ECONOMIC VALUE OF DALL SHEEP HUNTING IN ALASKA

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May 1990

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THESIS

Presented to the Faculty of the University of Alaska
in Partial Fulfillment of the Requirements
for the Degree of

MASTER OF SCIENCE

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Fairbanks, Alaska

May, 1990

ABSTRACT

Economic values of Dall Sheep (Ovis dalli dalli) hunting were estimated using expenditures analysis and contingent valuation methods of willingness-to-pay (WTP) and willingness-to-sell (WTS). An 82% response rate was received to a questionnaire mailed to all who hunted Dall sheep in Alaska in 1983 (n=2519). More than $7 million was spent on the hunt, including foregone income. Alaska's economy received an estimated $2.5 million from nonresidents' expenditures. The projected total WTP was $2.1 million. Using WTS methods, hunters estimated a net benefit of nearly $30 million for the opportunity to hunt Dall sheep in the same area in 1984, and more than $20 billion for all future opportunities in Alaska. Significant trends in expenditures, WTP and WTS values were associated with demographic characteristics including residency, income, experience and hunt success. Other noneconomic measures of the importance of Dall sheep were described.

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ACKNOWLEDGEMENTS

It is my pleasure to give credit to those who assisted me in this study. Cumulatively, their contributions, large and small, made the completion of this work possible. My apologies to any I have neglected to name.

I am forever grateful to my husband, Stephen M. Murphy, whose valuable advice and counsel was only outweighed by his patience and understanding.

This study was funded by the Foundation for North American Wild Sheep, both its national organization and its Alaska chapter; by the Alaska Department of Fish and Game (ADF&G); and the University of Alaska, Fairbanks (UAF).

Wayne E. Heimer, a Dall sheep biologist for ADF&G since 1971, formulated the idea of estimating the economic benefits associated with Alaska's Dall sheep after talking with Ray Demarci, British Columbia Fish and Wildlife Branch, in 1982. He wrote a proposal for work, obtained funding from the Foundation for North American Wild Sheep, and then delegated the work to me. Wayne's expertise on sheep and sheep hunters provided a practical basis for many decisions associated with this work. Perhaps more important was his long-standing commitment to seeking and nurturing the mutually beneficial relationship between Dall sheep and those who hunt them. His foresighted recognition of the benefits of having an informed and cooperative public contributed much to the willingness of many sheep hunters to reply to the questionnaire. His creativity, dedication and quiet, but contagious, joy at contributing to wildlife

conservation was a source of inspiration and strength.

I had the good fortune to enlist the guidance of Dr. Robert B. Weeden, Dr. William G. Workman, and Dr. John A. Kruse as my graduate committee whose complementary skills and talents neatly converged with the topic of natural resources economic valuation in Alaska. Dr. Weeden, chair, with his long experience in environmental conservation in Alaska, provided me with a veritable feast of food for provocative thought on environmental ethics, planning, and philosophy, and he never let a meeting pass without a pun, like a light dessert. I am also grateful for his steering me ably through the administrative maze and arranging a stipend. Dr. Workman ever patiently reviewed the foreign concepts of economics to this biologist, generously lent books with no due date, and tolerated innumerable interruptions. He delighted me with his surprised admiration at just how interesting and amazing Dall sheep hunters are as a group despite personal testimony from his colleague, Dr. Alan Jubenville. Dr. Kruse of the University of Alaska, Anchorage, with his easy-going demeanor, steered me through the hazardous minefield of survey and research design. Though sheep hunters in 1983 may have been willing to respond to most any inquiry regarding their interest in Dall sheep, it is to Dr. Kruse's credit the data are meaningful. I am also grateful that his interest and commitment to this study remained undiminished despite the distance between our two respective campuses. Dr. Wayne C. Thomas generously consented to join the committee during the critical period of my thesis defense while Dr. Kruse was on sabbatical. Dr. Patrica Kwachka, Department of Anthropology, was the outside examiner at my thesis defense

and offered thoughtful recommendations which doubtlessly improved the quality of this work. I would also like to thank Mary Ann Borchert, Office of the Graduate School, UAF, for her sound advice and her ability to deliver that advice as if it was coming from a good friend. If only all my future administrative working relationships could be like this.

There were many at the ADF&G office in Fairbanks who assisted in the initial brainstorming sessions of questionnaire design and who participated in subsequent seminars on resource economics. The entire staff of Game (now Wildlife Conservation) Division in Fairbanks contributed either their valuable time, their ideas, or both. I would like to particularly thank Robert O. Stephenson and Catherine M. Harms for their thoughtful suggestions, and Robert F. Mclean and Matthew H. Robus, Habitat Division, for their expertise. I would also like to extend my appreciation to Richard Bishop, Ronald M. Burton, W. Lewis Pamplin and Dr. Wayne L. Regelin for assisting me with the important administrative considerations. In addition, Mr. Pamplin generously agreed to sign the cover letter accompanying the survey though the responsibility brought him some of the more exciting comments from sheep hunters. The questionnaire illustrations of Cynthia Pappas, Habitat Division, ADF&G, Anchorage, undoubtedly encouraged hunter response rate. A number of respondents retained the upper right-hand corner of their questionnaire's cover.

Special thanks go to Daniel J. Reed, a Biometrician with ADF&G and a sheep hunter himself, for patiently sharing more time than he had to spare, his experience in resource

economics, his sense of humor and his refreshingly pragmatic approach to design and analysis of wildlife research. The analysis of the data would not have been possible without his technical support and would have been much less enjoyable. I would also like to thank Jesse Venable for creating a data coding program which allowed me to transfer a large volume of information to a manageable form. I appreciate the additional technical support of Clayton L. Cranor and Laurence C. Bryne of Alaska Biological Research, Inc. (ABR) which allowed me to analyze the data and compose this work on a small computer at home.

I am grateful to Nathan P. Johnson who selflessly reviewed all but the final draft. His thorough and thoughtful work helped clarify the complex mixture of concepts contained in this study. His expression of support through his gift of his skills and time were important bridges to each new writing stage.

I am most appreciative of the talents of Terrence Davis and Ann Halleen who in addition to their jobs and busy lives found time to type the manuscripts complete with tables. I am also indebted to Robert J. Ritchie, ABR, whose generous extension of his company's facilities contributed to the completion of this work.

Lastly, I thank all of the Dall sheep hunters who responded to the survey. I hope this work in some small way contributes to your being able to continue to enjoy the exquisite challenge of hunting Dall sheep in Alaska.

INTRODUCTION

This study estimates economic values for Dall sheep and their habitat in Alaska by describing the economic benefits of Dall sheep hunting. The value of the land as habitat necessary to support viable and useable populations of sheep is essentially associated with the value of the use of sheep. The estimates were made using natural resource economic valuation expenditures analysis and contingent valuation.

The techniques associated with natural resources economic valuation are relatively new and are still being refined. Consequently, a high level of cooperation from the designated study population (the hunters) is necessary to obtain reliable estimates of economic value. Hunters of Dall sheep were selected in part because historically they have been willing to cooperate with state wildlife biologists by providing information about their hunts. Although contingent valuation techniques had never before been used in Alaska to measure hunters' benefit of big game hunting, it was hoped Alaska's Dall sheep hunters would extend their cooperation to this study.

Information from this study has a broad range of applications. It demonstrates the general importance of wildlife to the state economy and more specifically documents the amount Dall sheep hunters spent on various goods and services, both in and outside of Alaska. Such data are useful to economists, tourism officials, and legislators as well as to Alaska's business community.

In addition to measuring the cost of the hunt to the hunter, this study also documents the economic benefit hunters received from their Dall sheep hunt. Such valuation information in conjunction with additional information can assist land use planners, legislators and other decision makers in making difficult choices between the benefits of Dall sheep (and their habitat) and the benefits of an alternative land use. Portions of sheep habitat in Alaska have been considered for uses that were not compatible with the maintenance of existing wild sheep populations. Future proposals for development are likely. If habitat for Dall sheep is to receive full consideration as an important use of the land, its associated value needs to be described in terms that invite more dialogue than "priceless", a term that can easily be translated as "no price or "no value," as well as "beyond trade."

This study also provides information about Dall sheep hunters as a group. Wildlife managers, land use planners, guides and tourism officials are among those who can benefit from this aspect of the study.

This study was not designed to estimate all values associated with Dall sheep or their habitat. Sheep have value to individuals who do not hunt. In addition, Dall sheep may be considered as having an intrinsic value of their own. Therefore, the economic values estimated here are incomplete estimates of the overall value of sheep and their habitat.

OBJECTIVES

There are three objectives associated with this study. The first is to determine the contribution of sheep hunting expenditures to the economy of Alaska based on the total dollar amount spent by hunters on one year's (1983) Dall sheep hunt and the portion of those funds that were spent in Alaska. The second objective is to estimate the benefit of sheep hunting to sheep hunters using contingent valuation techniques. The third objective is to obtain sociological and demographic information about sheep hunters to interpret the economic information and for improved understanding of those who hunt Dall sheep.

BACKGROUND

Dall Sheep Hunting in Alaska

Alaska's Dall sheep represent approximately 40% of the estimated 180,000 wild sheep of North America (Table 1). Historical records indicate that continental populations of wild sheep were substantial prior to the settlement of the American and Canadian west between 1850-1900. Wild sheep numbers were dramatically reduced through loss of habitat, overhunting, and exposure to fatal or debilitating diseases from domestic animals. Since the 1930's, private interest groups and government agencies have tried to maintain and increase the number of wild sheep although it is unlikely that current continental populations will ever return to historical levels due to loss of habitat. Wild sheep populations of Alaska and northern Canada have been the least affected due to their relatively remote habitat. But as land ownership changes and interest in development of

Table 1. Sheep hunting opportunities in North America, by species and by geographic region, 1983.

Area	Total Sheep	Percentage Available to hunt	1983 Annual Harvest	Comments
Dall sheep (Ovis dalli dalli)				
Alaska[1]	72,650	70	1,100	11% huntable sheep on LEH[2] system.
British Columbia[3]	200	100	10	
Northwest Territory[4]	7,000	86	150	
Yukon Territory[5]	19,000	72	183	
Total	98,850	72	1,443	
Stone sheep (Ovis dalli stonei)				
British Columbia[3]	10,500	100	266	
Yukon Territory[5]	3,000	97	35	
Total	13,500	99	301	
Rocky Mountain Bighorn sheep (Ovis canadensis canadensis)[6]				
Alberta	10,000	60	238	
Arizona	<100	0	0	
Colorado	4,030	90	90	1983: 1,271 applications received for 404 permits for 1/lifetime opportunity to hunt. No non-residents.
Idaho	2,805	84	75	1983: 126 LEH permits available.

Table 1. Continued.

Area	Total Sheep	Percentage Available to hunt	1983 Annual Harvest	Comments
Rocky Mountain Bighorn sheep (*Ovis canadensis canadensis*)[6] Continued				
Montana	4,600	83	67	
Nevada	70	0	0	
New Mexico	500	?	6	1983: 582 applications received for 11 permits for 1/lifetime opportunity to hunt.
Oregon	250	86	6	1983: 1,344 applications received for 6 permits.
South Dakota	165	75	5	1983: 5 permits available only to residents for 1/lifetime opportunity.
Utah	200	0	0	
Washington	100	0	0	
Wyoming	6,705	99	186	1983: 4,211 applications received for 360 permits. 1/4 permits reserved for non-residents.
Total	29,525	~77	673	
California Bighorn sheep (*Ovis canadensis californiana*)[6]				
Alberta	10,000	60	225	1983: Nonresidents = 17% hunters.
British Columbia	4,250	94	105	1983: 25% of huntable sheep on LEH system.
Idaho	530	94	6	1983: 11 LEH permits for 1/life-time opportunity to hunt.

Table 1. Continued.

Area	Total Sheep	Percentage Available to hunt	1983 Annual Harvest	Comments
California Bighorn sheep (*Ovis canadensis californiana*)[6] Continued				
Nevada	425	0	0	
North Dakota	225	0	0	
Oregon	1,007	100	34	1983: 5,400 applications for 38 LEH permits.
Washington	550	100	4	1983: 3,549 applications for 23 LEH permits.
Total	16,987	70	374	
Desert Bighorn sheep (*Ovis canadensis nelsoni, mexicana, cremnobates*)[7]				
Arizona	4,000	88	44	1983: 50 LEH permits available.
California	4,000	0	0	
Colorado	60	0	0	
Mexico[8]	5-9,000	?	?	1983: 50 permits available.
Nevada	5,200	75	94	1983: 119 LEH permits available.
New Mexico	100	0	0	
Utah	2,500	?	?	1983: 10 permits available.
Total	20,860-24,860	?	138+	

[1] Heimer, W.E. 1985.

[2] LEH=limited entry hunt. Hunters selected by lottery drawing or by registration.

Table 1. Continued.

[3] Elliot, J.P. 1985; Thornton, pers. commun.

[4] Poole, K.G. and R.P. Graf 1985.

[5] Hoefs, M. and N. Barichello 1985; Carey, J., pers. commun.

[6] Thorne, E.T. et al. 1985; Coggins, V. pers. commun.; Ericson, G. pers. commun; Reich, J. pers. commun.; Schoomveld, G. pers. commun.; Thorne, T. pers. commun.; Toweill, D. pers. commun.; Tsukamoto, G. pers. commun.

[7] Weaver, R.A. 1985; Karpowitz, J. pers. commun.; Lee, R. pers. commun.; Tsukamoto, G. pers. commun.

[8] Sandoval, A.V. 1985.

this region increases, large portions of sheep habitat may be designated for alternative uses, resulting in a decline in numbers of Dall sheep (Buechner 1960, Geist 1971, Trefethen 1975, Hoefs and Barichello 1985).

The Dall sheep is one of several species of North American wild sheep. Although their classification at the species and subspecies level is controversial, the Northern Wild Sheep and Goat Council currently recognizes two species, the thinhorns (Ovis dalli) and the bighorns (Ovis canadensis), which have eight subspecies, one now extinct (Ovis canadensis auduboni) (Valdez 1982). Many sheep hunters prize four major types in North America which combine several subspecies: Dall sheep, Stone sheep (O. d. stonei), Rocky Mountain bighorn (O. c. canadensis, O.c. californiana), and desert bighorn (O. c. nelsoni, O.c. mexicana, O.c. cremnobates) (Nesbitt and Wright 1981). An increasing number of hunters distinguish between the Rocky Mountain bighorn (O.c. canadensis) and the California bighorn (O.c. californiana) as the former tends to grow more massive horns.

Dall sheep are currently the most abundant wild sheep in North America, and possibly in the world (Valdez 1982). For those interested in hunting Dall sheep, 73% of the estimated 98,850 total Dall sheep can be found in Alaska, making the state a likely place to hunt.

The responsibility for the management of Dall sheep in Alaska falls under the jurisdiction of ADF&G. ADF&G species management goals for Dall sheep include protection and maintenance, scientific and educational study, diversified

recreational uses, and commercial and subsistence uses (ADF&G 1976, Bos 1988). As an example, Dall sheep hunting would be considered a recreational or subsistence activity while the guiding of Dall sheep hunters would be considered a commercial enterprise.

Those who hunt sheep enjoy a greater array of hunting opportunities in Alaska than anywhere else in North America. In 1983, the year data for this study were collected, most hunting opportunities in other states or Canadian provinces were limited due to diminished populations, especially of bighorn sheep. It was not uncommon to find hunting opportunities restricted solely to the chance drawing of a limited entry permit for a one time opportunity to hunt, even if a sheep is not taken on the hunt (Table 1). In strong contrast, in 1983 about 70% of Alaska's sheep populations were open to hunting by both Alaska residents and nonresidents. Over 2,500 people hunted Dall sheep in Alaska that year, and 16% of them were nonresidents of Alaska. They killed 964 sheep in the 41 day season (August 10 to September 20) (ADF&G, 1984).

Alaska's state regulations for sheep hunting in 1983 included restrictions of taking one ram (or, in two areas, ewe) per hunter per year, minimum horn size, and some area-specific restrictions on the type of transportation to be used. All hunters over 16 years old were required before hunting to purchase a hunting license, and all hunters regardless of age must have obtained a harvest report form to be completed and returned either within 10 days of killing a sheep or within 15 days of the close of the hunting season if they did not take a sheep. In addition,

nonresident sheep hunters were required to purchase a sheep tag (a metal lock to be attached to the cape) and to hire a guide unless hunting sheep with a resident relative within the second degree of kindred, that is, relatives who were parents, grandparents, children, grandchildren, sisters or brothers.

Not all areas of sheep habitat in Alaska were open to all hunters in 1983. Late season (October 1, 1983 through April 30, 1984) hunts were held for only local subsistence hunting purposes in some remote areas of the state. Federal regulations protected sheep residing within national park boundaries from hunting except for subsistence purposes by qualified local residents. In Denali National Park and in several smaller areas closed by regulation, sheep could not be hunted by anyone.

