are defined the same as for the Northeast region.) Again, family income, X_{6i}, failed to exert any significant influence on the dependent variable or on the coefficients of the other independent variables. Hunting success, X_{3i}, exerted its usual negative impact upon additional hunting trips. Also, as for the Northeast region, number of licensed hunters in the family, X_{4i}, exerted a positive influence upon hunting trips taken.

As for the Northeast area, X_{5i}, years of hunting experience by head of household, failed to exert a significant influence. It was therefore deleted, along with X_{6i}, family income.

Contrary to many economic models, the inclusion or omission of variables X_{3i}, X_{4i}, X_{5i}, and X_{6i} did not have a great impact upon the coefficient of the important cost variable, X_{1i}. (The cost coefficient has a crucial effect upon the net economic values which will be presented in a later section.) However, as mentioned earlier, distance, X_{2j}, has a very important impact upon the variable cost coefficient. The effects of the other variables upon the variable cost coefficient can be observed as the variables are added in the stepwise regression:

Step number	Next variable entered	Variable cost coefficient, $\hat{\beta}_1$	Distance coefficient, $\hat{\beta}_2$
1	Variable cost........ X_{1i}	-.009361	---
2	Distance............. X_{2j}	-.005690	-.005518
3	Licensed hunters in family........... X_{4i}	-.005265	-.005442
4	Hunting success...... X_{3i}	-.004328	-.005358
5	Hunting experience... X_{5i}	-.005021	-.004912
6	Family income........ X_{6i}	-.004904	-.004897

As shown above, no great change is observed in $\hat{\beta}_1$ after the important distance variable has entered. A similar pattern was observed for the previous Northeast region and also for the other hunting regions. Therefore, for our data, no very large specification bias would appear to be introduced by omitting one or more of the variables X_{3i}, X_{4i}, X_{5i}, and X_{6i}.

However, the reader could object, at this point, that the last 4 variables above might have had greater impact on the variable cost coefficient if distance, X_{2j}, had been excluded in the preceding listing of the variable cost coefficient. To refute this hypothesis, the stepwise regression can be re-run, with X_{2j} excluded. The variable cost coefficient behaved as follows:

Step number	Next variable entered	Variable cost coefficient, $\hat{\beta}_1$
1	Variable cost........... X_{1i}	-0.009361
2	Licensed hunters in family............. X_{4i}	-0.009955
3	Hunting success......... X_{3i}	-0.008964
4	Hunting experience...... X_{6i}	-0.008425
5	Family income.......... X_{5i}	-0.008291

From the above results, it can be seen that $\hat{\beta}_1$ never drops to its value in the more completely specified model. Also, R^2 is 0.257 for the above 5 independent variables, as compared to $R^2 = 0.337$ for Equation (4). Therefore, it is concluded that distance, X_{2j}, cannot be deleted without causing a serious bias.

Although X_{3i} and X_{4i} did not have much impact on the variable cost coefficient, $\hat{\beta}_1$, X_{3i} and X_{4i} were usually statistically significant and were retained in the model to reduce the variance of the regression. On the other hand, income (X_{6i}) and hunting experience (X_{5i}) usually increased the variance of the regression, and were therefore omitted.

Region I, Northwest Oregon

The Northwest Oregon region has the major population concentration of the state, since it includes the Portland, Salem, and Eugene areas, Figure 1. Due to this heavy population concentration, Region I had the most hunter days for deer of any region in 1968, almost 382,000 according to the 1969 Annual Report of the Oregon State Game Commission. (However, total deer harvested were only about 36,000, as compared to over 45,000 for the Northeast Oregon region.)

Roosevelt elk are also important in Region I, with over 65,000 hunter days according to the 1969 Annual Report. A total of 1,954 elk were harvested by the hunters in Region I in 1968.

There were 139 families in our sample who hunted in the Northwest area. In sharp contrast to the Northeast and Central Oregon areas, there were only 13 families from outside the area who hunted in the Northwest region. Of course, not many hunters would be expected to travel to the Northwest region which already has heavy hunting pressure and less favorable hunting conditions.

The two outside distance zones averaged one-way measured distances to the edge of the Northwest area of 60 and 62 miles. All other zones were located within the region itself, and were assigned a distance index of zero, except for 6 Portland zones which were assigned an index of 23 miles. It was observed that the Portland area residents averaged 23 miles further in order to reach their hunting sites, as compared to the other hunters within the region.

Basing the regression upon the individual observations,

$$(5)\quad \hat{Y}_i = 0.0307 - \underset{(.003534)}{0.007172}\, X_{1i} - \underset{(.003648)}{0.009720}\, X_{2j} - \underset{(.2053)}{.2898}\, X_{3i} + \underset{(.06305)}{0.4880}\, X_{4i}.$$

$R^2 = 0.387$

$n = 139$

A somewhat less reliable estimate of the variable cost coefficient was obtained in (5), as compared to the earlier estimated coefficients for the Central and Northeast Oregon hunting areas. One reason for the higher standard errors for $\hat{\beta}_1$ and $\hat{\beta}_2$ in (5) was that the hunters in the Northwest zone averaged lower hunting trip expenses and shorter distances traveled. Consequently, with a smaller range of X_{1i} and X_{2i} values, the sums of squares for X_{1i} and X_{2i} would be smaller and would result in higher variances for the coefficients, $\hat{\beta}_1$ and $\hat{\beta}_2$.

Despite the higher standard errors, the coefficients of (5) appear plausible. Again, family income, X_{6i}, failed to have any significant impact upon number of hunter trips taken or upon the coefficients of the other independent variables. All coefficients in (5) had the appropriate signs, as discussed earlier for the other regions.