The opportunity to hunt sheep in a few additional areas was restricted to limited entry permit systems that applied to only 11% of the nearly 51,000 sheep living in areas open for hunting to the general public. These permit systems were established to meet management objectives of hunting under aesthetically pleasing (uncrowded) conditions or for increased opportunity to take a trophy-sized sheep, not for the purpose of halting a decline in numbers of sheep.

Despite these restrictions, those who hunted Dall sheep in Alaska in 1983 chose from a variety of hunting opportunities in eight major mountain ranges, each having its own unique characteristics of terrain, weather and accessibility (Figure 1). When deciding where to hunt, hunters may have considered public information from

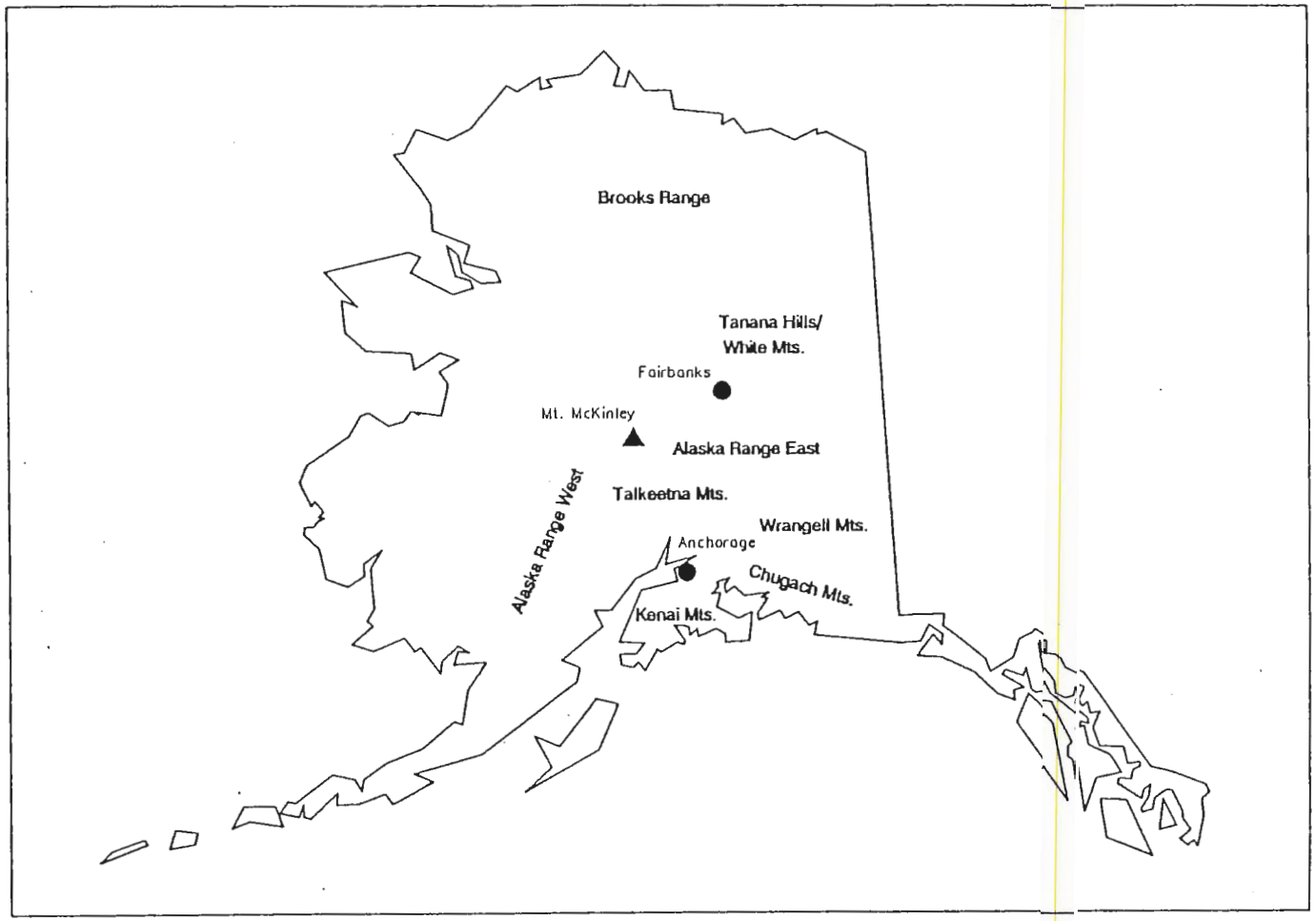


Figure 1. Dall sheep hunt areas, Alaska.

government agencies, popular literature, or oral tradition about sheep populations within these mountain ranges. For example, some sheep populations have particular characteristics of population density that may affect hunters' success (Heimer and Smith 1975). Hunters interested in trophy animals may have chosen to hunt in areas from which trophy-sized animals have been taken in the past. Other hunters may have chosen to hunt in areas known more for their remoteness than for their large or abundant sheep. In 1983, two areas were also open to ewe hunting on a restricted basis, although only 1% of those who hunted sheep in 1983 hunted ewes.

The abundance and variety of sheep hunting opportunities was a notable factor differentiating Alaska from other states and provinces in 1983. The demand for sheep hunting has increased annually. By 1989, the number of resident and nonresident hunters had risen 16% and 46%, respectively, above 1983 levels (ADF&G 1990). This occurred despite the mid-1980's decline in the state's economy, which affected the incomes of many residents causing some to leave Alaska in search of employment. Whether or not this range of opportunities will remain available is dependent upon the management of sheep populations and their habitat.

Dall Sheep and Land Use Decisions

In Alaska, the management of Dall sheep habitat comes under the legal jurisdiction of the land owner or steward. Nearly all Dall sheep habitat is administered by either the state (Alaska Department of Natural Resources, DNR) or the

federal government (U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, U.S. Forest Service, U.S. Army, or U.S. Air Force) depending upon location. Very little Dall sheep habitat has been selected for Alaska native land holdings under Alaska Native Claims Settlement Act of 1972 (ANCSA). The agencies with jurisdiction over sheep habitat have other interests and responsibilities in addition to conservation of wildlife habitat. As a consequence, conflicts between sheep and other activities already occur and are likely to occur in the future.

A brief description of conflicts between Dall sheep and other uses of their habitat may be useful. Some conflicts between activities incompatible with Dall sheep may result in short-term disruptions of the distribution of animals in a particular area. Low-flying aircraft that disturb sheep are an example. These aircraft may be used in conjunction with the transport of material and personnel for mining, military training missions, biological surveys, or for recreation. Depending on the frequency, duration and seasonal timing of the flights and the type of aircraft, the impacts may be slight to severe (Geist 1975, Heimer 1978, ADF&G 1986).

Long-term disruptions in the distribution of Dall sheep are of particular concern to hunters as well as to ADF&G. Population die-offs of wild sheep have occurred in many western states (and continue to occur in remnant and transplanted populations) due to overgrazing and the transmission of exotic diseases and parasites (e.g., Pasteurella hemolytica, Parainfluenza type III,

Protostrongylus spp.) from outwardly healthy domestic livestock (Trefethen 1975, Thorne et al. 1985, Onderka 1986, Schwantje 1986). It is not known if Dall sheep possess natural resistance to infections transmitted from domestics, although it is unlikely. Plans to allow large scale domestic grazing in areas of Alaska frequented by Dall sheep have been proposed, although few enterprises to date have survived the review process (Preston 1983). Currently, most applications for grazing permits are for relatively small operations though only one infected domestic animal is needed to begin an epidemic (Alaska Rural Development Council 1974, Heimer et al. 1982, Foreyt et al. 1983).

An example of an existing potential hazard to Dall sheep can be found outside of Delta, Alaska, on land adjacent to sheep habitat. Dr. Randall Zarnke (1986) has documented a dramatic increase in the prevalence of the antibody Parainfluenza type III in the Delta area bison (Bison bison) herd from 0% prior to 1977 to 100% by 1984. This virus has been implicated in severe respiratory disease of bighorn sheep (Parks et al. 1972). Dr. Zarnke hypothesized that domestic cattle served as the source of the disease introduction into the bison herd. Because the summer range of the bison extends into sheep habitat, the bison may become a vector for the disease from domestic cattle to wild sheep across the center of Alaska (Preston 1983, W. Heimer pers. commun.).

The purpose of land use planning is to help the administrative agencies anticipate such short- and long-term disturbances and direct land use decisions to reduce the possibility of conflicts (ADF&G 1986). Many land use plans

are currently being developed by cooperating agencies and public interest groups. These were begun after major land ownership decisions were made by the completion of state land selections as directed by the Alaska Statehood Act (1958) and by legislation, such as ANSCA and the Alaska National Interest Lands Conservation Act of 1980 (ANILCA). Following these ownership decisions, the degree of land use planning in Alaska exceeded that ever seen before in U.S. history (Cooley 1984).

In drawing up land use plans affecting wildlife habitat, the state agencies, ADF&G and DNR, are guided by Article VIII of the state constitution regarding development of natural resources. Article VIII indicates that when it becomes necessary to set priorities for alternative uses of a particular area, the priorities are to be based on "public interest", "beneficial uses", and for "maximum benefit of [Alaska's] people". Federal agencies have different mandates, but similar general directives for developing balanced approaches to land use (for those permitted) and conflict resolution.

There may be some disparity between plan formulation and implementation because of a variety of forces influencing decisions (Briassoulis 1989). Decisions are made through complex review processes that incorporate various measures of the relative importance of economic, social and political concerns. These decisions are often made with "no audit trail" (Schafer and Davis 1989). Land uses whose benefits are well defined may be regarded more highly and selected more often that alternatives whose benefits are poorly defined. In times of economic stress,

land use proposals which appear to offer immediate economic (and thus political) benefit are appealing.

Authors in the field of environmental planning call for the use of effective decision-making techniques that develop an understanding of the tradeoffs between economic development and environmental conservation (e.g., Tribe et al. 1976, Bakus et al. 1982, Briassoulis 1989) and discourage the use of any single measure for decision making (e.g., Tribe et al. 1976, Dorfman 1985, Sagoff 1988). More needs to be done to identify and analyze the success of specific planning processes, but many people seem to agree that a method is needed that includes and evaluates perceived quantitative and qualitative values (Briassoulis 1989, Shafer and Davis 1989). This study contributes information towards both measures of value. Land use plans and the decision making forum that acknowledges and encourages discussion of benefits associated with market and nonmarket land uses can provide a broader range of alternative land uses and can help derive creative solutions to land use conflicts.

The growing pressure on the state's narrow-based economy increases the possibility that land use conflicts will occur and that hard choices will have to be made between wildlife and other industries. The achievement of ADF&G species management goals and the maintenance of the current range of recreational opportunities associated with Dall sheep are largely dependent upon cooperative agreements among administrative agencies and the cumulative effect of their decisions regarding future uses of sheep habitat.

Natural Resources Economic Valuation

Wildlife habitat is often at a disadvantage when considered as a land use option because its importance is rarely expressed in terms that are comparable to the economic benefits of housing, agriculture or other industrial options. The latter are often seen as producers of income and jobs to communities which, in turn, can lend support to local, state and federal government. Although some revenue is generated due to activities associated with wildlife habitat, the apparent benefits of wildlife habitat rarely appear to match the immediate gains projected from other development projects. This can be attributed to the historical and cultural perspective of wildlife as public property. That is, many human uses of wildlife are not bought and sold under traditional market circumstances, but are "commodities" that provide open (nonexcludable) and uncompetitive (nonrival) benefits to all people in society (Samuelson 1954). It is difficult to describe the relative economic importance of wildlife outside the market framework. Based on prices of those few wildlife commodities that enter normal markets, the relative value of wildlife would be near zero. However, because many social values are associated with wildlife, it is clear that wildlife have considerable worth.

The definition of "value" is complex as any dictionary will show. Many of the diverse concepts are based on relative expressions of importance. Values associated with wildlife can be described as either intrinsic or extrinsic (Brown and Manfredo 1987). Intrinsic, or inherent, values of wildlife exist apart from human perceptions such as the importance of wildlife in an ecological sense. The

extrinsic, or social, value of wildlife is its relative value to humans and can be either negative (e.g., a wolf to a rancher) or positive (e.g., a wolf to a wildlife enthusiast), or both to even the same individual at different times. Variations in extrinsic values are due to individual human perceptions, not due to any changes in the object being valued.

Researchers in behavioral sciences generally agree that extrinsic (social) values of wildlife can be broadly described as being either held or assigned (Kaiser et al. 1988). Held extrinsic values follow ideals and principles and may be described in terms of rights or freedoms, while assigned extrinsic values describe the object's relative importance to other objects and are often expressed in economic terms. Rolston (1985) suggests these assigned values stem from individual preferences, which in turn stem from held values of individual benefit, societal preference, and societal benefit.

An individual's economic (assigned) values of wildlife resources are composed of another complex of values (Figure 2). Recreational and commercial values are associated with direct uses of wildlife. Financial values, those associated with marketed goods and services required for recreational and commercial use of wildlife, are present within both. There are few financial aspects associated with other uses of wildlife, including: option values, those associated with the relative importance of having the potential opportunity to use wildlife; existence values, those associated with the relative importance of just knowing that wildlife "are there" regardless of the likelihood of more direct use of

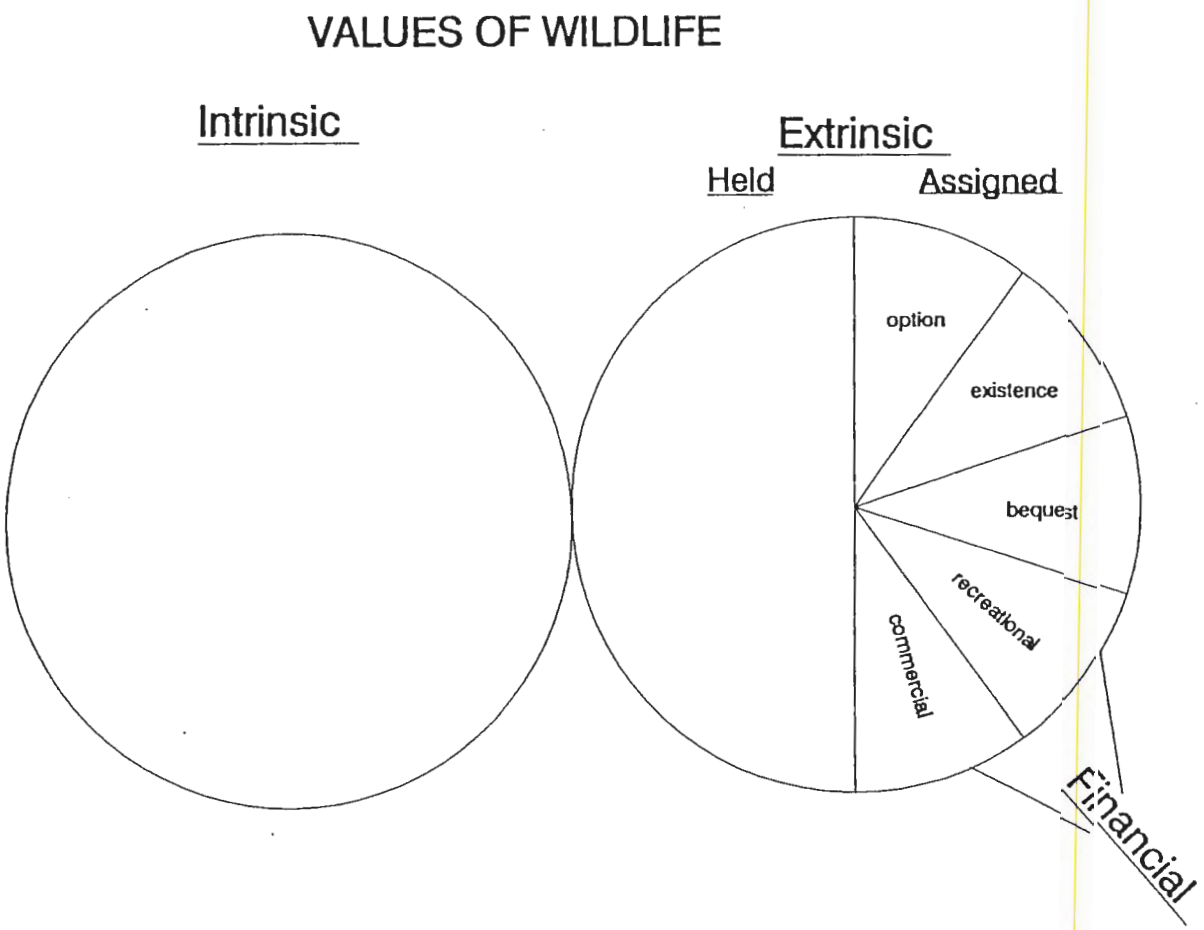


Figure 2. Values associated with wildlife (adapted from Loomis et al. 1984).

wildlife; and bequest values, those associated with the relative importance of providing wildlife for future generations of people. Hence, financial values represent only a portion of the total value of wildlife resources (Loomis et al. 1984). Langford and Cocheba (1978) identified further divisions of values associated with specific uses of wildlife, summarizing that any wildlife valuation process must recognize these complexities and not rely solely on financial expressions of value. Natural resource economic valuation is an important step in recognizing the existence of additional values besides financial.

Expressing the value of wildlife to people may seem inherently impossible because the experience has a large aesthetic component. Bart et al. (1979) argues this view is mistaken and uses art as an example of an aesthetic commodity that one can often buy or sell. When no market appears to exist, the relative expression of value becomes difficult. However, values are reflected in human behavior and this behavior can be observed, measured and theoretically predicted.

Several techniques can be used to estimate economic value of wildlife resources. The selection of technique depends on the characteristics of the object to be evaluated as well as other practical considerations. In this study, expenditures analysis and contingent valuation techniques were used.

Expenditures analysis measures what consumers actually pay (financial value) in association with travel to and use

of the wildlife resource. Since the 1940's, this technique has been used to express the value of hunting and fishing. It became a commonly accepted expression of value because it produced large numbers useful and sometimes beneficial to wildlife in political decisions. Expenditures analysis is limited because total costs are not a reflection of value to the purchaser, but rather of contributions to the local economy. Consequently, the technique often underestimates the value of resources that are associated with few identifiable expenditures but have additional values to the consumer. Expenditures analysis may serve its best, and perhaps only, legitimate use to economists as a measure of impacts on local economies (Loomis et al. 1984). However, its use persists in political circles. It is also used as evidence of the importance of the nonconsumptive use of wildlife (Hay and McConnell 1979).

The theoretical measure of net economic benefit of a commodity (e.g., a sheep hunt) to the consumer (hunter) may be determined by total benefit received (represented by total willingness to pay) less actual expenditures. The difference is termed consumer surplus and represents the amount of benefit gained beyond the price paid. The existence of consumer surplus is evident in that it could be feasible for a "perfectly discriminating monopolist" to charge each individual their maximum willingness to pay for use of a particular good or service.

Consumer surplus can be measured using either contingent valuation method (CVM) and directly asking individuals who use a resource to define their values, or by inference using observations of individuals' behavior with

the use of the travel cost methodology. Discussion in this paper will be limited to the CVM direct measures of net benefit used in this study.

CVM uses the two techniques of willingness to pay (WTP) and willingness to sell (WTS) to estimate consumer net benefit. WTP technique asks consumers to estimate the maximum amount they would be willing to pay to use a wildlife resource before deciding it was too expensive. The net benefit is the difference between the maximum amount willing to pay and the price actually paid. This technique is appropriate when estimating the value of a single opportunity to use a resource (e.g., to hunt sheep). The WTS technique asks consumers for the minimum price they would charge for the sale of their opportunity to use the resource. This technique is appropriate for use when considering other land use proposals that would likely eliminate future opportunities for use of the resource. Resource users are questioned in person or through the mail. Their responses to a series of specific questions indicate relative value. In theory, WTP and WTS obtain the same measure of benefit, but empirical studies have found measurable differences (Larson and Workman 1982, Knetsch and Sinden 1984, Cummings et al. 1988, Coursey et al. 1987).

The use of CVM has increased in the past 20 years. The U.S. Water Resources Council Principles and Guidelines of 1983 endorsed its use as appropriate for measuring costs and benefits associated with changes in nonmarket resource values in water resource projects. CVM also has been used to satisfy the resource valuation requirements for measuring net economic benefit directed by the Rangeland Renewable

Resources Planning Act of 1974, National Forest Management act of 1976, and the Bureau of Land Management's Rangeland Policy. Other agencies using CVM include the U.S. Army Corps of Engineers, Bureau of Reclamation and the Soil Conservation Service (Sorg and Loomis 1985, Steinhoff et al. 1987).

The technique is still being perfected through its increasing use. Researchers in the field have found that fewer problems such as strategic behavior or game playing (respondents giving hypothetical answers to hypothetical questions) are encountered when the following conditions are met: the resource being evaluated is clearly identified, when the users have recent and specific knowledge of the resource, and the questions are worded carefully (Langford and Cocheba 1978, Workman 1983, Donnelly et al. 1987, Cummings et al. 1988). Hammack and Brown (1974) whose study served as a model for this study, were successful at identifying the user group and the values to be measured when they estimated economic values associated with waterfowl hunting.

An important contribution of resource valuation is its attempt to define these more difficult values and, in that process, giving these values recognition and standing. Increased public awareness of a manner by which their values can be expressed may, over time, lead to improved techniques and better measures.

Recently, other researchers have explored economic values associated with sheep hunting. Loomis et al. (1985) used travel cost analysis to estimate the value of bighorn

sheep hunting in Idaho. Kay (1988) estimated economic values for bighorns in Nevada using expenditures and contingent valuation. Phillips (1981) chronicled expenditures for sheep hunters in Wyoming. Pearse Bowden Economic Consultants (1977) and Reid (1985a, 1985b) described expenditures values and net benefits of mountain sheep hunters in British Columbia. When possible, results from this study will be compared with those of other studies.

METHODS

Data characterizing Dall sheep hunting in Alaska were collected using a questionnaire (Appendices A and B) mailed to people who hunted Dall sheep during the August 10-September 20, 1983 hunting season. These individuals (n=2519) were identified from the harvest report forms required by ADF&G. Individuals who hunted during the October 1, 1983 - April 30, 1984 subsistence sheep hunting season (approximately 75 people, ADF&G 1984), were not surveyed based on recommendations from the Subsistence Division, ADF&G (T. Haynes, pers. commun.).

Because the survey was conducted as a census rather than as a random sample of the sheep hunter population, it was crucial to obtain a high response rate. A number of survey techniques were used to solicit hunter response, reduce nonresponse bias, and increase the reliability and the precision of the results (Appendix C).

Questionnaires were mailed to resident (n=2107) and nonresident (n=412) Dall sheep hunters. Three weeks after the initial mailing, a reminder postcard was mailed to nonrespondents (Appendix D). A second mailing of the questionnaire was sent to nonrespondents after another three weeks.

Hunters were assumed to have followed questionnaire instructions and to have given accurate responses to the best of their knowledge. This assumption was important to data analysis and interpretation.

The completed questionnaires were analyzed using SPSS/PC software (Norusis 1988). Descriptive statistics were used to summarize data. Many of the survey questions presented categorical choices to hunters to facilitate responses. As a result, much of the data were categorical. Where needed in analysis, midpoints of categories were used (e.g., $25,000 was used in place of $20,000 - $29,000 income interval). Nonparametric statistical tests (chi-square, Mann-Whitney, Kruskal-Wallis) were used to test hypotheses regarding the central tendency of the categorical data. Parametric statistical tests (t test and F test) were used in exploratory multiple regression analysis of categorical data.

Hunters provided information on their 1983 hunt such as hunt area and whether or not they killed a sheep, their past sheep hunting experience and their plans for future hunts. General demographic questions included age, income, residence, and, if a resident of Alaska, the number of years as a resident. Results were summarized separately for resident and nonresident hunters and the two groups were compared in most analyses. Where possible, the results were compared to other sources of similar data.

The questionnaire was designed to obtain information to estimate the expenditures and benefits associated with the 1983 Dall sheep hunt. The cost of the hunt included direct expenditures plus foregone income. Hunters were not asked to pro-rate the value of hunt-related equipment or services purchased in a previous year. This was done in the interest of encouraging a high response rate though the end result would be an underestimation of the full cost of the

hunt to the hunter. Hunters were asked to estimate expenditures made to businesses in Alaska so an estimated total contribution to Alaska's economy in 1983 could be determined. Nonresident hunters who may have combined their sheep hunt with other activities such as hunting for other species or tourism, were asked to estimate the fraction of their total expenditures attributable to the hunting of sheep. Expenditure data were summarized and compared by residency. Results of demographic data analysis were used to compare the expenditures of subgroups of hunters by residency. Estimates of total costs to all hunters and total benefits to the state economy were made. The results were compared with those of other studies.

The contingent valuation methods (CVM) of willingness to pay (WTP) and willingness to sell (WTS) were used to estimate the net benefits, or the consumer surplus, to hunters for their 1983 sheep hunt. Wording of CVM questions were modeled after Hammack and Brown (1974).

WTP was presented in one question that asked how much more than their actual costs would hunters have been willing to pay before deciding it was too expensive to hunt during the 1983 season. Hunters could choose from continuous, but uneven-sized, intervals including an open-ended category for specific amounts more than $5,000. Results were summarized using the midpoints of intervals (plus any specific amounts over $5,000) and compared by residency. Approximations of net benefits to all hunters were made. Nonparametric tests (Mann-Whitney and Kruskal-Wallis) were used to analyze the variability in WTP by selected demographic variables. These variables included: residency (resident or nonresident),

income category, years residency, success in taking a sheep on the 1983 hunt (yes or no), and hunt area. The continuous variable, years of Alaska residency, was modified to use in nonparametric statistics. Its groups, <5 years and ≥5 years, were chosen somewhat arbitrarily based on its frequency distribution.

Multiple regression analysis was used to explore the combined influence of demographic characteristics on WTP bids of resident hunters. Variables were chosen based on what seemed likely to influence WTP. Variables that were composed of interval data (e.g. income) were modified using the midpoints of intervals and then were used with other variables with continuous distributions (e.g. 1983 hunt expenditures) as independent variables in the regression analysis. The variables included income, number of years of Alaska residency, years of Dall sheep hunting experience, 1983 hunt expenditures, and total number of Dall sheep killed. Natural logarithm and square transformations of these variables also were tried. Any form of a variable that improved the equation's goodness of fit was retained. Other variables were composed of categorical data not modified to simulate continuous data. These included 1983 hunt success at taking a sheep (yes or no), number of years of Dall sheep hunting experience (1 or >1). These were incorporated into multiple regression analysis using full and reduced models (Neter et al. 1985). Significant differences ($p<0.05$) between each full and reduced model would have indicated a variable had a significant influence on residents' WTP. Results were compared with other studies of hunters' net benefit of sheep hunting.

The four questions comprising the WTS portion of the questionnaire asked hunters to estimate the price they would charge for the sale of their opportunity to hunt Dall sheep under time and area specific conditions: next year in their 1983 hunt area, next year in any hunt area in Alaska, all future opportunities to hunt in their 1983 hunt area, and all future opportunities in any hunt area in Alaska. Hunters could choose from the same contiguous, but uneven-sized, intervals that were used for the WTP question. Results for each question were summarized using the midpoints of intervals (plus specific amounts over $5,000) and compared by residency. Results by residency were divided into two subgroups based on comments made by respondents that indicated their bids could be outliers. Analysis of the variability in WTS bids was similar to that of the WTP data, using t tests and F tests in exploratory multiple regression analysis and nonparametric statistics. The median WTS values of subgroups were compared and tested for significant differences using the Mann-Whitney test. Variability in the distribution of residents' WTS was further examined by using the dichotomous responses to three variables to form eight demographic divisions. The choice of variables was based on what seemed likely to influence WTS and they included: success in taking a sheep in 1983 (yes or no), years of Dall sheep hunting experience (1 or >1), and years residency in Alaska (< or $\geq$5 years). The latter variable was in a continuous data format, so a somewhat arbitrary decision was made based on its frequency distribution to transform it into a dichotomous variable. The Kruskal-Wallis test, a nonparametric test for analysis of variance by ranks, was used to detect a significant difference among demographic divisions. If differences were found at $p<0.05$, the

Kruskal-Wallis test for multiple comparisons was used to determine which pairs of demographic divisions were significantly different (Conover 1980).

RESULTS AND DISCUSSION

SURVEY RESPONSE

The questionnaires used in analysis of the results represent 82% of all hunters who reported hunting Dall sheep in Alaska during the August 10 - September 20, 1983 season (Table 2). Some respondents did not answer all portions of the questionnaire; therefore, sample sizes for individual questions vary.

DEMOGRAPHICS

Residency

Alaska resident Dall sheep hunters lived in over 50 different communities across the state, in both urban and rural areas, and 2 residents lived outside of the state (Table 3). The Greater Anchorage and Fairbanks areas were listed as residence by 40% and 23% of the hunters, respectively. The Greater Anchorage area included Anchorage proper, Fort Richardson, Elmendorf Air Force Base, Chugiak, and Eagle River. The Greater Fairbanks area included Fairbanks proper, North Pole, Fort Wainwright, and Eielson Air Force Base. Only about 2.6% of the hunters claimed residence in communities not part of the state's interconnected road/ferry system. This distribution is similar to the general distribution of Alaska's population (U.S. Department of Commerce 1982).

Nonresident hunters came from 42 states and 6 countries outside of the United States (Table 4). Texas (14.8%),

Table 2. Questionnaire response rate for Dall sheep hunters in Alaska, 1983, by residency.

Questionnaires	Total Hunters	Residents	Nonresidents
Number sent (N)	2519	2107	412
Number returned undeliverable	90	81	9
Number presumed delivered (N')	2429	2026	403
Number returned and used in analysis	2073	1722	351
% N	82%	82%	85%
% N'	85%	85%	87%

Table 3. Number and percentage of Alaska resident respondents who hunted Dall sheep, 1983, by major geographic areas and communities.

Area	Number of hunters	Percentage of total (n=1722)
INTERIOR ALASKA	**451**	**26.2**
Bettles (and Wiseman)	6	0.3
Central	1	0.1
Chitina	4	0.2
Circle	9	0.5
Clear	6	0.3
Delta (and Fort Greely)	32	1.9
Eagle	2	0.1
Greater Fairbanks	341	22.8
Eielson Air Force Base	31	1.8
Fairbanks	240	13.9
Fort Wainwright	31	1.8
North Pole	35	2.0
Salcha	4	0.2
McKinley Park	5	0.3
McGrath	6	0.3
Nenana (and Anderson)	6	0.3
Tok	33	1.9
NORTHWEST ALASKA	**10**	**0.6**
Ambler	1	0.1
Kotzebue	4	0.2
Nome	3	0.2
Point Hope	1	0.1
Teller	1	0.1
SOUTHCENTRAL ALASKA	**1131**	**65.7**
Greater Anchorage	676	39.3
Anchorage	513	29.8
Chugiak	29	1.7
Eagle River	82	4.8
Elmendorf Air Force Base	24	1.4
Fort Richardson	28	1.6
Cantwell	4	0.2
Copper Center	17	1.0
Cordova	7	0.4
Gakona	20	1.2
Glennallen	53	2.1
Greater Kenai	54	8.8
Anchor Point	9	0.5

Table 3. Continued.

Area	Number of hunters	Percentage of total (n=1722)
Clam Gulch	2	0.1
Cooper Landing	4	0.2
Girdwood	4	0.2
Homer	24	1.4
Hope	2	0.1
Kasilof	5	0.3
Kenai	26	1.5
Moose Pass	3	0.2
Ninilchik	5	0.3
Seward	9	0.5
Soldotna	47	2.7
Sterling	14	0.8
Kodiak	11	0.6
Palmer	78	4.5
Sutton	7	0.4
Talkeetna	8	0.5
Valdez	27	1.6
Wasilla	62	3.6
Willow	7	0.4
SOUTHEAST ALASKA	**70**	**4.1**
Haines	9	0.5
Juneau	34	2.0
Ketchikan	7	0.4
Petersburg	11	0.6
Skagway	1	0.1
Sitka	7	0.4
Wrangell	1	0.1
SOUTHWEST ALASKA	**32**	**1.8**
Aniak	1	0.1
Bethel	7	0.4
Cold Bay	2	0.1
Hooper Bay	1	0.1
King Cove	2	0.1
King Salmon	8	0.5
Naknek	2	0.1
Nikolai	1	0.1
Port Alsworth	3	0.2

Table 3. Continued.

Area	Number of hunters	Percentage of total (n=1722)
Quinhagak	2	0.1
Skwentna	2	0.1
Togiak	1	0.1
OUTSIDE OF ALASKA	**2**	**0.1**
Alabama	1	0.1
Illinois	1	0.1
MISSING	**26**	**1.5**

Table 4. Number and percentage of nonresidents by state, province or country who hunted Dall sheep in Alaska, 1983.

State, Province, or Country	Number	Percentage
Alaska	2	.6
Alabama	2	.6
Arizona	3	.8
California	42	11.9
Colorado	17	4.8
Connecticut	1	.3
Florida	9	2.5
Idaho	4	1.1
Illinois	5	1.4
Indiana	5	1.4
Iowa	4	1.1
Kansas	5	1.4
Louisiana	2	.6
Maine	1	.3
Maryland	2	.6
Massachusetts	3	.8
Michigan	20	5.7
Minnesota	9	2.5
Mississippi	1	.3
Missouri	3	.8
Montana	12	3.4
Nebraska	4	1.1
Nevada	4	1.1
New Hampshire	1	.3
New Jersey	4	1.1
New Mexico	4	1.1
New York	15	4.2
North Carolina	3	.8
Ohio	3	.8
Oklahoma	3	.8
Oregon	10	2.8
Pennsylvania	21	5.9
South Carolina	1	.3
South Dakota	4	1.1
Tennessee	1	.3
Texas	52	14.8
Utah	8	2.3
Virginia	2	.6
Washington	16	4.6
West Virginia	5	1.4

Table 4. Continued.