<u>Region II, Southwest Oregon</u>

Characteristics of the Southwest Oregon administrative region are similar to those of the Northwest, except that hunting pressure is considerably less in Southwest Oregon, due to the lack of major cities in the area. Total deer hunting days for Southwest Oregon were only around 219,000 in 1968, as compared to 326,000 for the Northwest area and 315,000 for the Central region [Annual Report, 1969]. Similarly, fewer total deer were taken, 22,500 as compared to 26,640 for the Central area and 36,250 for Northwest Oregon. In addition to deer, 1,295 Roosevelt elk were taken by hunters in Southwest Oregon.

As was the case for Northwest Oregon, most of the people who hunted in Southwest Oregon resided within that area. Out of 80 observations in our sample, only 15 resided outside of the region.

Best regression results were

$$(6) \quad \hat{Y}_i = 1.0166 - \underset{(.007128)}{0.009930}\, X_{1i} - \underset{(.004847)}{0.008197}\, X_{2j} - \underset{(.2846)}{0.6404}\, X_{3i} + \underset{(.1894)}{0.3126}\, X_{4i}.$$

$R^2 = 0.172$

$n = 80$

According to t test, the least reliable estimate of the variable cost coefficient was obtained for this region, as indicated by a fairly large standard error in (6). Again, as for the Northwest region, one would expect less precision of estimation because of smaller variation in variable cost per hunting trip and distance to the hunting site. A smaller size sample for this region also contributed to the higher variances of the coefficients in (6).

Despite the higher variances, the magnitude of the variable cost coefficient is in the same range as the variable cost coefficient for the Northwest region. This observed stability tends to increase one's confidence in the estimated coefficient.

Region V, Southeast Oregon

Smallest of the five hunting regions, in terms of number of hunting days and deer taken, is the Southeast Oregon area. In 1968 there were about 186,000 hunter days for deer and a harvest of nearly 20,680 deer, which was not far behind the Southwest Oregon area harvest of 22,500 deer [Annual Report, 1969]. Like the Central region, relatively few elk were harvested in the Southeast area.

As was the case for the Central and Northeast Oregon areas, most of the hunters resided outside the zone. Out of the 88 families of our sample who hunted in Southeast Oregon, 82 resided outside the Southeast area and 79 of these 82 families were from Western Oregon.

Best linear regression results appeared to result from:

(7) $\hat{Y}_i = 0.3139 - 0.001078\ X_{1i} - 0.0007411\ X_{2j} - .0708\ X_{3i} + 0.04067\ X_{4i}.$
$(.0006810) \quad (.0002762) \quad (.05208) \quad (.02337)$

$R^2 = 0.237$

$n = 88$

Variables X_{5i} and X_{6i} had no appreciable influence on $\hat{Y}_i$ or $\hat{\beta}_1$ and $\hat{\beta}_2$. The coefficient for variable cost in (7) is considerably smaller than for the other four regions. As a result of this smaller coefficient and smaller constant term in (7), net economic value for the Southeast area is much smaller, as shown in the later economic analysis.

The Exponential Demand Function Fitted by Logarithmic Transformation

The linear demand model of the preceding section can be criticized because it can be argued that the demand curve should not directly intersect the vertical axis with increasing price or cost, but rather should become asymptotic to it. Although several algebraic forms of the demand function could satisfy this asymptotic property, the exponential function is one of the most convenient to employ. Sometimes the power function has been used [Wennergren, 1967]. However, this function yields a constant elasticity of demand, and cannot be used to find the maximum revenue possible to a nondiscriminating single owner (since revenue is maximized only at elasticity equal to one). Therefore, we fitted the exponential function,

(8) $$Y = \exp[\beta_o + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k],$$

which has the advantage of variable elasticity of demand.

The exponential function is also convenient to fit by ordinary least squares by means of logarithmic transformation. Defining the variables exactly as for the linear demand function discussed in the preceding section, the exponential function was fitted in the form

(9) $$\ln Y_i = \beta_o + \beta_1 X_{1i} + \beta_2 X_{2j} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i}.$$

Coefficients for resulting regressions for each region are presented in Table 27. (Variables X_{5i} and X_{6i} were usually not significant and were deleted.)

Table 27. Summary of Results from the Exponential Demand Function for the Five Hunting Regions of Oregon (Fitted by Logarithmic Transformation)

Independent variables	Regression Coefficient				
	Region I N.W. Oregon	Region II S.W. Oregon	Region III Central Oregon	Region IV N.E. Oregon	Region V S.E. Oregon
Constant...........	-0.826343	-0.292463	-0.860059	0.011780	-1.562355
Variable cost per hunting trip, X_{1i}...........	-0.016248 (0.003397)a/	-0.022425 (0.004938)	-0.008171 (0.002637)	-0.009814 (0.001398)	-0.009797 (0.002877)
Measured one-way distance to region, X_{2j}....	-0.029087 (0.003507)	-0.025145 (0.003358)	-0.009381 (0.001465)	-0.005298 (0.000717)	-0.002623 (0.001167)
Animals taken per hunter trip, X_{3i}........	-0.665871 (0.197298)	-0.708242 (0.197176)	-0.510787 (0.152665)	-0.320684 (0.137218)	-0.288072 (0.220818)
Number of licensed hunters per family, X_{4i}.....	0.286751 (0.060607)	0.261346 (0.131191)	0.295937 (0.061078)	0.306250 (0.054523)	0.238014 (0.098300)
R^2 (in terms of logarithms).................	0.557	0.640	0.495	0.525	0.349
R^2 (real numbers).......	0.453	0.120	0.345	0.407	0.201
Number of observations..	139	80	144	242	88

a/ Standard errors are in parentheses below the regression coefficients.

The standard errors for the variable cost coefficients in Table 27 tend to be smaller relative to the coefficient than for the linear demand function. This greater precision may be somewhat misleading, however, since the dependent variable is now the natural logarithm of Y_i, rather than Y_i in the real numbers.