State, Province, or Country	Number	Percentage
Wisconsin	10	2.8
Wyoming	7	2.0
British Columbia	1	.3
British West Indies	1	.3
Holland	1	.3
Mexico	1	.3
Switzerland	2	.6
West Germany	13	3.7
(missing)	4	1.1
TOTAL	354	100

California (12.0%) and Pennsylvania (6%) were named most frequently. West Germany was named by 68% of the alien hunters (n=16).

Years of Residency in Alaska

The range in number of years residents lived in Alaska was broad, from one (n=38) to 72 years (n=2) with a mean of 10.6 years (SD=8.98, n=1691). About 35% lived in Alaska 5 years or less and 75% lived in Alaska less than 15 years (Figure 3).

Age

Questions about age are considered by some social researchers to be a sensitive question for respondents. However, only 1.3% of all respondents declined to answer this question.

The ages of Dall sheep hunters in 1983, ranged from under 20 years (n=122) to 70 or more years (n=12). The distribution of age data for residents was significantly different from nonresidents (X^2=270; df=14; $p<0.05$; n=2047). Using the midpoints of age categories, the average resident hunter was 35 years old while the average nonresident hunter was 45 years old. More nonresidents than residents were 70+ years and fewer were under 20 years (Figure 4). The high number of relatively young resident hunters may reflect the lower age of Alaska's general population. Census figures from 1980 show Alaska's population (mean age=26.1 years) to be younger than the United States as a whole (mean age=30.0 years) (U.S. Department of Commerce 1981, 1982). It is possible that only older nonresidents could afford to hunt.

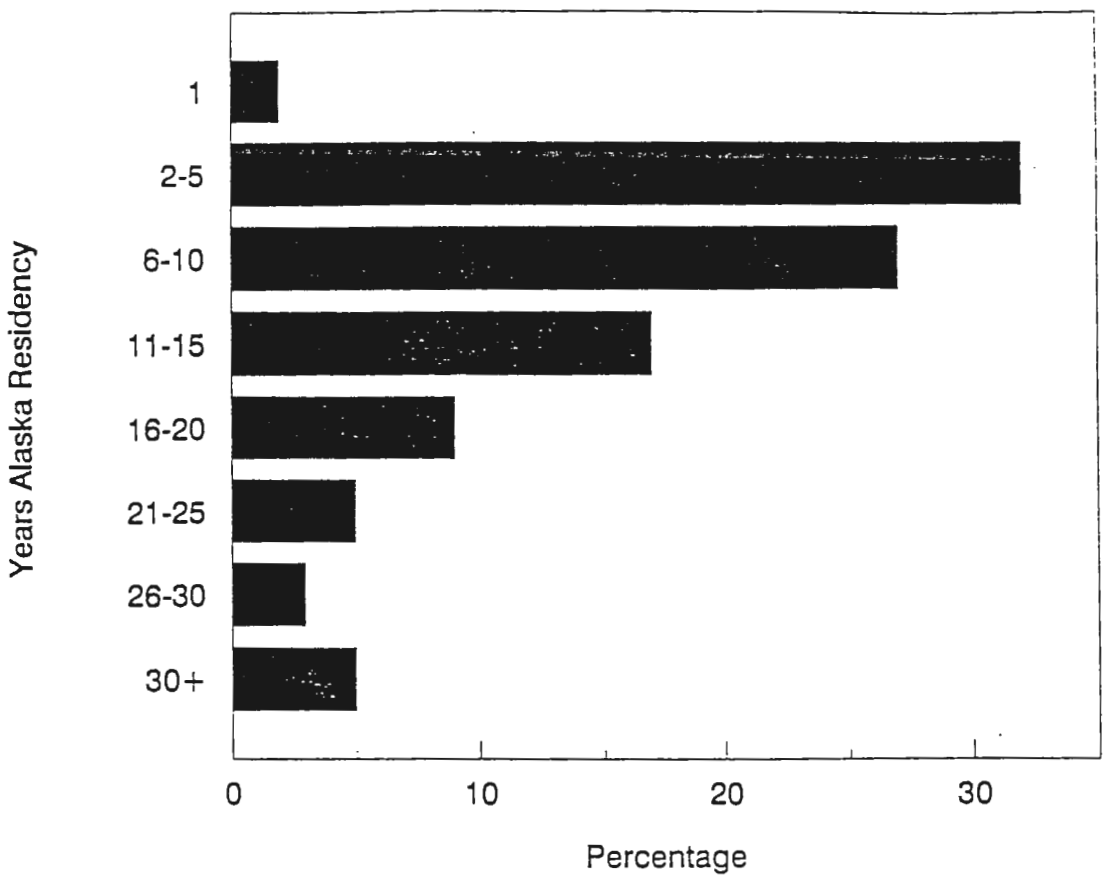


Figure 3. Years of residency of Alaska resident Dall sheep hunters, 1983 (n=1691).

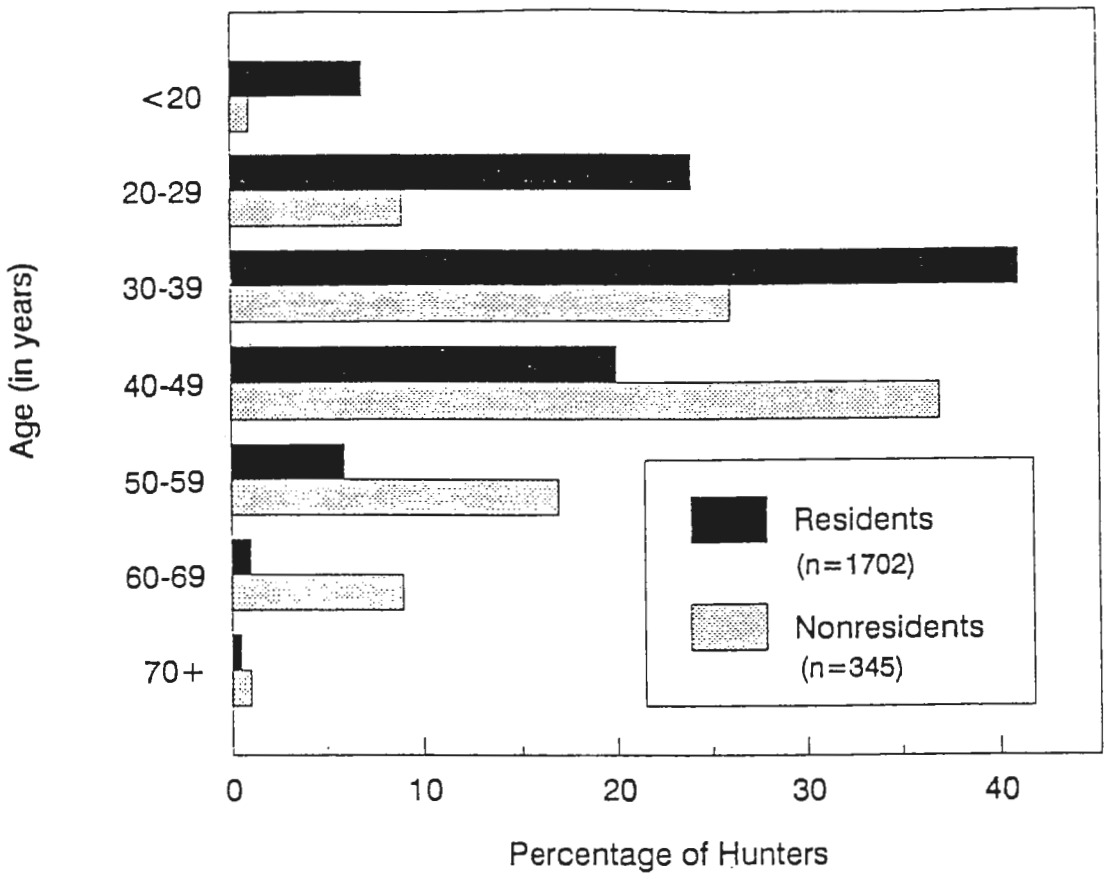


Figure 4. Ages of Dall sheep hunters in Alaska, 1983, by residency.

Income

Income, like age, is considered a personal question which respondents in many surveys choose not to answer. In this survey, only 5.2% of the residents and 6.5% of the nonresidents declined to disclose their total household income. These relatively high responses rates are an indication of respondents' level of cooperation.

Information about income was in categorical form, so the midpoints of income categories were used for analytical purposes. The midpoint for the $140,000+ category was designated as $145,000 which may have introduced some bias into the analysis.

The median income of resident Dall sheep hunters in 1983 was $45,000 (Figure 5). Ninety five percent (94.8%) of residents had incomes less than $105,000 (n=1632). National census information from 1980 reported that the median income level for Alaska residents was $25,421 as compared to the $17,680 median income for the nation as a whole (U.S. Department of Commerce 1981, 1982).

The distribution of income for nonresident Dall sheep hunters was significantly different from resident hunters (X^2=270; df=14; $p<0.05$; n=1960). The median income level for nonresident hunters was $65,000. The distribution of income data indicated there could be several subpopulations of nonresident hunters as characterized by income (Figure 5). Two-thirds (66.2%, n=351) of nonresidents had incomes less than $105,000, with a median of $45,000, similar to resident hunters. The remaining one-third of nonresident hunters earned incomes $\geq$$105,000, with a median

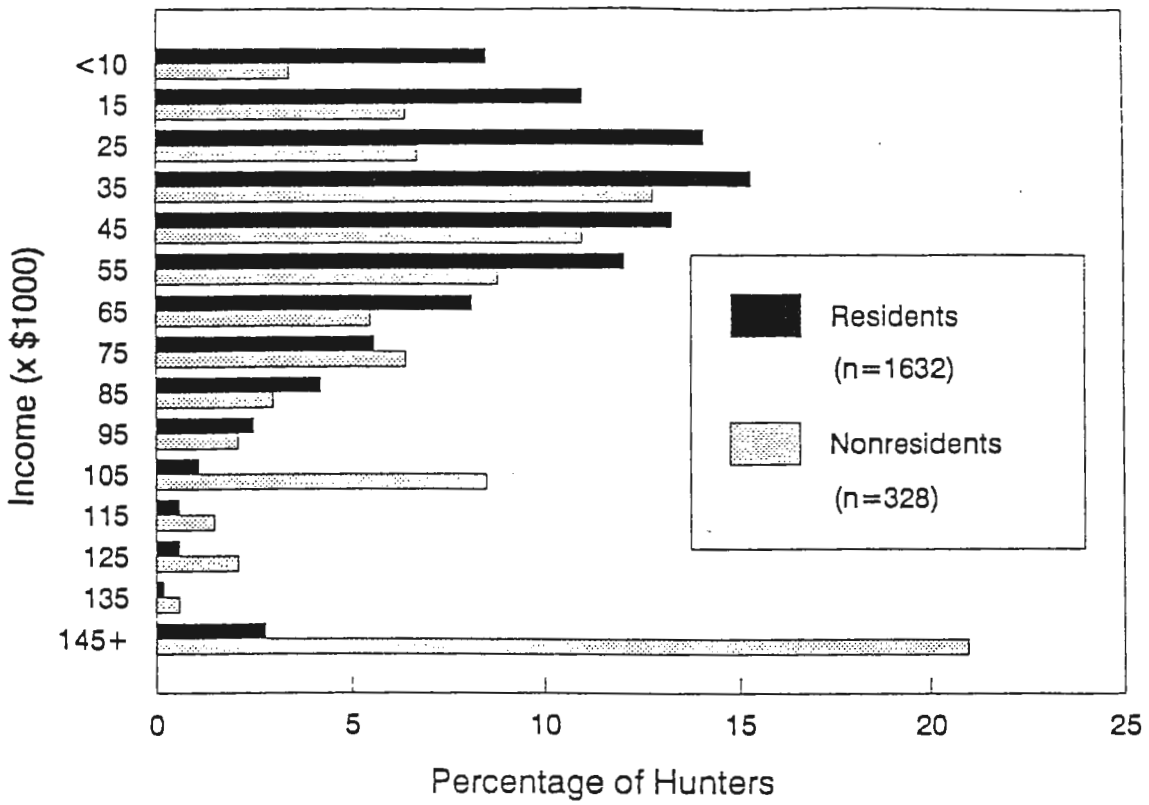


Figure 5. Total household income of Dall sheep hunters in Alaska, 1983, by residency.

of $145,000. This peak was likely due to the open-ended characteristic of the last income category. It masked the secondary peak in the $100,000-$110,000 category (Figure 5).

Employment Status

The question regarding hunter employment was an important precursor to the question requiring an estimation of foregone income. Nearly 87% of all hunters were employed (n=2064). Less than 13% were unemployed (Table 5).

Employment patterns for residents and nonresidents were significantly different (X^2=269; df=2; $p<0.05$; n=2064). Employed resident hunters tended to work for someone else (65%, n=1714) while employed nonresidents tended to be self-employed (64%, n=348).

After indicating they were unemployed, some hunters noted they were students (n=28) or retired (n=26) (Appendix E). The age distribution of unemployed hunters suggests that even more individuals were either in school or retired. Two resident hunters commented they had quit their jobs to hunt sheep.

Additional Comments

Hunters were invited to return comments with their questionnaire. Sixty-five percent of the residents (n=1722) and 46% of the nonresidents (n=351) wrote responses (Appendix E). The comments, though subjective, provided insights into the reasons behind responses to questions.

Table 5. Employment status of Alaska residents (n=1714) and nonresidents (n=350) who hunted Dall sheep in Alaska in 1983.

Residency	Employment Status					
	Self-employed		Employee		Unemployed	
	No.	Row %	No.	Row %	No.	Row %
Resident	353	20.6	1118	65.2	243	14.2
Nonresident	223	63.7	104	29.7	23	6.6

HUNTING DEMOGRAPHICS

Hunting Experience

The total years of Dall sheep hunting experience for all hunters ranged from 1 (n=988) to approximately 55 (n=1), with a mean of 3.5 years (SD=4.5, n=2073) (Figure 6). One hunter, born in Alaska and now in his 70's, wrote that he had been sheep hunting "nearly every year since 1928". One nonresident hunter had hunted sheep in Alaska in 1952.

A large percentage of hunters (48%) were hunting Dall sheep in Alaska for the first time in 1983. First-time hunters comprised 42% of the resident hunters and 77% of the nonresident hunters. It is possible that hunters possessed additional sheep hunting experience gained in other states or countries, but the extent of such experience is unknown.

Future Plans For Hunting Dall Sheep in Alaska

Nearly all residents hunters (95%, n=1715) and many of the nonresident hunters (67%, n=351) said they planned to hunt Dall sheep in the future. Just 2.2% said no, while the remaining 7.4% were undecided (n=2066). This is an indication of the high degree of interest hunters had toward future hunting opportunities. Those who did not plan future sheep hunts in Alaska (n=46) were primarily nonresidents (76%) who perhaps saw their 1983 hunt as a once-in-a-lifetime experience or did not enjoy their 1983 hunt.

Hunters who planned to hunt sheep in Alaska again were asked to estimate how often they expected to hunt. Residents and nonresidents had significantly different responses

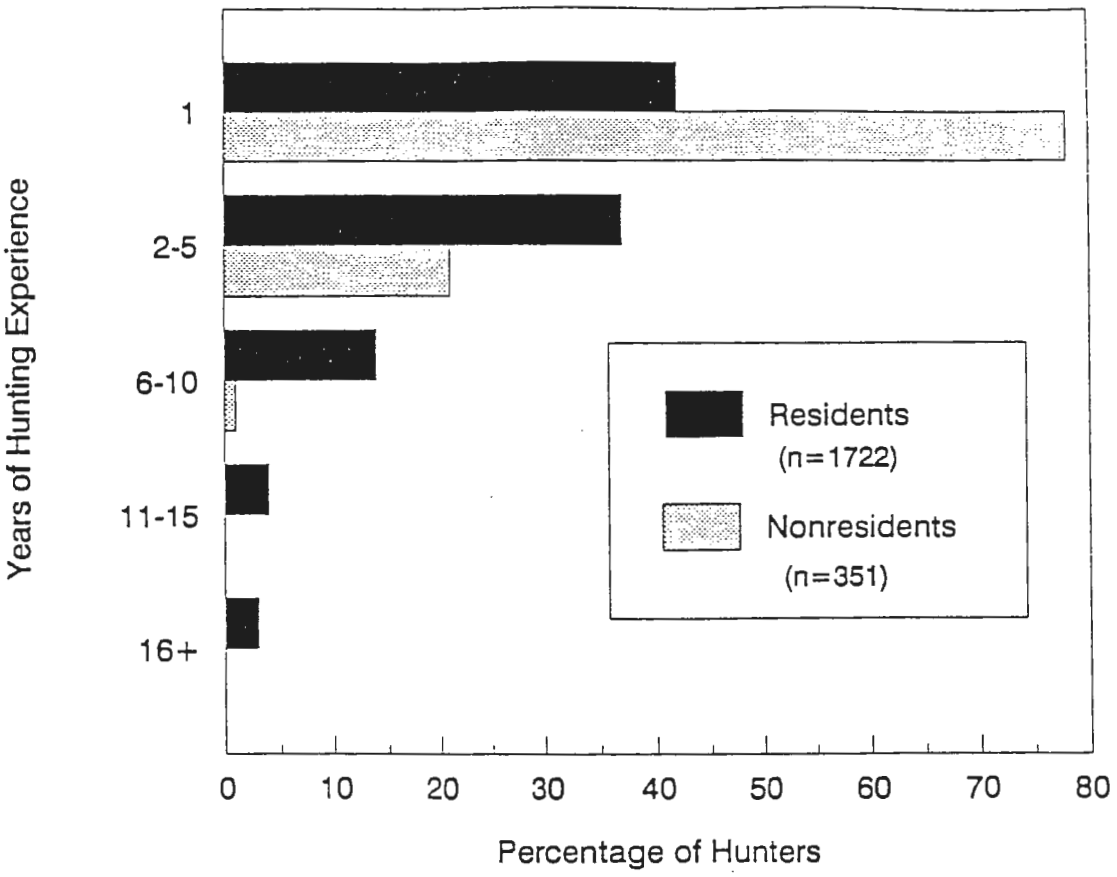


Figure 6. Total number of years of Dall sheep hunting experience by Dall sheep hunters in Alaska, 1983, by residency.