This questionable aspect of the results is illustrated by the R^2 values given in the lower part of Table 27. The R^2 value given by the computer print-out is in terms of the logarithms. To be comparable to the results of the linear model, one should transform the predicted values back into real numbers. By making this transformation and recomputing the Σe_i^2, we obtain the R^2 values in terms of the real numbers, given in the next-to-bottom line of Table 27. The R^2 values in terms of real numbers are considerably smaller than the R^2 based on logarithms. The real number R^2 values are also less than those obtained from the linear demand functions for two of the regions.

One problem with fitting the exponential by taking the logarithm of Y_i as the dependent variable is that a biased prediction of Y_i in terms of the real numbers is obtained. This bias can be seen by comparing Lines 1 and 2 of Table 28. The predicted sum for Region II is only about 62 percent of the actual sum. This bias could lead to an underestimate of net economic value and, therefore, should be corrected.

Correction for bias is easily accomplished by simply multiplying the predicted values from the exponential function by the ratio of the actual to the predicted sums, given in the third line of Table 28. As might be expected, this correction also leads to an improved accuracy of prediction. This improvement can be seen by comparing Lines 4 and 5 in Table 28. After correction for bias is made, the exponential demand function gives a higher R^2 value than the linear demand function for each of the five regions.

Results from the Exponential Function Fitted by Nonlinear Methods

In view of the preceding section where correction of bias for the exponential function was made, it might be thought that it would be better to minimize the sums of squared deviations from regression by nonlinear techniques [Edwards, 1962]. In fact, iterative methods were employed to obtain such regressions

Table 28. Bias for Exponential Demand Function and Comparison of R^2 Values After Correction for Bias

	Region I N.W. Oregon	Region II S.W. Oregon	Region III Central Oregon	Region IV N.E. Oregon	Region V S.E. Oregon
Actual ΣY_i	85.77	82.96	64.43	227.91	18.02
Predicted $\Sigma \hat{Y}_i$	61.75	51.53	49.65	160.52	13.31
Ratio of actual to predicted sum	1.389	1.610	1.298	1.420	1.354
Real number R^2 (for uncorrected exponential)	0.453	0.120	0.345	0.407	0.201
Real number R^2 (bias-corrected exponential)	0.551	0.238	0.423	0.519	0.305
R^2 (for linear demand function)	0.387	0.172	0.337	0.395	0.237

for each of the five hunting regions.

Since nonlinear techniques do minimize the deviations from regression in terms of the real numbers, the sum of the predicted values of the dependent variable in real numbers tends to be quite close to the actual sum of the dependent variable. Thus, no correction for bias would ordinarily be needed, in contrast to our results in the preceding section.

Another advantage of nonlinear techniques is that smaller deviations from regression and higher R^2 values are almost always obtained. However, despite these advantages, our parameter estimates were not satisfactory, even though higher R^2 values were obtained. The results tended to be quite erratic from one region to the next, insofar as the coefficients of the independent variables were concerned. Since estimation of net economic values depends crucially upon reliable estimates of structural parameters, the results from the nonlinear fitting were judged to be unsatisfactory for the purposes of this study. Perhaps the reason for the erratic nonlinear estimates of the regression coefficients was the high variability in the individual expenditure and hunting trip patterns, cf. Kmenta, p. 466 [1971]. Therefore, we used the previous estimates rather than those obtained by nonlinear techniques.

NET ECONOMIC VALUE OF THE OREGON BIG GAME RESOURCE

Once the demand function has been properly specified and estimated, it is relatively simple to compute the net economic value, although as previously mentioned, there have been two commonly employed measures of net economic value: (1) Maximum revenue to a monopolistic owner who charges only one price, and (2) consumer surplus, which would correspond to the maximum revenue possible to a "perfectly discriminating" monopolistic owner. These values will be presented for each region for both the linear and exponential demand functions.

Net Economic Values for Region IV, Northeast Oregon

Since Region IV had the greatest hunting trip expenditures, net economic values will be presented first for this area.

Results From the Linear Demand Function

For the Northeast Oregon area, Equation (3), based upon the individual observations, gave the best statistical results, and is therefore used to generate net economic values.

Revenue to nondiscriminating monopolist. If there were no negative predicted Y_i values from Equation (3), then one could simply substitute the mean values for all the independent variables into (3) to obtain the equation,

$$\hat{Y} = \overline{Y} - \hat{\beta}_1 P, \tag{10}$$

where P denotes increased cost above the actual costs incurred by the hunters, and $\overline{Y}$ is the mean. Then, one could multiply the right-hand side of (10) by P to obtain the total revenue function resulting from various imposed hunting fees. The total revenue function could then be differentiated with respect to P and set equal to zero, to give the exact profit-maximizing level of P. This profit-maximizing value of P would then be substituted back into (10) to obtain the number of hunting trips taken at that price. Then, the maximizing price times the preceding quantity would give the maximum possible total revenue.

In practice, however, the procedure is complicated somewhat because some of the predicted $\hat{Y}_i$ values become negative as the hypothesized fees (cost increases) become larger. Thus, at higher and higher hypothesized fees, one must delete those observations which become negative. The effect of this procedure is to give a profit-maximizing level at higher hypothesized hunting fees, since no negative revenue values are allowed for the lower predicted Y_i values. (Some families have fewer family members who hunt, have to travel greater distances, etc., which results in lower predicted values from Equation (3).)

In order to insure no negative predicted values, the aggregate demand function for the sample observations was constructed as follows: First, suppose that there are no negative predicted values at the zero fee level. Then the aggregate function for the sample observations would be

$$(11) \qquad \sum_{i=1}^{n} \hat{Y}_i = n\overline{Y} - (n\hat{\beta}_1)P.$$

However, as P increases, some Y_i value will eventually become negative. At the P value where this first observation is less than zero, a new equation for the aggregate sample demand must be computed. This new equation would be

$$(12) \qquad \sum_{i=1}^{n-1} \hat{Y}_i = \sum_{i=1}^{n-1} \hat{Y}_i - [(n-1)\hat{\beta}_1]P.$$

This new function would hold until the second $\hat{Y}_i$ value became zero. Then another function would be computed, etc.

Following the above procedure, the revenue-maximizing price from Equation (3) was about $133 per hunter trip, and the corresponding number of hunting trips to be taken, at $133 per trip, was about 94.75 trips. Multiplying $133 times 94.75 gives about $12,602 which could supposedly be obtained from our sample of 242 families who hunted in Northeast Oregon. Since we had 693 complete questionnaires, which represented 693 families or 1,289 hunters out of 363,000 for 1968, the blow-up factor was (.8416)(363,000) ÷ 1,289 = 237.0. (From our data, it was estimated that about 84.16 percent of the licensed hunters actually hunted big game in 1968.)

Multiplying the blow-up factor times the revenue obtained from our sampled hunters gave (237.0)($12,602) = $3.0 million. Thus, estimated net economic value to a non-discriminating monopolist for the Northeast Oregon hunting area would be $3.0 million, based upon the linear demand function.

As mentioned earlier, the maximum revenue to a non-discriminating monopolist has been criticized as being an underestimate of net economic value to the recreationists, since some people would be willing to pay more than the revenue-maximizing price, and other people would also be obtaining benefits at zero fees, even though they would not be willing to pay the revenue-maximizing price. Hence, the consumer surplus has gained much support in recent years [Clawson and Knetsch, 1966; Knetsch and Davis, 1966].

Consumer surplus. Estimation of an individual's consumer surplus is equivalent to computing that area lying beneath his demand curve but above his transfer costs necessary for participation. Making these computations from Equation (3) and values of the independent variables of (3) for observed families, an estimated consumer surplus of about $30,707 is obtained for the 242 families in our sample who hunted in Northeastern Oregon. Multiplying the sample consumer surplus by the blow-up factor of 237.0 gives an estimated total consumer surplus of $7.28 million.

As would be expected, the consumer surplus estimate of net economic value is higher, about 2.4 times that for the non-discriminating monopolist. As mentioned earlier, the consumer surplus concept is now usually considered to be a more valid measure of net economic value, although final choice may depend upon the proposed use of the estimate.

The Pearse method was also used to obtain "an aggregate value in the form of consumer surplus" [Pearse, p. 96, 1968]. Following Pearse's method, the observed hunters for Northeast Oregon had a "Pearse surplus" of $154,178. Multiplying by the blow-up factor of 237.0 gave an estimated total "Pearse surplus" of about $36.6 million! However, as shown in an earlier section, the "Pearse surplus" has no economic meaning, and should therefore be disregarded.

Estimated Net Economic Values for All Regions From the Linear Demand Function

Maximum revenue to a non-discriminating monopolist and consumer surplus are presented in Table 29 for each of the five Oregon hunting regions. Since both measures for a given region are based upon the same demand curve, the consumer surplus is from 2.2 to 2.8 times as much as the maximum possible revenue to a non-discriminating monopolist.

The Northeast Oregon area accounted for almost 60 percent of the estimated net economic value, with over $7 million estimated consumer surplus. Next highest net values were for Northwest Oregon, with almost $1.8 million consumer surplus, followed by Southwest Oregon with almost $1.4 million. Total estimated consumer surplus in Table 29 was over $12 million. It could be noted at this point that the total consumer surplus amounts to 12.17 ÷ 18.6 equals about 65 percent of the estimated total variable expenditures presented in an earlier section.

Estimated Net Economic Values for All Regions From the Exponential Demand Function

As discussed in an earlier section, the exponential demand function had certain logical advantages over the linear demand function. Also, the exponential function gave a better fit (higher R^2 values) for all regions than the linear demand function, after the exponential function was corrected for bias, Table 28.

Maximum revenues possible to a non-discriminating monopolist are presented in Table 30. These values were obtained by multiplying price times the demand equations aggregated over all sample observations to obtain a total sample revenue function for each region. Differentiating the total revenue functions with respect to X_1, and equating to zero, gave the revenue-maximizing prices. Substituting the maximizing prices back into the demand equations yielded the quantities to be taken. Then, multiplying the quantities to be taken times the maximizing prices gave the maximum revenues possible from the sampled hunters. Blowing up the maximum revenues from the sampled hunters by 237.0 yielded the estimates in the middle column of Table 30.

Table 29. Estimates of Net Economic Value for the Five Hunting Regions of Oregon, Based Upon the Linear Demand Function

Region	Revenue to non-discriminating monopolist	Consumer surplus
Region I, Northwest Oregon.....	$ 634,000	$ 1,779,000
Region II, Southwest Oregon....	632,000	1,396,000
Region III, Central Oregon.....	510,000	1,214,000
Revion IV, Northeast Oregon....	2,987,000	7,277,000
Region V, Southeast Oregon.....	225,000	503,000
TOTAL................	$4,988,000	$12,169,000

Table 30. Estimates of Net Economic Value for the Five Hunting Regions of Oregon, Based Upon the Exponential Demand Function

Region	Revenue to non-discriminating monopolist	Consumer surplus
Region I, Northwest Oregon.....	$ 462,000	$1,251,000
Region II, Southwest Oregon....	324,000	877,000
Region III, Central Oregon.....	691,000	1,869,000
Region IV, Northeast Oregon....	2,036,000	5,504,000
Region V, Southeast Oregon.....	161,000	436,000
TOTAL................	$3,674,000	$9,937,000

The Northeast Oregon hunting area again yielded the largest revenue, \$2.04 million, which was over 55 percent of the total for the state. This importance of the Northeast area is in agreement with the results of the linear demand function presented in Table 29. However, the Central Oregon hunting area ranked second highest in Table 30 for the exponential demand function, whereas it ranked only fourth for the linear function in Table 29.