(X^2=450; df=4; critical value=9.488; $p<0.05$). Most resident hunters said they plan to hunt every year or every other year, regardless of the number of times they had hunted sheep before (73.6%, n=1626) Only 12.4% of the residents said they would hunt only once or twice more in their lifetime. Most (62%) of these discouraged hunters were hunting Dall sheep for the first time in 1983. Nonresidents reported the opposite. More than 65% said they would only hunt sheep in Alaska once or twice more, while just 11.6% said they would hunt every year or every other year.

1983 HUNT DEMOGRAPHICS

Why Nonresidents Came to Alaska

Nearly all of the nonresidents selected "to hunt Dall sheep" (60.1%) or "to hunt big game other than Dall sheep" (32.5%) to describe their primary reason for coming to Alaska in 1983. This indicated that for these individuals hunting was not a casual activity opportunistically taken up as they visited the state. Four percent of the respondents cited "to visit relatives" and 1% each cited "tourism" and "other" as their primary reasons for coming to Alaska. "Other" was occasionally explained as fishing (n=6), work (n=3), visiting friends (n=1), and article assignment for a magazine (n=1).

When examining all reasons for travelling to Alaska regardless of rank, hunting Dall sheep was cited by 77.8% of the nonresident hunters (n=337). Other reasons were: hunting big game, 56%, tourism and vacation, 27%, to visit relatives, 14.8%, and other, 6%, (the percentages exceed 100 as more than one reason was often cited). This information indicates how much hunting sheep and hunting in general was

the motivation for these people to travel to Alaska.

Big Game Hunting Species Preference of Nonresidents

For those nonresidents who cited "to hunt big game" as their primary reason for coming to Alaska, a follow-up question asked the respondent to rank the species they most wanted to hunt. However, almost all respondents answered this question regardless of their primary reason for visiting Alaska. These data were viewed as indicative of relative interest in which species these hunters most wanted to hunt in 1983.

Dall sheep was listed as the primary species by almost all respondents wanted to hunt in 1983 (Table 6) Four other species were named as the primary species by 41 hunters including brown bear (Ursus arctos) (9%), caribou (Rangifer tarandus) (1%), mountain goat (Oreamnos americanus) (1%) and moose (Alces alces) (<1%)(n=347).

The species nonresident hunters were interested in hunting besides Dall sheep varied (Table 6). The species hunters most often ranked as second was brown bear, and third was caribou. Dall sheep outranked the second place brown bear by nearly sixfold because many hunters were only interested in hunting sheep.

Of those nonresidents who said their primary reason for travelling to Alaska was "to hunt big game" (n=113), the species selected as first choice included Dall sheep (68%, n=77), brown bear (24%, n=27), caribou (3.5%, n=4), mountain goat (2.7%, n=3), and moose (1.8%, n=2). Of those who came primarily "to hunt Dall sheep" (n=211), just three (1.4%)

Table 6. Number of nonresident hunters who ranked big game species according to their hunting preference, 1983 (n=347). The most preferred species is ranked 1.

Species	Rank											SUM
	1	2	3	4	5	6	7	8	9	10	11	
Black Bear	-	18	18	11	12	4	2	4	2	1	-	72
Brown Bear	32	58	11	5	3	-	-	-	-	-	-	109
Caribou	4	57	35	21	8	3	2	1	-	-	-	131
Dall Sheep	306	31	1	6	1	1	-	-	-	-	-	346
Black-tailed Deer	-	-	1	-	1	2	1	2	-	3	7	17
Elk	-	1	1	2	2	2	1	1	1	5	3	19
Moose	2	30	41	19	5	-	4	-	-	1	-	102
Mountain Goat	3	5	5	8	2	4	1	1	1	-	-	30
Muskox	-	-	1	-	1	2	1	1	6	2	3	17
Wolf	-	7	18	12	10	8	5	1	2	1	-	64
Wolverine	-	2	3	3	7	9	3	6	3	1	1	38

hunters said a species other than Dall sheep, brown bear, was their first choice. This served as a check on the validity of the responses.

This information gives insights into what motivated these people to travel to Alaska and clearly points to Dall sheep hunting being the strongest reason. This factor probably contributed to nonresidents' high response rate to the questionnaire (87%, Table 2).

This information also provides supportive evidence for hunter folklore that maintains that most sheep hunters are so focused on the activity, they do not casually hunt sheep while hunting other higher priority species. Little data has been available previous to this study to substantiate this idea. Unfortunately no comparable data were collected for resident hunters.

Nonresidents' Willingness to Travel to Alaska Without Opportunity to Hunt Sheep

Sixty-three percent of the nonresident hunters said they would not have made their 1983 trip to Alaska if they could not have hunted Dall sheep (n=347). About a quarter (27.4%) of the nonresident hunters answered "yes", they would still travel to Alaska even if they could not hunt sheep, and the remaining 8.5% were not sure.

For hunters who would have still come to Alaska without the opportunity to hunt sheep (n=96), more than half (55.3%) had selected "to hunt big game" as their primary reason for their trip to Alaska. These big game hunters included 93% of those who had selected species other than Dall sheep as

the species they most wanted to hunt (n=41). Another 15% cited to visit relatives, tourism and other as primary reasons for visiting Alaska. The remaining 30% (n=27) selected Dall sheep. It is unknown why these latter hunters would still come to Alaska, unless their secondary reasons for visiting Alaska were compelling enough to justify their travel.

Hunt Areas

The question asking "Where did you hunt?" might have been the most difficult demographic question on the survey. Admittedly, Alaska mountain ranges are enormous areas but hunting tradition, like traditions associated with fishing, maintains that one should never tell exactly where one hunts. Still, nearly all (99%) of the respondents were willing to identify in which mountain range they hunted. Only 23 hunters, 11 residents and 5 nonresidents, were unwilling or, in the case of nonresidents, did not know where they hunted. This is another indication of the level of cooperation these individuals were willing to extend. It may also indicate a high level of confidence in the assurances of anonymity on the questionnaire. It was not possible to verify the accuracy of each hunter's statement due to the anonymity of the responses. However, the proportion of hunters per hunt area corresponds to ADF&G harvest records, indicating consistency (ADF&G 1984).

No hunters claimed to have made multiple trips to the same hunt area and almost all hunters chose just one hunt area. Only 33 resident hunters (1.9%, n=1711) chose two hunt areas and five (0.3% of total residents) of these said they hunted in three areas. Four nonresident hunters (1%)

hunted two areas and none hunted three areas. To simplify analysis, only one hunt area was evaluated. This meant arbitrarily deciding to use the first area listed in the data file. As hunt area codes were not entered in any consistent order, little bias towards one area over another was likely to have occurred during data entry for the 37 hunters that hunted in multiple areas (1.8% of all hunters).

Regardless of residency, the area chosen by most hunters was the Wrangell Mountains (Table 7). This area typically has more hunters than any other areas (Harkness, 1989). Reasons for its popularity include dense sheep populations, the opportunity to find a trophy sized sheep, varied means of access including a road system, and the highest number of guides available to nonresident hunters (ADF&G 1984, Heimer and Smith 1975, Alaska Department of Commerce and Economic Development 1982).

The similarities between areas hunted by resident and nonresident hunters ended there. The distribution of residents and nonresidents by hunt area were significantly different (X^2=94.150; df=7; $p<0.01$; n=2057). Resident hunters next most frequently chose the Alaska Range East of Denali National Park and the Chugach Mountains, areas within relatively close proximity to road systems or within short distances of airports.

Few resident (or even nonresident) hunters named the Tanana Hills, White Mountains area despite its proximity to Fairbanks. The area is sparsely populated by sheep and about half of the area is restricted by a limited entry permit system. The Alaska Range West of Denali Nationa.

Table 7. Number and percentage of resident and nonresident Dall sheep hunters in Alaska, 1983, by hunt area.

Hunt Area	Residents		Nonresidents	
	n	%	n	%
ARE[1]	391	23	50	15
ARW[2]	97	7	53	15
BRR[3]	192	11	78	22
CMR[4]	259	15	40	12
KMR[5]	126	8	8	2
TCW[6]	174	10	27	8
THW[7]	40	2	2	1
WMR[8]	432	25	88	25

[1] Alaska Range East of Denali Natl. Park

[2] Alaska Range West of Denali Natl. Park

[3] Brooks Range

[4] Chugach Mtns.

[5] Kenai Mtns.

[6] Talkeetna, Chulitna, Watana Mtns.

[7] Tanana Hills, White Mtns.

[8] Wrangell Mtns.

Park and the Kenai Mountains also were relatively unpopular areas for residents, the former possibly due to its inaccessibility, competition with guides, and relatively unknown qualities of its sheep populations. Although the Kenai Mountains are very accessible to residents of the Anchorage area, it was used by few hunters, possibly due to an uncertain status of sheep populations.

For nonresidents, the most popular hunt area after the Wrangell Mountains was the Brooks Range, which has numerous guides, areas of dense sheep populations, and a good possibility of finding a ram with trophy-sized horns. The Brooks Range had the highest ratio of nonresident hunters to resident hunters. Nonresidents may have been less concerned than resident hunters with the distance and cost of getting to the Brooks Range after having travelled a great distance already. Or their travel costs to the hunt area may have been included in the price of their guided hunt.

The Alaska Range East of Denali National Park, the Alaska Range West of Denali National Park, and the Chugach Mountains were similar in their attraction to nonresident hunters. Fewer nonresidents chose to hunt in the Talkeetna, Chulitna, and Watana Mountains northeast of Anchorage possibly due to a low number of guides available or their being relatively unknown to nonresidents.

The Kenai Mountains had the lowest nonresident to resident ratio possibly due to a low number of guides. The Tanana Hills, White Mountains area was not used by many nonresidents probably due to the low number of permits, sparse sheep populations and absence of guides.

Alternate Hunting Areas

About 50% of the hunters (n=2066) indicated they would still have gone sheep hunting if their 1983 hunt area had been unavailable. Regardless of hunter residency, the three areas most frequently selected as alternatives were the Wrangell Mountains (24.7%) Brooks Range (19.6%) and the Chugach Mountains (17.7%). A few nonresident hunters chose Canada over any other hunt area (4.2%, n=6). Canada, especially in the Yukon Territory, offered similar hunting opportunities to nonresidents in 1983. The three least popular alternate areas were Tanana Hills, White Mountains (2.3%), Alaska Range West of Denali National Park (4.9%) and Kenai Mountains (5.1%).

Sheep Taken

In 1983, 39% of all hunters reported that they had killed a sheep (n=2075). Almost 70% of these hunters were residents. However, a higher percentage of nonresidents (70%) were successful in taking a sheep than were resident hunters (33%). These ratios are typical and are often attributed to the services of a guide, transportation type to the hunt area, and number of days spent hunting (ADF&G 1984, Harkness 1989).

The hunt areas where resident hunters had their highest success rates were the Brooks Range (46% successful, n=89) and Wrangell Mountains (40%, n=170). For nonresidents, hunters in the Wrangell Mountains had the highest success rate, 78%. (Table 8).

Table 8. Number and percentage of resident and nonresident hunters who killed a Dall sheep on their 1983 Dall sheep hunt in Alaska, by hunt area.

Hunt Area	Residents (%)	Nonresidents (%)
ARE[1]	136 (35)	38 (76)
ARW[2]	37 (38)	32 (60)
BRR[3]	88 (46)	56 (72)
CMR[4]	59 (23)	24 (60)
KMR[5]	23 (18)	4 (50)
TCW[6]	35 (20)	18 (67)
THW[7]	14 (35)	1 (50)
WMR[3]	173 (40)	69 (78)

[1] Alaska Range East of Denali Natl. Park

[2] Alaska Range West of Denali Natl. Park

[3] Brooks Range

[4] Chugach Mtns.

[5] Kenai Mtns.

[6] Talkeetna, Chulitna, Watana Mtns.

[7] Tanana Hills, White Mtns.

[8] Wrangell Mtns.

EXPENDITURES

Response Rate

Nearly all respondents provided data on expenditures, including 97.2% of the residents (n=1722) and 96.3% of the nonresidents (n=351). Reasons for nonresponse as indicated by written comments included "someone else paid for the hunt" (30%) and "dislike financial questions" and "dislike questionnaire" (30%) (number of total nonrespondents=61).

Total and Variability in Expenditures

The total amount hunters reported spending on their 1983 Dall sheep hunt was $5,870,053 (mean=$2,918, n=2012). The median amount was $1,232.

Cost to individual hunters was extremely variable because the total was composed of the summation of multiple costs associated with the purchase of goods (e.g., camping equipment), services (e.g., chartering a plane), and foregone income. Foregone income was the amount hunters could have earned had they not gone on their sheep hunt and for which they were not compensated by paid leave. Many expenditures were related to residency. Resident hunters typically had lower costs because they had lower license fees, no tag fees, no requirement to purchase the services of a guide, and usually had no costs associated with travel to Alaska (Table 9). Nonresidents often combined their sheep hunt with other activities and purchased additional goods and services.

Few costs associated with the hunt were invariable. Only the prices for license and tag fees were without alternatives (except by changing residency). Costs for all

Table 9. Itemized total expenditures for Dall sheep hunters in Alaska, by residency, 1983.

			Residents	Nonresidents[1]	Total
Foregone Income		Total	$904,947	$490,520	$1,395,467
		Mean	1,307	3,009	1,632
	Range:	Min.	5	200	
		Max.	35,000	20,000	
		n	692	163	855
Transportation to Alaska		Total	750	324,145	324,895
		Mena	-	982	982
	Range:	Min.	750	200	
		Max.	750	7,500	
		n	1	330	331
Guide		Total	46,405	1,416,455	1,462,860
		Mean	1,105	4,785	4,328
	Range:	Min.	75	100	
		Max.	7,000	21,800	
		n	42	296	338
Tips		Total	1,620	64,925	66,545
		Mean	162	282	277
	Range:	Min.	20	20	
		Max.	500	3,500	
		n	10	230	240
License, Tag Fees		Total	29,516	191,089	220,605
		Mean	18	602	113
	Range:	Min.	5	150	
		Max.	460	1,700	
		n	1,630	317	1,947
Transportation within Alaska		Total	429,318	74,631	503,949
		Mean	276	385	288
	Range:	Min	1	10	
		Max	5,500	1,800	
		n	1,558	194	1,752

Table 9. Continued.

		Residents	Nonresidents[1]	Total
Lodging	Total	22,534	35,243	57,777
	Mean	100	184	138
Range:	Min.	4	25	
	Max.	555	1,250	
	n	226	192	418
Restaurants and Entertainment	Total	$45,729	$45,753	$91,482
	Mean	61	161	88
Range:	Min.	12	8	
	Max.	1,500	1,500	
	n	753	285	1,038
Tourism and Gifts				
	Total	8,446	81,005	89,451
	Mean	70	335	246
Range:	Min.	3	20	
	Max.	500	5,000	
	n	121	242	363
Guns, Ammunition (outside Alaska)	Total	64,368	145,823	210,191
	Mean	327	698	
Range:	Min.	6	10	
	Max.	2,500	6,000	
	n	197	209	406
Guns, Ammunition (inside Alaska)	Total	241,347	27,211	268,558
	Mean	214	406	225
Range:	Min.	2	10	
	Max.	2,500	5,500	
	n	1,126	67	1,193
Camera, Film (outside Alaska)	Total	39,102	64,151	103,253
	Mean	195	332	262
Range:	Min.	1	7	
	Max.	1,500	2,000	
	n	201	193	394

Table 9. Continued.