Most of the estimates of net economic values were slightly lower for the exponential function in Table 30, as compared to the linear function in Table 29. One would be inclined to accept the estimates from the exponential, since it gave a better fit to the observations, Table 28.

Consumer surplus values for all five regions totalled about \$11 million. Again, for reasons discussed earlier, the consumer surplus is a better measure of net economic value for most purposes.

Consumer surplus values were obtained for the sampled hunters by integrating for each region,

$$\text{(13)} \qquad \text{C.S.} = \left[\sum_{i=1}^{n} \hat{Y}_i \right] \cdot \int_0^\infty e^{\hat{\beta}_1 P} \, dP.$$

Equation (13) reduced to $\sum_{i=1}^{n} \hat{Y}_1 \div |\hat{\beta}_1|$, since $\hat{\beta}_1$ was always negative. In (13), P represented additional costs or fees incurred above those actually incurred by the sample hunters. Then, by multiplying the above values by the blow-up factor of 237.0, consumer surplus for each region was easily obtained.

Effect of Omitting Fixed Costs From the Demand Estimates

Actually, the estimated consumer surplus in Tables 29 and 30 represent an underestimate of net economic value in that expenditures for hunting and associated equipment were excluded from the cost variable of the demand equation. To the extent that these durable items were incurred solely for the purpose of of hunting, it is not accurate to omit them from estimates of net economic value. At the same time, however, there are certain difficulties in trying to incorporate them into the demand function.

In Clawson's original study [1959], it is quite clear that he was justified in omitting the fixed costs of transportation (cars) for the people visiting national parks, since it is highly unlikely that the people bought their cars just to visit the parks. However, in the case of our Oregon hunters, it is not so simple. For example, in Table 3, hunting equipment expenditures in 1968 were about $9.279 million. Certainly most of these expenditures were made for the purpose of big game hunting. Similarly, the $2.591 million for special clothing probably was allocated fairly accurately to big game hunting. However, for the $32.73 million spent on camping equipment, it is difficult to assess the accuracy of the allocation to big game. For purposes of demand estimation, one would really need an estimate of those items purchased which would <u>not</u> have been purchased if there had been no big game hunting in Oregon.

Furthermore, even if the expenditure of $32.73 million were the additional amount incurred because of big game hunting, one should translate these fixed investments into an annual amortized equivalent for all hunters, so that it would be comparable to the hunting trip expenses.

If one disregards the preceding difficulties and assumes that the $44.6 million total in Table 3 represents a fair estimate of annual costs to the big game hunters, then the net economic value would be greatly increased. For example, if one assumes a linear demand function, and that the fixed costs were distributed among the individuals in exactly the same proportion as the variable costs, then from simple numerical examples it is easy to see that the slope and vertical intercept would be increased and consumer surplus would be increased exactly by a ratio of the fixed costs to the variable costs.

Unfortunately, the above result has to be interpreted with caution, since different assumptions regarding the relative distribution of the individual hunter's fixed and variable costs would give a different estimate of consumer surplus. For example, if a linear demand function is again assumed, but it is hypothesized that each hunter has exactly the same fixed cost, then the demand function would shift to the right with no change in slope. Thus, the consumer surplus would remain exactly the same, since the increased area under the demand curve would be exactly offset by the increased costs of the individual hunters. Thus, it would be possible to have no increase in net economic value if fixed costs were included in the demand estimating procedure!

Of course, this last possibility of having no increase in consumer surplus seems highly unlikely, since one can observe great variation in investment in equipment by different hunters. However, the reason for considering the case was to illustrate the wide range in outcomes possible from different assumptions regarding the amount of the individual's fixed cost relative to his variable costs. (In fact, by assuming an inverse relationship between the individual's fixed and variable costs, it would even be possible to arrive at a lower estimate of consumer surplus when including fixed costs in the demand estimation. Again, this possibility would be extremely unlikely, since fixed and variable costs were positively correlated in our survey.)

In summary, the estimates of consumer surplus in Tables 29 and 30 probably underestimate net economic value of the Oregon big game resource, due to exclusion of fixed costs from the demand estimation. However, to properly estimate the effect of fixed costs would require an analysis of the investment of each family's durable items to determine an estimated cost per year. Such an analysis would require more information than was collected in our study.

SUMMARY AND CONCLUSIONS

During the summer and fall of 1968, a mail survey of Oregon big game hunters was conducted. In the first phase of the survey, about 3,000 questionnaires were mailed to a random sample of licensed hunters before the general deer season. This first questionnaire pertained to the investment by the hunter and his family in hunting and associated equipment.

In the second phase of the survey, about 1,480 game hunting trip records were mailed to the hunters, in which they were asked to record all their hunting trip expenses. (Both questionnaires are included in the Appendix.) For both questionnaires, first and second reminders were mailed if earlier questionnaires were not returned.

Gross Expenditures by Oregon Big Game Hunters in 1968

From the questionnaire pertaining to investment in hunting and associated equipment, an annual average investment per family of about $239 was estimated. Thus, a total investment by all Oregon hunters of about $44.6 million per year was estimated. Over $9 million per year was spent for hunting equipment, such as rifles, scopes, bows, arrows, etc. Over $35 million was expended for special clothing and camping equipment allocated to hunting.

From estimated variances, the 95 percent confidence interval for total investment was estimated to be $44.6 million ± $4.8 million. Therefore, total investment by licensed Oregon big game hunters in 1968 probably was between $39.8 and $49.4 million.