		Residents	Nonresidents[1]	Total
Camera, Film (inside Alaska)	Total	115,757	14,876	130,633
	Mean	116	173	121
Range:	Min.	1	10	
	Max.	1,050	4,000	
	n	996	86	1,082
Camping Equipment (outside Alaska)	Total	$44,138	$50,589	$94,727
	Mean	239	316	275
Range:	Min.	5	10	
	Max.	2,000	3,000	
	n	185	160	345
Camping Equipment (inside Alaska)	Total	263,280	26,165	289,445
	Mean	207	247	210
Range:	Min.	5	20	
	Max.	2,500	3,300	
	n	1,272	106	1,378
Taxidermy (outside Alaska)	Total	30,508	99,832	130,340
	Mean	355	584	507
Range:	Min.	30	20	
	Max.	2,500	3,200	
	n	86	171	257
Taxidermy (inside Alaska)	Total	139,601	50,132	189,733
	Mean	379	597	420
Range:	Min.	2	7	
	Max.	1,500	3,000	
	n	368	84	452
Other Costs (outside Alaska)	Total	8,057	14,495	22,552
	Mean	537	1,318	6741
Range:	Min.	16	45	
	Max.	3,500	10,000	
	n	15	11	26

Table 9. Continued.

		Residents	Nonresidents[1]	Total
Other Costs (inside Alaska)	Total	202,907	25,372	228,279
	Mean	1,097	976	1,082
Range:	Min.	3	10	
	Max.	2,500	1,400	
	n	185	26	211
Total	Total	$2,638,691	$3,231,362	$5,870,053
	Mean	1,576	9,560	2,918
Range:	Min.	10	460	
	Max.	38,960	35,870	
	n	1,674	338	2,012

[1] Nonresidents' expenditures equal the total amount hunters spent, including costs associated with tourism, hunting other species, visiting relatives or other activities.

other items were influenced by respondent choices. Although nonresident hunters must hire a guide according to Alaska statutes (unless hunting with an Alaska resident relative), guide fees (and the services included) are not regulated and therefore vary considerably. For most items, hunters exercised some degree of choice. A hunter's costs were partly due to individual preferences, affordability, and by necessity, such as in the case of injury or game law citation. The sum of these individual costs determined total expenditures.

Resident Hunter Expenditures

Total expenditures, including foregone income, for resident respondents came to $2,638,691 (mean=$1,576.28, n=1674). The total cost of hunting varied from $10 (n=1) to $38,960 (n=1). The median cost to hunters was $977, so the distribution of these data was positively skewed (7.2) with only a few paying large sums. Twenty-five percent of the resident hunters spent less than $400 on their hunt. Less than 5% spent more than $5,000 on their hunt.

The highest percentage of residents' expenditures was for the cost associated with foregone income (Table 10). This was in part due to the high number of employed hunters (see Table 5). The uncompensated time spent hunting sheep instead of working cost residents a mean of 1.4% (SD=3.2%, n=1632) of their annual household income.

Most residents (95%) purchased hunting licenses (hunters under 16 or over 65 years need not buy an annual license), and most (93%) had costs associated with transportation to the hunt area. Less than 3% of the

Table 10. Percentage of total expenditures by itemized categories of Dall sheep hunters in Alaska, 1983, by residency.

Itemized Expenditures	Percentage of Total Expenditures	
	Residents	Nonresidents
Foregone Income	34.30	15.18
Transportation to Alaska	0.02	10.03
Guide	1.76	43.84
Tips to Guides	0.06	2.01
License, Tags	1.12	5.94
Transportation within Alaska	16.27	2.31
Lodging	0.85	1.09
Restaurants, Entertainment	1.73	1.42
Tourism, Gifts	0.32	2.51
Firearms	11.59	5.36
Camera, Film	5.87	2.45
Camping Equipment	11.65	2.38
Taxidermy	6.45	4.64
Other	8.00	1.23

residents purchased transportation to Alaska or guide services (Table 11).

All expenses associated with the hunt, including foregone income, cost residents on average almost 5% of their annual household income (n=1627) (Figure 7). The median amount was only 2.8% indicating that the distribution of these data was positively skewed. A few residents (10%) spent more than a tenth of their annual income for their hunt. Some of these hunters were under 20 years old and may have had their hunts paid for by someone else.

Some of the variability in resident expenditures can be attributed to the differences between experienced hunters (those who had hunted Dall sheep in Alaska at least once before, n=987) and inexperienced hunters (n=716). Total expenditures of Alaska resident Dall sheep hunters who were hunting for the first time were significantly less than the expenditures of more experienced Alaska resident hunters (Mann-Whitney $U=286475.0$; $p<0.05$). The mean total costs of inexperienced hunters was 64% of mean total costs of experienced hunters. The total amounts spent for most itemized expenditures also were significantly different. Experienced hunters spent more on average for every item except guide fees and tips, and firearms and other funds paid to businesses outside of Alaska. No significant differences were detected using chi-square tests ($p>0.05$) between novice and experienced hunters in their income distribution level, success rate or transportation type used on the sheep hunt.

Table 11. Percentage of Alaska residents and nonresidents who spent money in the following categories for their Dall sheep in Alaska, 1983.

Itemized Expenditures	Percentage	
	Residents (n=1722)	Nonresidents (n=351)
Foregone Income	40.0	46.4
Transportation to Alaska	0.1	94.0
Guide	2.4	84.3
Tips to Guides	0.6	65.5
License, Tags	94.7	90.3
Transportation within Alaska	91.5	55.3
Lodging	13.1	54.7
Restaurants, Entertainment	43.7	81.2
Tourism, Gifts	7.0	68.7
Firearms	76.8	78.6
Camera, Film	69.5	79.5
Camping Equipment	84.6	75.8
Taxidermy	26.4	72.6
Other	11.6	10.5

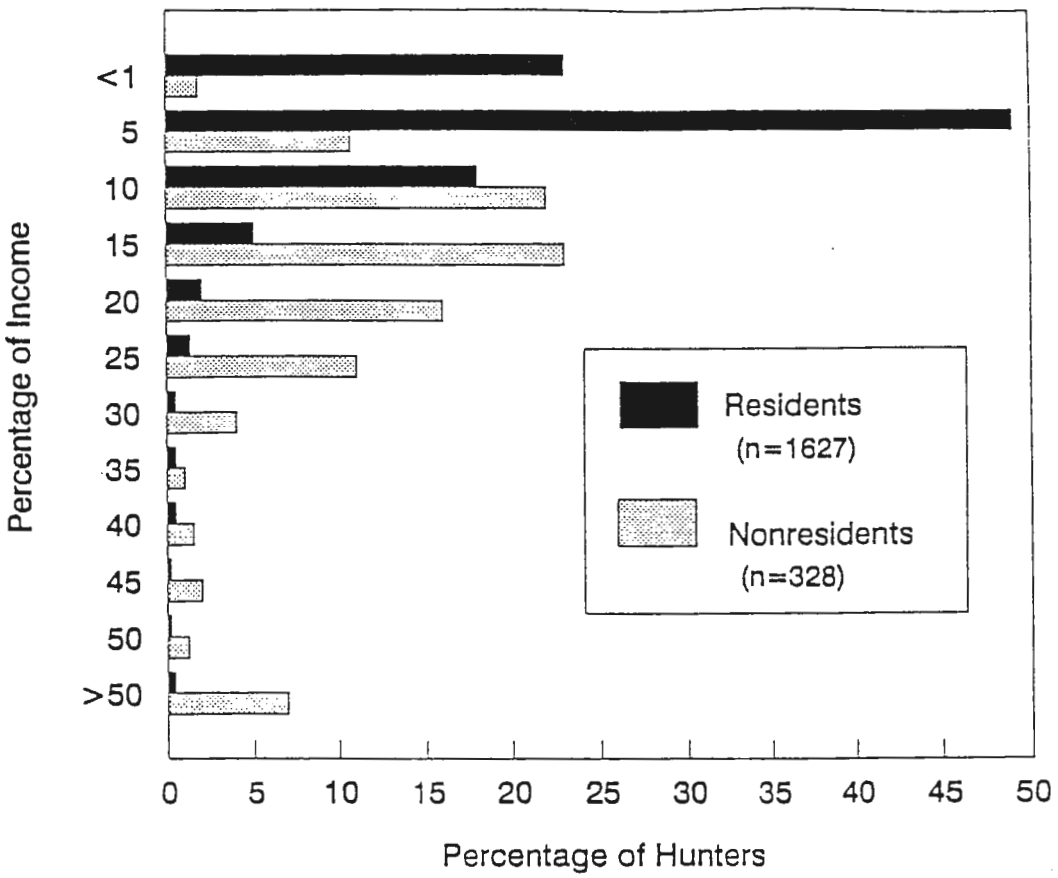


Figure 7. Percentage of annual income spent on Dall sheep hunt by hunters in Alaska, 1983, by residency.

A few resident hunters hired a guide for a mean price of $1,105 (n=42). Most (62%) of these were hunting sheep for the first time, but the remainder had hunted sheep as many as 19 times. Relative newcomers as well as residents of 35 years hired a guide. Their mean total expenditures were 2.3 times the average and were significantly more than those of the average of unguided resident hunters (Mann-Whitney U=14499.0, $p<0.01$,n=1722). Guided resident hunters, however, did not kill more sheep than other resident hunters. Only 28.6% claimed to have killed a sheep, but they apparently enjoyed their hunt because the most frequent comment made on their questionnaires was related to the personal importance of sheep hunting ("priceless" reported by 54%).

Nonresident Hunter Expenditures

Nonresidents' total expenditures including foregone income was $3,231,362 (mean=$9,560, n=351) (Table 9). The total cost of hunting varied from $460 (n=1) to $35,870 (n=1) with a median amount of $8150. The range for nonresidents was not as great as the range for resident hunters and the distribution was quite different. Seventy-eight percent of the hunters spent over $5,000.

The greatest expenditures by nonresidents were attributed to guide services (43.8%) and foregone income (15.2%) (Table 10). Guide services may have included all or part of many items such as food, lodging, and transportation to the hunt area within Alaska.

Nonresidents were willing to pay a large portion of their annual income for a Dall sheep hunt. Nonresidents

spent a mean of 21.5% (median=13.3%) of their annual household income on their sheep hunt (n=328) (Figure 7). More than 65% of the nonresidents spent more than a tenth of their annual income on their sheep hunt, while only 10% of the resident hunters spent this proportion. This may explain why most nonresident sheep hunters do not plan to return to Alaska to hunt sheep very often. For some hunters, especially those in the lower income categories, the hunt was probably a once-in-a-lifetime experience.

Some of the variability in nonresident expenditures can be attributed to differences in income, selection of a guide, and additional expenditures associated with other activities such as hunting other species or tourism. Income distribution data suggested at least two subpopulations of nonresidents, those with incomes of less than $105,000 or those with incomes equal to or more than $105,000 (using midpoints of income categories). Expenditures between the two groups were significantly different (Mann-Whitney U =7988.5; $p<0.05$). Those with incomes less than $105,000 spent a median amount of 17.7% of their income (n=217) while those with incomes equal to or greater than $105,000 spent a median amount of only 8% (n=111).

Some nonresidents plan to hunt at least every other year (n=26, or 7.4%). Their expenditures averaged 12.5% of their annual income, and only half that of the average expenditure of nonresidents as a whole. Demographic data indicated that seven (or 27%) of these hunters had relatives in Alaska and were probably able to avoid hiring an expensive guide. Of the remaining 20 hunters, one mentioned that someone else had paid for his hunt. It is unknown how

the others had been able to hunt inexpensively other than by experience. Additional information about the hunters indicated their strong interest in hunting sheep in Alaska. Nearly all (n=26, or 96%) of these hunters said that Dall sheep was the primary species they planned to hunt in 1983 and five indicated Dall sheep hunting was extremely important ("priceless") to them.

Because some nonresidents combine their sheep hunt in Alaska with other activities, all were asked to choose the fraction (1/8 to 7/8) of their total expenditures that could be attributed solely to sheep hunting if their total expenditures included costs associated with the hunting of other game, on tourism, vacation or business. Forty percent of the nonresident hunters chose a fraction indicating their total expenditures including foregone income contained costs of goods, services and time not associated with sheep hunting. The adjusted amount that nonresidents spent solely on the hunting of Dall sheep was $2,615,577 (mean=$7,738, n=338) or 81% of the total amount spent by nonresidents. The resident hunter questionnaire was designed so that only expenditures associated with Dall sheep hunting were included and no comparable adjustments were necessary.

Expenditures by Hunt Area

Some of the variability in hunter expenditures also can be explained by where they hunted. Significantly higher total expenditures were made by residents who hunted in the Brooks Range as compared to those hunting in other areas (Mann-Whitney U=103589.0; $p<0.05$; n=2057) (Table 2). These higher costs were primarily due to significantly higher transportation costs (Mann-Whitney U=80678.0; $p<0.05$;

n=2073). Most hunters lived relatively far from this hunt area (40% of the residents who hunted in the Brooks Range lived in the greater Anchorage and Kenai areas) and 38% of residents used several modes of transportation to get to the Brooks Range. These included commercial aircraft (26%), chartered small (bush) aircraft (71%), highway vehicles (34%) and other means (13%). Because the Brooks Range, like all mountain ranges in Alaska, is very large, costs also varied according to where the hunting camp was located within the mountain range.

The highest average total expenditures for nonresident hunters belonged to those who hunted in the Alaska Range West of Denali National Park (Table 12) although they were not significantly higher than in other areas (Mann-Whitney $U=6603.0$, $p=0.057$, $n=351$). The guide fees paid by nonresidents who hunted in this area were significantly higher than fees for guides in other areas (Mann-Whitney $U=6193.0$, $p<0.05$, $n=351$). Because the guide fees may have included costs for transportation and other services, it is difficult to specifically identify the reasons for the high cost of nonresident hunting in the Alaska Range West of Denali National Park.

Benefit to Alaska's Economy

Alaska's economy benefitted directly from the total amount of "new money" nonresidents spent within the state. The expenditure items included in this calculation were all costs minus forgone income, transportation to and from Alaska, and all purchases designated as made outside of Alaska (Appendices A and B). The amount residents spend is not typically included by economists in this measure of

Table 12. Summary statistics for expenditures of Dall sheep hunters in Alaska, 1983, by hunt area and residency.

Hunt Area		Residents	Nonresidents	All Hunters
ARE[1]	Total Sum	$590,240	$472,447	$1,062,687
	Mean	1,510	9,449	2,410
	SD	1,876	4,505	3,425
	Max.	16,072	20,250	20,250
	n	391	50	441
ARW[2]	Total Sum	$ 160,263	$570,369	$ 730,632
	Mean	1,652	10,762	4,871
	SD	1,638	7,047	6,176
	Max.	7,622	31,825	31,825
	n	97	53	150
BBR[3]	Total Sum	$424,655	$785,523	$1,210,178
	Mean	2,212	10,071	4,482
	SD	2,592	6,156	5,325
	Max.	22,872	35,870	35,870
	n	192	78	270
CHR[4]	Total Sum	$359,208	$348,820	$ 708,028
	Mean	1,387	8,721	2,368
	SD	3,410	5,311	4,473
	Max.	38,960	25,803	38,960
	n	259	40	299
KMR[5]	Total Sum	$ 89,261	$ 45,800	$ 135,061
	Mean	708	5,725	1,008
	SD	818	2,845	1,574
	Max.	5,125	7,855	9,435
	n	126	8	134
TCW[6]	Total Sum	$221,355	$233,280	$ 454,635
	Mean	1,272	8,640	2,262
	SD	1,608	5,105	3,460
	Max.	9,672	22,760	23,560
	n	174	27	201

Table 12. Continued

Hunt Area		Residents	Nonresidents	All Hunters
THW[7]	Total Sum	$ 63,227	$ 19,720	$ 82,947
	Mean	1,581	9,860	1,975
	SD	1,350	2,573	2,254
	Max.	5,975	11,680	11,680
	n	40	2	42
WMR[8]	Total Sum	$716,944	$781,617	$1,498,561
	Mean	1,660	8,882	2,882
	SD	1,981	9,913	5,204
	Max.	12,835	83,200	83,200
	n	432	88	520

[1] Alaska Range East of Denali Natl. Park

[2] Alaska Range West of Denali Natl. Park

[3] Brooks Range

[4] Chugach Mtns.

[5] Kenai Mtns.

[6] Talkeetna, Chulitna, Watana Mtns.

[7] Tanana Hills, White Mtns.

[8] Wrangell Mtns.

total benefit to the state because economic theory maintains that if residents could not have gone on their hunt, they would have used the same funds to purchase other goods or services in the state. One could argue that given Alaska's economic dependency on goods and services from outside of the state, this traditional measure of total benefit to the state may not be as applicable as elsewhere. To answer the question regarding the state's economic benefit from resident hunters' expenditures, the questionnaire should have included a question asking what these residents would have purchased if they could not have hunted Dall sheep in 1983.

The amount spent by nonresidents within Alaska was at least $2,052,857 (mean=$5,848.60, n=351), 78% of which was spent solely on hunting Dall sheep ($1,608,400, mean=$4582, n=351). These figures are based on the summation of expenditures designated as spent in Alaska, plus guide fees and tips, license and tag fees, lodging, restaurants, and tourism.

These are minimum figures for several reasons. Some respondents provided only a total figure for their costs, not defining the portions spent inside or outside of the state, and other hunters declined to give any economic information on their survey. Nonrespondents to the whole survey also contributed an unknown amount to the state economy.

The expenditures by nonresidents in Alaska provided employment and income for an unknown number of individuals in Alaska. Though no input-out modeling of the flow of

hunters' expenditures to sales, employment and income was done to better define the economic impact Dall sheep hunting has on Alaska's economy, this theoretically could be done. Jones and Stokes Associates, Inc. (1987) modeled the sport fishing industry in southcentral Alaska and reported the $93.2 spending by resident and nonresident anglers in 1986 translated into direct employment of 2,178 persons, most in retail trade and secondly in guide services, who earned $18.3 million. Total output (production of goods and services) generated by angler spending was more than $206 million, and supported 2,840 jobs with earnings of more than $65.2 million.

It is not known how long nonresidents' Dall sheep hunters' expenditures remained within the state economy. Some money was probably traded in exchange for goods and services whose components or raw materials originated entirely within the state. Since little in Alaska is produced independent of goods and services from other areas, each time money changed hands as it was spent, some portion was leaked out of the state's economy, diminishing the amount retained. The retained portion of the original total in conjunction with a multiplier (as generated by input-output modeling) can measure how much total business or income results from the original expenditure (Coppedge and Youmans 1970).

Projected Expenditures, All Dall Sheep Hunters, 1983

Not all hunters responded to the questionnaire, though all who hunted Dall sheep in Alaska are likely to have made some expenditures. Assuming nonrespondents had expenditures similar to the mean amount by residency, then total costs of

Dall sheep hunting would be greater. The estimated total expenditures exceeded $7 million, with $3.3 million and $3.8 million spent by residents and nonresidents, respectively (Table 13). The estimated total benefit to Alaska's economy, composed of the amount nonresident hunters spent for goods and services within Alaska and excluding foregone income, would also be greater with the inclusion of projected amounts from nonresident nonrespondents. The estimated total contribution to Alaska's economy by all nonresident hunters was $2.5 million (Table 13).

Expenditure Findings from Other Studies

Several other studies have estimated expenditures made by mountain sheep hunters and can be compared with those in Alaska (Table 14). The amounts have been adjusted so they are in 1983 U.S. dollars. Mean total expenditures for all hunters in Alaska were greater possibly due to transportation costs. Mean expenditures by residents in Alaska are midway between those of Nevada and British Columbia, neither of which specifically asked hunters to include foregone income as part of their total costs.

In British Columbia, the data were collected in 1981 (Reid 1985a, Reid 1985b). All sheep hunters were required to pay license fees. Nonresidents also needed to purchase tags and the services of a guide. Guide fees varied but were the most expensive item for nonresident hunters.

In Nevada, data were collected in 1984-1986, and reflect costs associated with hunting desert, Rocky Mountain and California bighorn sheep (Kay 1988). Guides are not required for nonresident hunters in Nevada. All sheep hunts

Table 13. Projected total expenditures for all who hunted Dall sheep in Alaska in 1983, by residency, and projected amount all nonresident Dall sheep hunters spent within Alaska which benefited the state economy in 1984.

HUNTERS	TOTAL EXPENDITURES	n
Resident Hunters	$3,321,220.00	2,107
Nonresident Hunters	$3,814,522.00	412
Total	$7,135,742.00	2,519
Amount Nonresidents Spent Within Alaska	$2,503,199.00	412

Table 14. Comparison of sheep hunters' expenditures by state or province.

	All Hunters	Residents	Nonresidents
Alaska[1](1983)			
Total	$5,254,268	$2,638,691	$2,615,577
x	$ 2,611	$ 1,576	$ 7,738
n	2,012	1,674	338
British Columbia (1983)[2]			
Total		$3,867,540	
$2,073,$17793,763			
x	$ 1,988	$ 1,310	$ 5,022
n	1,945	1,586	359
Nevada (1984)[3]			
Total	$ 232,223	$ 191,682	$ 46,541
x	$ 2,346	$ 2,106	$ 5,068
n	100	91	9
Wyoming (1980)[4]			
Total	$ 475,299	$ 242,139	$ 233,160
x	$ 1,317	$ 893	$ 2,586
n	361	271	90

[1] Alaska nonresident expenditures shown are associated only with the Dall sheep hunt.
[2] Reid, R. 1985
[3] Kay, F. et al. 1984
[4] Phillips, C. 1981

in Nevada are restricted to a limited entry permit and opportunities to hunt sheep are few (Table 1).

There are some difficulties with a comparison of expenditures due to regional differences in markets and prices. In addition, the studies were not identical in content and procedure.

CONTINGENT VALUATION -- WILLINGNESS TO PAY

The contingent valuation method (CVM) directly measures consumer surplus, or net benefit, and was applied in this study using two techniques to measure the amount of net benefit hunters derived from their sheep hunt. The results from the willingness to pay (WTP) CVM are discussed here while the results from the willingness to sell (WTS) CVM are presented later.

The wording of the WTP question was modeled after Hammack and Brown (1974). Hunters were asked to estimate how much more they would have been willing to spend on their 1983 Dall sheep hunt in Alaska before deciding it was too expensive to hunt. Hunters were presented with a list of intervals from which to choose a dollar amount. The intervals were contiguous but of uneven increments that ranged from small ($50) to large ($2000) with the last choice being open-ended and requesting a specific amount (Appendices A and B). These increments were used in the interest of accommodating a variety of bids and maintaining a high response rate from hunters.

Response Rate

Ninety-two percent of all hunters responded to the question (n=2073). Nonresidents more than residents tended to leave the question blank. Almost 12% of all nonresidents (n=351) did not reply as compared to 7% of the residents (n=1722).

Bids could not be verified to determine their legitimacy because no money was actually exchanged in this mail survey. As is the case for all survey questions, hunters were assumed to have followed instructions and to have answered the question to the best of their knowledge.

Some responses could not be used in the analysis. Three hunters (0.1%) gave extraordinarily high dollar figures, far in excess (>100%) of their income, and added comments that indicated they had no intention of actually paying the high amount. Forty-two hunters (2%) replied $0 and, with comments about the priceless quality of hunting sheep, indicated their bids were protest bids rather than evidence of their being at financial limits. Thirty-three (1.6) of all respondents replied only "priceless" or similar comments in response to this question, indicating they would hunt sheep regardless of the price. All of these hunters were not true nonrespondents because they did indicate their attitudes and values toward sheep hunting and did not leave the question blank. Although the responses could not be used in benefit-cost analysis, they were descriptive of the relative importance of Dall sheep hunting to these individuals. The low percentage of known protest bids received (4%) may be indicative of the generally high level of cooperation and reliability existing within the remaining

responses.

The number of useable responses for determining net benefit through WTP technique was 1834, or 88% of all who returned questionnaires (n=2073). These included 90% (n=1722) of all resident respondents and 82% (n=351) of all nonresident respondents. The data collected represent 73% of all sheep hunters (73% of the residents and 70% of the nonresidents) who hunted during the August 10 to September 20 season of 1983.

Total and Projected Total Net Benefit Estimates

The sum of the net benefits for all hunters was about $1.8 million (n=1834) (Table 15). Residents were willing to pay more than $1.3 million (n=1546). Nonresidents were willing to pay nearly a half million dollars (n=288).

Hunters were willing to pay a median dollar amount of $625 (n=1834) in addition to their expenditures before deciding sheep hunting was too expensive. In this case, the median was a better measure of central tendency than the mean, $961 (SD=$1750), because the distribution of data was positively skewed (4.5) with a small group of individuals willing to pay large sums (Figure 8).

If all nonrespondents had the same median WTP by residency (see below) as respondents, then the net benefit for all who hunted in 1983 would be approximately $2,126,325 (n=2519). Total net benefit for residents, including nonrespondents, would be $1,523,075 (n=2107). Total net

Table 15. Summary statistics for Alaska Dall sheep hunters' maximum willingness to pay (WTP) for their hunt in 1983, by residency.

	Residents	Nonresidents	All Hunters
Median WTP	$375	$875	$625
Mean WTP	$836	$1,526	$955
SD	$1,235	$1,672	$1,335
Maximum	$20,000	$10,000	$20,000
Sum	$1,312,700	$438,625	$1,752,325
n	1546	288	1834
Projected Total WTP	$1,523,075	$603,250	$2,126,325
n	2,107	412	2519

Figure 8. Maximum dollar amount hunters were willing to pay beyond their expenditures for their Dall sheep hunt in Alaska, 1983, by residency.

benefit for nonresidents, including nonrespondents, would be $603,250 (n=412).

Variability in Willingness to Pay

The responses for WTP were highly variable despite the removal of known protest bids. Such strong variability needed to be investigated to determine if the responses were more than random or capricious. Although it is impossible to know what was in respondents' minds as they answered surveys, past researchers have found that WTP bids are often related to certain demographic characteristics plus the availability of substitutes (that is, other sheep hunting opportunities) (Cummings et al. 1988). The variability in distribution of WTP bids in this study was examined using variables which seemed likely to influence WTP. The following categorical demographic variables were used in nonparametric statistical analysis: success in taking a Dall sheep in 1983 (yes or no), income group, residency (resident or nonresident), hunt area, and, for resident hunters, the number of years of Alaska residency (<5 or ≥ 5).

Hunters who were successful at taking a sheep in 1983 were willing to pay more than hunters who were unsuccessful (Mann-Whitney $U=336048.5$; $p<0.05$; $n=1879$). Willingness to pay was also different according to income group. The median WTP bids of different income groups were significantly different (Kruskal-Wallis $X^2=167.0417$; $p<0.05$; $n=1819$).

Some variability in WTP also could be attributed to differences in hunt area regardless of residency. Hunters who went to the Brooks Range had the highest median WTP,

while hunters of the Kenai Mountain Range had the lowest median WTP bids (Kruskal-Wallis X^2=47.5276; $p<0.01$; n=1870) (Table 16). It is not known how the area hunted influenced WTP bids, but numerous unquantified factors, such as ease of travel, cost, the opportunity for success at killing a sheep, aesthetic hunting conditions, and opportunity to take a trophy ram may have been important. Hammit et al. (1989) found environmental (outdoors) and social (crowding and hunter behavior) to be the best predictors of a quality hunting experience and can be distinguished from the quality hunt determinants of animal population variables.

Residency was found to be another factor which influenced the central tendency of WTP. Resident hunters were willing to pay significantly less on average, $375 (n=1546), than were nonresident hunters, $875 (n=288) (Mann-Whitney U=185189.5; $p<0.01$; n=1879). These results suggest that nonresidents derive a greater net benefit from Dall sheep hunting in Alaska than do resident hunters because they are willing to pay more. Residents may have been less willing to spend additional money because of their comparatively lower incomes. Income is a common factor associated with WTP bids (Cummings et al. 1988). Residents also may have been influenced by the relative ease of foregoing a sheep hunt this year and planning to go next year, with the hope that another year's hunt would be no more expensive or income would be higher. Interpretations of differences between resident and nonresident WTP bids may be difficult because nonresidents may have included their assessment of additional benefits received from services, such as travel to the state and the services of a guide. Consequently, resident and nonresident hunting can be thought of as two different commodities with a similar goal,

Table 16. Median willingness to pay (WTP) bids by hunt areas of Alaska resident and nonresident Dall Sheep hunters for their 1983 hunts. Areas listed in order of highest to lowest median WTP for all hunters.

Hunt Area	All Hunters (n)	Residents (n)	Nonresidents (n)
BRR[1]	$875 (245)	$625 (173)	$1250 (72)
ARW[2]	$625 (31)	$625 (85)	$875 (46)
THW[3]	$625 (40)	$625 (38)	$625 (2)
ARE[4]	$625 (408)	$875 (359)	$625 (49)
WMR[5]	$625 (465)	$375 (395)	$875 (70)
CMR[6]	$375 (274)	$375 (240)	$875 (34)
TCW[7]	$375 (184)	$375 (160)	$875 (24)
KMR[8]	$375 (121)	$375 (115)	$1688 (6)

[1] Brooks Range
[2] Alaska Range West of Denali Natl. Park
[3] Tanana Hills, White Mtns.
[4] Alaska Range East of Denali Natl. Park
[5] Wrangell Mtns.
[6] Chugach Mtns.
[7] Talkeetna, Chulitna, Watana Mtns.
[8] Kenai Mtns.

to hunt Dall sheep.

Variability in WTP bids of resident hunters was further explored. Residents who had lived in Alaska five years or more were willing to pay more than residents who were relative newcomers (Mann-Whitney U=216754.4; $p<0.05$; n=1523). Residents who had more than one year of Dall sheep hunting experience were willing to pay more than first-time hunters (Mann-Whitney U=253001.5; $p<0.01$;n=1571).

Multiple regression and correlation analyses were used to explore the combined influence of demographic variables on WTP. The regression equation explaining the most variability showed the WTP of residents to be a function of the natural log of 1983 hunt expenditures, income and total number of sheep killed as independent variables (Table 17). The significance level of each of the variables in the regression equation was high ($p<0.01$). The amount of variability in resident WTP values explained by the regression analysis was not large ($r^2=0.296$). But, it can be viewed as relatively high given the categorical nature of many variables and the skewness of much of the data.

The natural log of 1983 hunt expenditures had a positive relationship with WTP and explained more variability in WTP than any other variable. Its presence can be interpreted to imply that residents who spent relatively large sums on their hunt were likely to be willing to spend even more before deciding not to go sheep hunting. Income, often a primary determinant of WTP (Cummings et al. 1988), was also important. The positive influence of the total number of sheep taken means that increasing WTP bids were associated with hunters who had

Table 17. Correlation matrix and multiple regression equation (t values in parentheses) of variables associated with willingness to pay (WTP) for Alaska resident hunters (n=1473). Some new variables have been created using natural logarithms (ln) transformations of original variables. From survey of Dall sheep hunters in Alaska, 1983.

	(ln) WTP	(ln) EXPEND	INCOME	KILLS
(ln)WTP	1.000	-	-	-
(ln)EXPEND	.519	1.000	-	-
INCOME	.285	.283	1.000	-
KILLS	.185	.190	.177	1.000

$$\ln WTP = 2.821 + 0.44(\ln EXPEND) + 5.65 \times 10^{-6}(INCOME) + 0.04(KILLS)$$
$$(t\ value) = (19.61) \quad (20.18) \quad (6.32) \quad (3.17)$$

$r^2 = .29590$
$F = 207.04734$
$n = 1481$
$p<0.01$

(ln)WTP - natural logarithm of willingness to pay
(ln)EXPEND - natural logarithm of 1983 hunt expenditures
INCOME - total household income
KILLS - total number of Dall sheep taken

more past successful hunts. Lower WTP bids were associated with resident hunters who spent less on their hunt, had lower incomes and few past successful hunts.

Total years of Dall sheep hunting experience and total number of sheep killed were not independent variables. Although either could have been used in the equation, the latter variable was found to effect more change in the F value of the equation and explain more variability, and so was used in the final equation. Years of residency in Alaska as a variable did not significantly improve the goodness of fit of the equation.

The three categorical variables incorporated into a general linear test using the full and reduced model technique (Neter et al. 1985) evaluated whether the WTP of residents was significantly higher if residents killed a sheep in 1983, they had more than one year of hunting experience, and/or they had lived in Alaska five years or more. The regression analysis did not show these variables had a significant influence on higher WTP bids. Because nonparametric statistics were able to show significant differences in WTP bids due to these variables (Table 17), amount of variability (skewness) and the uneven sized categories of the WTP data made the regression analyses less effective.

Similar nonparametric and multiple regression analyses were applied to the nonresident data. Nonresident hunters with more than one year of Dall sheep hunting experience (n=68) did not have significantly greater WTP bids than first-time nonresident hunters (n=237)(Mann-Whitney $U=8047.0$; $p>0.05$;n=305).

Nonresident hunters were found to be willing to pay more if they had higher incomes. Median WTP values were found to be significantly different between three income groups formed using information from the frequency distribution on nonresident income (Figure 5). Hunters with incomes less than $45,000 for whom a Dall sheep hunt in Alaska was possibly a one time experience were willing to pay a median WTP of $625, while hunters with incomes of $45,000 to $115,000 had a median WTP of $875, and hunters with incomes greater than $115,000 including the open-ended category of $145,000+ had a median WTP of $1250 (Kruskal-Wallis X^2= 18.4716; $p<0.01$; n=287).

The combined effect of these demographic variables could not explain much variability in multiple regression analyses. The categorical nature and skewness of variables probably contributed to the low coefficient of determination (Table 18). The highest correlation values were obtained using the natural logarithm form of WTP. Income was the only variable with a correlation value greater than 0.2.