From the hunting trip record questionnaire, hunter families spent about $118.70 on big game hunting trips during 1968. Total big game hunting trip expenses for all Oregon hunters in 1968 were estimated to be $18.6 million. Estimated 95 percent confidence intervals indicated that hunting trip expenses probably ranged somewhere between $17.0 to $20.2 million.

Combining the investment in hunting and associated equipment with hunting trip expenses gave a total estimated expenditure of $63.2 million by Oregon big game hunters in 1968. Of course, nonresponse and incomplete questionnaires could be a source of serious bias in these estimates.

Considering the variances involved, the estimated 95 percent confidence intervals indicated that total expenditures by Oregon hunters in 1968 probably ranged somewhere between $58.0 and $68.4 million.

Net Economic Value of the Oregon Big Game Resource

Estimates of net economic value are sensitive to the specification of the demand model employed. In this study, the two most important explanatory variables were average hunting trip expenses per trip, and distance to the hunting region. Distance was included to account for nonmonetary effects of varying amounts of travel required, and had an important influence on the coefficient for average variable cost per hunting trip. As compared to traditional distance zone estimation procedures, estimation based upon individual observations was much more efficient, and better separated the effect of average variable cost per hunting trip versus the nonmonetary costs of travel.

Demand equations were estimated for each of the five hunting regions of Oregon. In addition to average variable cost per hunting trip and distance, hunting success and number of licensed hunters in the hunting family were also usually statistically significant, although these two variables had much less impact on the coefficient of average variable cost and net economic value estimates. In contrast to salmon-steelhead fishing in Oregon in 1962 [Brown, et al., 1962], average family income did not exert a significant influence on amount of hunting taken or the resulting net economic value estimates.

Several algebraic forms of the demand equation were fitted. Best overall results appeared to be obtained from the exponential demand function fitted by logarithmic transformation but corrected for bias in terms of the real numbers. Two measures of net economic value were presented: (1) Net revenue possible to a non-discriminating monopolist, and (2) consumer surplus. However, consumer surplus is more generally accepted as a full measure of the net economic benefits accruing to the recreationists [Clawson and Knetsch, 1966].

Net economic value estimates for each of the five hunting regions of Oregon are presented in Table 31, along with hunting trip expenses. In total, consumer surplus is about 53 percent of the hunting trip expenses. However, this percentage is considerably higher in some regions and lower in others.

Table 31. Hunting Trip Expenses and Net Economic Value Estimates for the Oregon Big Game Resource, Based Upon 1968 Survey

Region	Hunting trip expenses	Estimated net economic value from exponential function (consumer surplus)
Region I, Northwest....	$ 3,091,320	$1,251,000
Region II, Southwest...	1,636,800	877,000
Region III, Central....	3,303,360	1,869,000
Region IV, Northeast...	8,914,980	5,504,000
Region V, Southeast....	1,653,540	482,000
TOTAL.........	$18,600,000	$9,937,000

An Application to Resource Management Decisions

Estimates of net economic value of big game hunting make it possible to compare economic values of this non-marketed commodity with other resource uses. In particular, monetary values for big game hunting may be useful for management decisions in those cases where big game animals are competitive with commercial timber production, domestic livestock grazing, farming, or other resource uses. The estimates may also be useful in allocating investment funds among regions. As an example, assume that a resource management agency is faced with the problem of allocating a limited budget for habitat improvement. Also, for the purpose of this example, assume that the same amount of investment would be required in each of the regions to produce one harvestable animal. Without knowledge of net economic values, one criterion which might be used would be to invest first in that region which had the least hunting success (Table 32). Using this criterion, one would invest first in either the Central or the Northwest region (for deer habitat) or the Central region (for elk habitat). By the same reasoning, one would invest last in the Northeast region, where hunting success is the greatest.

With knowledge of net economic values, on the other hand, the agency could come much closer to allocating funds according to the willingness of hunters to sacrifice their own resources in order to hunt big game. The measures of "net economic value per animal harvested" and "net economic value per hunter day" in Table 32 both suggest an ordering of investments which is much different than that obtained by using "hunting success" as the investment criterion. In spite of its high success ratio for deer kill (and about average success for elk kill), the Northeast region is identified by economic criteria as that region where the first habitat improvement funds should be invested. On the average, hunters should be willing to pay \$108 per animal harvested in the Northeast region versus \$70 and \$33 in the Central and Northwest regions, respectively. However, one limitation of the net economic values per hunter day and per animal harvested, in Table 32, is that the deer and elk are averaged together, which partly accounts for the higher values for the Northeast region, since the harvest in this region consists of a higher percentage of elk.

Limitations and Recommendations for Further Research

Although net economic value estimates in Table 31 have a stronger basis than those in previous studies, since the important nonmonetary effects of distance have been more accurately estimated, several economic and statistical deficiencies remain. For one thing, this study did not differentiate between species in estimating net economic values. For example, in Northeast Oregon elk hunting days in 1968 were almost 84 percent as much as for deer (Table 32). Thus, additional research estimating the net economic value for each species would have been of interest.

Another deficiency of this study was an inadequate treatment of quality of hunting in our demand models. One suggested possibility would be to use a composite variable representing probability of hunting success for hunting within

Table 32. Alternative Criteria for Investments

Net economic value per animal harvested

Region	Net economic value a/	Harvest c/ Deer	Elk	Total	Net economic value per animal harvested
Northeast....	$5,504,000	45,260	5,855	51,115	$108
Central......	1,869,000	26,640	108	26,748	70
Northwest....	1,251,000	36,250	1,954	38,204	33
Southwest....	877,000	22,550	1,295	23,845	37
Southeast....	436,000	20,680	198	20,878	21
TOTAL.....	$9,937,000	151,380	9,410	160,790	$ 62

Net economic value per hunter day

Region	Net economic value a/	Hunter days c/ Deer	Elk	Total	Net economic value per hunter day
Northeast....	$5,504,000	325,900	272,570	598,470	$9.20
Central......	1,869,000	314,600	8,270	322,870	5.79
Northwest....	1,251,000	381,800	65,320	447,120	2.80
Southwest....	877,000	219,200	29,960	249,160	3.52
Southeast....	436,000	185,900	8,180	194,080	2.25
TOTAL.....	$9,937,000	1,427,400 b/	384.300	1,811,700	$5.48

Hunting success c/

Region	Animals harvested by hunter		Animals harvested per hunter day		Hunter days per animal harvested	
	Deer	Elk	Deer	Elk	Deer	Elk
Northeast....	0.61	0.14	0.139	0.021	7.2	47.6
Central......	0.41	0.07	0.085	0.013	11.8	76.9
Northwest....	0.40	0.15	0.095	0.030	10.5	33.3
Southwest....	0.55	0.19	0.103	0.043	9.7	23.3
Southeast....	0.51	0.12	0.111	0.024	9.0	41.7
TOTAL.....	0.53	0.14	0.096	0.024	10.4	41.7

a/ Consumer surplus from exponential function.

b/ Excludes 152,200 early and late season days which were not identified by region.

c/ Oregon State Game Commission, 1969 Annual Report.

a given game management unit, combined with other factors such as access to hunting areas, hunting conditions, etc. Lack of time and funds prevented exploration of this possibility.

A serious difficulty with the results of this and previous similar studies is that investment in hunting and associated equipment has not been incorporated into the net economic value estimates. Since these investments often represent a substitution for variable hunting trip expenses (e.g., purchase of a camper may be a substitute for motel expenses), the exclusion of investment in durable items results in a serious under-estimate of net economic value. Future studies should attempt to measure the substitution of investment in durable equipment for variable trip expenses, thus permitting a more accurate estimate of net economic value. Another possibility would be to obtain the inventory and original cost of the durable recreational equipment owned by the sampled families, and their estimates of its present value, in order to obtain an annual cost equivalent for this investment. Then, the proper percent of this annual cost equivalent for a given family could be added to their variable hunting trip expenses for demand estimation.

Offsetting the exclusion of investment costs in this study, to a certain extent, was the inclusion of food expenditures. Actually, the hunters should have been asked to list only those expenses for food <u>in excess</u> of what they would have spent if they had not hunted. Since food and beverages accounted for 28.2 percent of all hunting trip expenses, Table 9, inclusion of all such expenditures tends to over-estimate actual net expenditures. However, this amount of \$5.245 million is small, compared to \$44.6 million expended annually for hunting gear and camping equipment allocated to hunting, which was excluded entirely from the net economic value estimates. Therefore, the overall estimate of net economic value in Table 31, even by consumer surplus, is considered to be quite conservative.

It should be mentioned that the computation of net economic value for each of the five regions was made independently of the other regions. In fact, hunting in the various regions could be considered to be substitutes for each other, and the question could be raised about the independence assumed in the net economic value computations. However, it can also be seen that the overall effect of this complication is to give a conservative estimate of value for each region. For example, hunters residing in Northwest Oregon should never be less willing to pay to hunt in Northeast Oregon if additional hunting charges were imposed for hunting in Northwest Oregon.

Finally, it should be noted that the net economic values in Table 31 do not include so-called non-consumptive values of big game, since some of the non-hunting public derive pleasure from viewing or photographing wildlife. Similarly, option demand by those who may wish to utilize the resource in the future is not included. These exclusions serve to further emphasize the conservative nature of the net economic value estimates in Table 31.

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APPENDIX

In the following pages the two sample questionnaires are presented. The investment questionnaire was first mailed in August, 1968. If no reply was received within 2 or 3 weeks, a first reminder letter and another questionnaire were mailed to the respondent. If there was still no response within about two weeks, a second reminder and another questionnaire were mailed.

The second questionnaire, the 1968 Big Game Hunting Record, was mailed to the respondents just before the beginning of the general deer hunting season. If no reply was received within two weeks after the major deer and elk seasons closed, then a first reminder letter and another questionnaire were mailed. If still no response was received within two weeks, a second reminder and another questionnaire were mailed.

Budget Bureau No. 42—S67008
Approval Expires July 1969

INVESTMENT IN BIG GAME HUNTING

1. How many members of your family, including yourself, are residing at home at the present time? ....

2. How many years altogether has the head of your household hunted big game? ....

3. Do you, or any member of your family, plan to hunt deer, elk, antelope or bear during 1968?
   Yes .... (Go to item #4)
   No .... (Skip to item #6)

4. What is the earliest month that you or any family member plan to start hunting big game this year? ....
   (month)

5. When do you and other family members plan to be finished with your big game hunting this year? ....
   (month)

6. Please record below expenditures made *during the past 12 months* for equipment used by your family for Big Game Hunting. Circle the appropriate percentage of the cost which should be allocated to the Big Game Hunting activity.

   EXAMPLE: Suppose that you purchased a small house trailer. If using the house trailer for big game hunting was the main reason for buying it, then you should circle one of the higher percents such as 50,60,70,80,90, or 100. On the other hand, if you purchased the house trailer mainly for activities other than big game hunting, then you should circle a lower percent such as 40,30,20,10, or 0.

Items purchased or acquired during past 12 months	Cost (only if incurred during past 12 months) (Dollars)	Percent allocated to Big Game Hunting
HUNTING EQUIPMENT		
Rifles or other firearms, including scopes and sights	....	0 10 20 30 40 50 60 70 80 90 100
Bows, Cross-bows, Quivers, Arrows, Broadheads and other archery equipment	....	0 10 20 30 40 50 60 70 80 90 100
Knives and other equipment for handling meat	....	0 10 20 30 40 50 60 70 80 90 100
Rifle cases or carriers	....	0 10 20 30 40 50 60 70 80 90 100
Other hunting gear and maintenance costs	....	0 10 20 30 40 50 60 70 80 90 100
SPECIAL CLOTHING		
Hunting boots, coats, hats, and gloves	....	0 10 20 30 40 50 60 70 80 90 100
Special underwear and rainwear	....	0 10 20 30 40 50 60 70 80 90 100
Ammunition belts or carriers	....	0 10 20 30 40 50 60 70 80 90 100
Other special clothing	....	0 10 20 30 40 50 60 70 80 90 100
CAMPING EQUIPMENT		
Tents and Tarps	....	0 10 20 30 40 50 60 70 80 90 100
Sleeping bags	....	0 10 20 30 40 50 60 70 80 90 100
Stoves, Coolers, & Lanterns	....	0 10 20 30 40 50 60 70 80 90 100
House trailers (including maintenance)	....	0 10 20 30 40 50 60 70 80 90 100
Campers (including maintenance)	....	0 10 20 30 40 50 60 70 80 90 100
Cost and maintenance of Pickups, Jeeps, Motorcycles & Boats	....	0 10 20 30 40 50 60 70 80 90 100
Pack boards & other packing equipment	....	0 10 20 30 40 50 60 70 80 90 100
Horses (including feed and stable costs), Saddles, Bridles, & Horse Trailers	....	0 10 20 30 40 50 60 70 80 90 100
Axes, Shovels, Saws, Ropes, & other camping equipment	....	0 10 20 30 40 50 60 70 80 90 100

(Please Turn Page)

7. Please record below major expenditures that you made *more than 12 months ago* for equipment used by your family for Big Game Hunting. *(List only items which you still use.)* Please circle the appropriate percentage of the cost which should be allocated to Big Game Hunting, as you did in the preceding table.

Major items purchased or acquired more than 12 months ago that you are still using	Purchase Cost (only if incurred more than 12 months ago)	Year or Years Purchased or Acquired	Percent allocated to Big Game Hunting
	(Dollars)		
Rifles or other firearms, including scopes, sights, & cases			0 10 20 30 40 50 60 70 80 90 100
Bows, Cross-bows, Quivers, and other archery equipment			0 10 20 30 40 50 60 70 80 90 100
Tents, Tarps, and Sleeping Bags			0 10 20 30 40 50 60 70 80 90 100
House trailers and campers			
Pickups, Jeeps, Motorcycles & Boats (in-			0 10 20 30 40 50 60 70 80 90 100
cluding maintenance)			0 10 20 30 40 50 60 70 80 90 100
Horses, Saddles, Bridles & Horse Trailers			0 10 20 30 40 50 60 70 80 90 100
Other major hunting and camping equipment			0 10 20 30 40 50 60 70 80 90 100

8. What was the approximate total taxable income of your family in 1967? (If more than one member of your family worked, include his or her income in the total):

- .... Under $3,000
- .... $3,000 - $5,000
- .... $5,001 - $7,000
- .... $7,001 - $10,000
- .... $10,001 - $15,000
- .... $15,001 - $20,000
- .... Over $20,000

9. What is the occupation of the head of the household? (NOTE: Please fill in each line)

Type of Industry or Profession ....

Specific Job ....

10. Is there anything else that you would like to tell us?

1968 BIG GAME HUNTING TRIP RECORD

Budget Bureau No. 42—S67008
Approval Expires July 1969

1. This record is designed to help you and other family members, who are presently residing at home, keep track of 1968 Big Game hunting trip expenses. Please record the information under each column heading for each hunting trip, in Oregon, family members take for deer, elk, or other Big Game during any of the 1968 hunting seasons.

   After your LAST Oregon hunting trip of the 1968 season, be sure to complete the back side of the page, then seal the record sheet so that the mailing address is on the outside, and mail it at your earliest convenience.

		1st Trip	2nd Trip	3rd Trip	4th Trip	5th Trip	6th Trip	7th Trip	8th Trip	9th Trip	10th Trip	11th Trip	12th Trip
List number of days spent on hunting trip, including travel time:													
How many family members?	Went on trip												
	Hunted on trip												
On this trip list total hours all members of family, counted together, spent hunting for:	Deer												
	Elk												
	Other (Specify)												
Number of Big Game animals bagged by your family on trip:	Deer												
	Elk												
	Other (Specify)												
Oregon Game Commission unit or area hunted on trip:													
TRANSPORTATION	Miles traveled from home to hunting site & back												
	Hours spent traveling from home to hunting site and back												
	Miles traveled while on hunting site, by vehicle												
	Amount, if any, paid to you by others for transportation $												
	Amount, if any, you paid to others for transportation $												
EXPENDITURES	Motels, hotels, camping or private hunting fees $												
	Ammunition, arrows, & broadheads $												
	Food, beverages & liquor on hunting trip $												
	Guide service & rental of horses, airplanes, or other vehicles $												
	Cutting & wrapping meat, tanning hides $												
	Other expenses incurred on hunting trip $												

(Please continue questionnaire on other side)

2. Please list the number of 1968 Oregon Big Game tags or licenses purchased by members of your family who are presently residing at home:

Hunter's or combination angler's & hunter's licenses.......... Resident.......... Non-Resident..........

General deer tags .... Resident.......... Non-Resident..........

Controlled season deer tags ....

General elk tags .... Resident.......... Non-Resident..........

General antelope tags ....

Other tags (Please specify) ....

3. Is there anything else that you would like to tell us?

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1968 HUNTING TRIP RECORD