Additional variability in nonresident WTP may be due to at least two factors: presence of substitutes and lack of homogeneity. Some nonresidents commented they would go to Canada to hunt Dall sheep if the price of hunting in Alaska became too high. Canada could be a substitute for some nonresident hunters with an average price of $8000 for comparable goods and services (N. Barichello and J. Carey pers. commun.). A favorable monetary exchange rate would act as an incentive for nonresident sheep hunters to travel to Canada for their hunt. No Alaska resident hunters suggested Canada was a substitute probably because they would lose their resident status, have to hire guides, and

Table 18. Correlation matrix of variables associated with willingness to pay (WTP) for Alaska nonresident hunters (n=246). Some new variables have been created using natural logarithm (ln) transformations of original variables. From survey of Dall sheep hunters in Alaska, 1983.

	(ln)WTP	EXPEND	INCOME	KILLED	EXPR
(ln)WTP	1.000	-	-	-	-
EXPEND	.167	1.000	-	-	-
INCOME	.207	.311	1.000	-	-
KILLED	-.027	-.103	.107	1.000	-
EXPR	-.045	.021	.021	.056	1.000

lnWTP = 6.58303 + 4.95529(INCOME)
(t values) = (48.607) (3.303)

r^2 = .04280
F = 10.90964
n = 246
P = <0.01

(ln)WTP - natural logarithm of willingness to pay
EXPEND - 1983 hunt expenditures
INCOME - total household income
KILLED - killed a sheep on 1983 hunt (yes=1,no=0)
EXPR - years of experience of hunting Dall Sheep in Alaska

incur greater costs. These data suggest that the price elasticity of demand for nonresidents is greater than for resident hunters.

Lack of social homogeneity also may have increased variability in nonresident WTP. The total number of nonresident respondents was only 288. The values assigned to the hunt by each of these hunters were based in part on a wide range of variables, a few of which were studied in this survey, which have been found by sociologists to influence economic decisions of Americans (Weiss 1988). Consequently, there were too few nonresident hunters coming from too many different backgrounds to easily find a linear relationship based on the information collected in this study.

Comparisons to Other Studies

Several other studies have examined the net benefit of sheep hunting in other states and these can be compared to these results (Table 19).

The values for hunting bighorn sheep (subspecies not identified) in Idaho were based on an indirect measure (a modified travel cost analysis) of net benefit and based on information collected in 1982 (Loomis et al. 1985). No distinction was made between values of resident and nonresident hunters.

Reid (1985b) collected CVM data on hunter values for mountain sheep hunting in 1981 and provided indices to interpret data in 1983 dollars. No net benefit data from nonresident hunters were available.

Table 19. Comparison of net benefit of sheep hunting to hunters from different states/provinces expressed as willingness to pay (WTP), by residency where available.

State	WTP All Hunters (n)	WTP Residents (n)	WTP Nonresidents (n)
Alaska[1]		$625	$375
$857			
Dall sheep	(1834)	(1546)	(288)
British Columbia[2]	--	$516	--
(no species identified)		(1586)	
Idaho[3]	$329	--	--
(no species identified)	(127)		
Nevada[4]			
Desert	$1615	--	--
Bighorn	(192)		
Rocky Mtn	$2584	--	--
Bighorn	(3)		
California	$1500	--	--
Bighorn	(3)		
(all species)	$1572	$1572	$2630
	(197)	(?)	(?)

[1] Median values used from this study.
[2] In Canadian dollars. Reid, R. 1985b.
[3] Donnelly et al. 1985.
[4] Kay F. 1988.

Kay (1988) gathered CVM data on hunters' values for hunting three subspecies of bighorn sheep in Nevada. All hunting opportunities were restricted to limited entry permits. In 1984 and 1985, the years he collected data, permits for Rocky Mountain and California bighorn sheep (three each) were newly available. There were 192 permits available for desert bighorn sheep. The high dollar amounts for hunters' willingness to pay reflect the uniqueness of the permit to hunt the larger-horned Rocky Mountain subspecies.

The value Alaska residents placed on their hunt were more similar to the values of resident sheep hunters of British Columbia than of Nevada. Hunting conditions in British Columbia are similar to those in Alaska while hunting opportunities in Nevada are extremely limited (Table 1). The relative rarity of hunting opportunities in Nevada may be reflected in the high WTP values.

CONTINGENT VALUATION -- WILLINGNESS TO SELL

The willingness to sell (WTS) contingent valuation method (CVM) for determining net benefit to the consumer was applied through a series of questions asking what price hunters would charge for the sale of their opportunity to hunt Dall sheep in Alaska. The responses theoretically represent an economic expression of the benefit of sheep hunting to hunters and the associated benefit of land remaining as sheep habitat. The series of questions asked hunters to estimate their value of the opportunity to hunt sheep under the following time and area specific conditions:

1) in 1984, in their 1983 hunt area, (WTS-1),

2) in 1984, in any hunt area in Alaska, (WTS-2),
3) all future opportunities in their 1983 hunt area, (WTS-3),
4) all future opportunities in any hunt area in Alaska, (WTS-4),

Successful measurement of net benefit is dependent upon receiving responses that approximate consumer action under similar, but real circumstances. In other surveys, WTS questions have elicited some strong and emotional responses from respondents expressed as "protest bids" ($0 or extreme dollar amounts). These responses are thought by some economic theorists to be to respondents' lack of familiarity with pricing a non-market item, the psychological affect of loss, and reaction to a perceived threat to personal freedom or rights (Coursey et al. 1987, Cummings et al. 1988).

The design of the questionnaire addressed this challenge. The paragraph presenting a WTS question tried to help the respondent envision the outcome ("If you were given this amount of money, you'd sell! And if you sold your hunting opportunity, you could not hunt..."). The questions were described as hypothetical and were called "what if" questions to reduce threatening aspects while reinforcing their hypothetical nature. Hunters were reassured that their answers were anonymous and important for determining the economic value of Dall sheep hunting to them (see Appendices A and B).

Response Rate

Response rates showed a large portion of hunters were willing to respond to WTS questions, but indicated respondents had increasing difficulty as the good being

valued became more complicated with each succeeding question. Eighty-two percent of all hunters (n=2073) responded to the first question (WTS-1) and about 71% answered the last question (WTS-4). Further examination found that not all responses were credible with some extreme dollar amounts, $10 million or $0, used to protest the questions. And, although the response rate was high, the amount of variability in WTS responses shed doubt on the validity of the responses. Because no money was actually exchanged in this mail survey, the bids could not be verified to determine which dollar bids were legitimate and which were measurements of additional and more closely held values. For example, $0 could either be a protest bid or indicate future opportunities to hunt sheep were without value for those who only wanted to hunt sheep once. Also, it was difficult to determine without verification the dollar amount beyond which an individual's response exceeded credibility.

Hunters' comments were used as a criterion to separate protest bids from legitimate bids. A majority (59%) of questionnaires with or without dollar bids contained comments to indicate values (Appendix F), including the following:

"Priceless" (31%)
"Hunting is a right and is priceless" (31%)
"I refuse to answer these questions because sheep hunting is too important" (3%).

A few hunters (4%) also made comments other than "priceless" that may have influenced their bids which included:

"I do not plan to hunt in that area in '84."
"I do not plan to hunt sheep at all in '84."
"This area was not my first choice."
or "Sheep was not my primary reason for hunting.".

For analysis, resident and nonresident hunters who commented on the priceless value of Dall sheep hunting, whether they gave a dollar amount or not, were combined into a group, "Priceless". These responses were compared to those who gave bids without indication of their intent. The latter group, called "Value", was thought to contain more credible WTS bids using the assumption that most hunters would write comments about strong emotional responses. Although some protest bids probably remained in the "Value" group, their effect was diminished. In addition, some legitimate bids may have remained in the "Priceless" group.

Sixty-nine percent of all respondents (n=2083) were in the "Value" group. Because of differences between resident and nonresident hunting, the responses were separated by residency. Sixty-seven percent (n=1147) of all resident respondents and 76% (n=283) of all nonresident respondents were in the "Value" groups. These represented 54% and 69% of all residents and nonresidents, respectively, who hunted Dall sheep in Alaska in 1983.

The variability in WTS responses was examined using several techniques, including multiple regression analyses and nonparametric tests on "Priceless" and "Value" groups by residency with the use of information from demographic data. Midpoints in the categorical responses to WTS were used to facilitate analysis. A summary discussion of WTS analyses follows the presentation of the results to individual

questions WTS-1 through WTS-4.

Willingness to Sell 1984 Hunt in 1983 Area (WTS-1)

Eighty-two percent of questionnaire respondents answered this question to indicate their values of one year's opportunity to hunt Dall sheep in a specific area (Figure 9, Table 20). Those who expressed the priceless value of Dall sheep hunting were less likely to respond. Similar percentages of resident and nonresident hunters did not respond to the question.

Residents

There was little relationship between residents' "Value" group responses to WTS-1 and variables which seemed likely to be influential in regression analyses (Table 21). All correlation values were less than 0.12 and the regression equation accounted for little variability (r^2=0.013). No equation could be built by the data analysis program for hunters in the "Priceless" group or for all resident hunters combined. This is probably due to the relatively high number of $0 and >$5000 values.

Consequently, multiple regression analyses of all WTS data were discontinued.

The validity of residents' WTS-1 responses was explored using nonparametric statistics. A significant difference was found between median prices stated by "Value" and "Priceless" groups of resident hunters (Mann-Whitney U=171310.0; $p<0.01$; n=1421). The variability in residents' responses was further explored using data on additional demographic characteristics which were thought to have

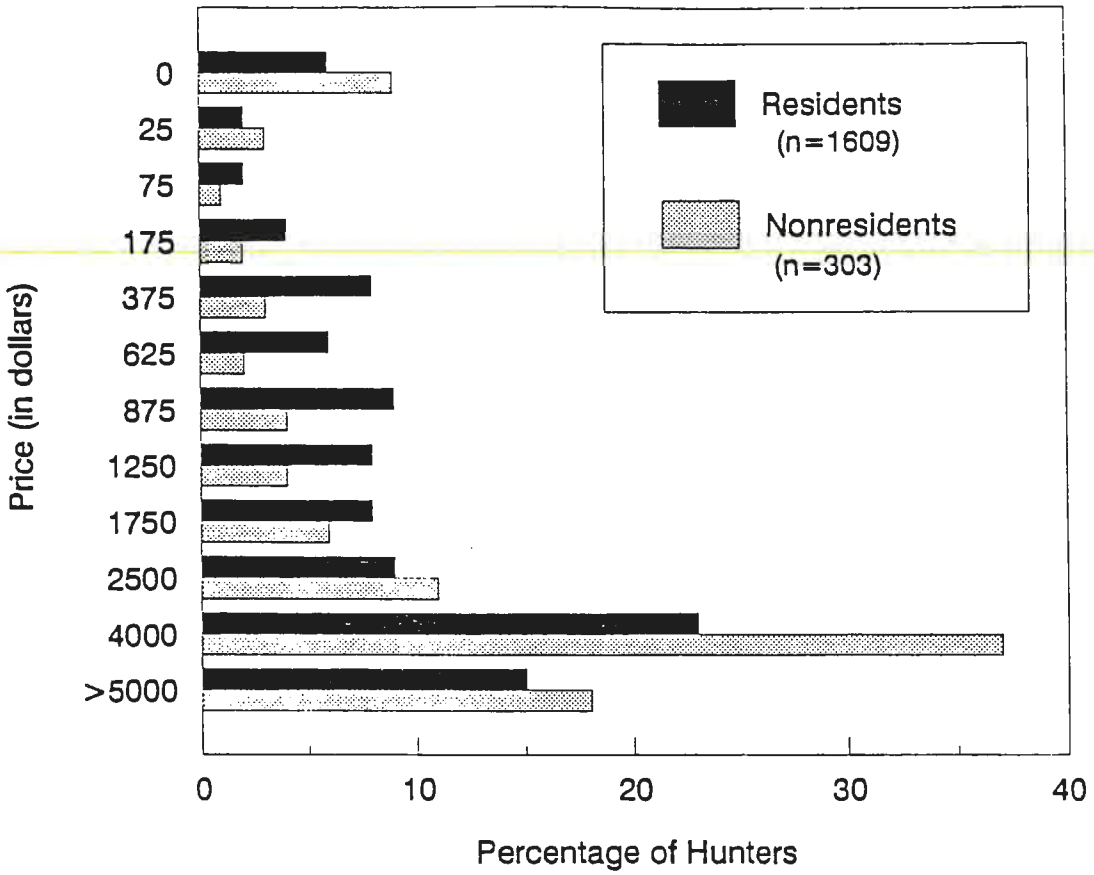


Figure 9. Dall sheep hunters' responses, by residency, to "What is the minimum price you would charge for the sale of your 1984 opportunity to hunt Dall sheep in Alaska in your 1983 hunt area?" (WTS-1). From survey of Dall sheep hunters in Alaska, 1983.

Table 20. Summary statistics for responses by residency to the question "What is the lowest price you'd charge for the sale of your opportunity to hunt Dall Sheep in 1984 in your 1983 hunting area?" (WTS-1). Also shown are the percentages who responded $0 or did not respond. Similar statistics are also given by hunter groups based on presence or absence of comments on the "pricelessness" of Dall Sheep hunting in Alaska.

	Residents	Nonresidents
All Hunters		
Median	$ 1,750	$ 4,000
Mean	$22.8 million	$ 23,211
SD	$46 million	$276,002
n	1,722	351
$0(%)	90(5%)	25(7%)
Missing(%)	302(18%)	67(19%)
"Value" - Hunters did not comment "priceless"		
Median	$ 1,750	$ 4,000
Mean	$ 25,298	$ 26,605
SD	$214,194	$298,954
n	1,147	283
$0(%)	43(4%)	20(7%)
Missing(%)	108(9%)	41(15%)
"Priceless" - Hunters did comment "priceless"		
Median	$ 2,500	$4,000
Mean	$8.4 million	$3,336
SD	$88.7 million	$2,789
n	575	68
$0(%)	47(8%)	5(7%)
Missing(%)	194(34%)	26(38%)

Table 21. Correlation matrix and multiple regression equation for willingness to sell (WTS-1) of resident Dall sheep hunters who did not comment on the priceless quality of the hunt ("Value" group) in Alaska, 1983.

	WTS-1	Income	Yrs Res	ln (Expend)	Kills	Killed
WTS-1	1.000	--	--	--	--	--
Income	-0.004	1.000	--	--	--	--
Yrs Res	0.037	0.154	1.000	--	--	--
ln (Expend)	-0.113	0.243	-0.000	1.000	--	--
Kills	-0.018	0.149	0.408	0.186	1.000	--
Killed	-0.004	-.020	-0.006	-0.202	-0.250	1.000

Resident "Value" WTS-1 = 151864.71 - 19050.09[ln(Expend)]
(t value) (4.222) (-3.620)

r^2 = 0.03
F = 13.10
p<0.01
n = 1011

WTS-1 - response to the question "What is the lowest price you would charge for the sale of your opportunity to hunt Dall sheep in 1984 in your 1983 hunt area?"

Income - total annual household income

Yrs Res - total years of residency in Alaska

ln(Expend) - natural logarithm of 1983 hunt expenditures

Kills - total number of sheep killed

Killed - killed a sheep on the 1983 hunt (yes=1, no=0)

influenced hunters' WTS values. The variables included: the number of years of Dall sheep hunting experience (one or more than one), whether the hunter took a sheep on the 1983 hunt (yes or no), and the number of years of residency in Alaska (less than five years, or five or more years). The dichotomous responses for each variable were used to separate resident hunters in "Priceless" and "Value" groups into eight demographic divisions each according to combinations of the three variables (Table 22). Kruskal-Wallis (a nonparametric analysis of variance) was used to test if the distributions of responses to WTS-1 were significantly different among the eight demographic divisions.

Responses of resident hunters in the "Value" group were analyzed first. The distributions of the responses by demographic division were found to vary significantly (Kruskal-Wallis $x^2=77.562$; $p<0.01$; n-1039) (Table 23). The Kruskal-Wallis test for multiple comparisons identified which demographic divisions had significantly different distributions ($p<0.01$) (Table 23). High median WTS-1 values appeared to be primarily associated with hunters who took a sheep in 1983 and had more than one year of Dall sheep hunting experience (divisions number 7 and 8). The number of years of residency in Alaska did not seen to be as important.

Analysis of the WTS-1 bids of residents in the "Priceless" group showed a similar relationship between high bids and more than one year of Dall sheep hunting experience plus taking a sheep on the 1983 hunt. Significant differences in the distribution of responses were found, but were not as strong as in the "Value" group(Kruskal-Wallis

Table 22. Eight demographic divisions for resident Dall sheep hunters' responses to willingness to sell questions.

Demographic Division #	Yrs Expr[1]	Kill '83[2]	Yrs Res[3]
1	1	No	<5
2	1	No	≥5
3	1	Yes	<5
4	1	Yes	≥5
5	>1	No	<5
6	>1	No	≥5
7	>1	Yes	<5
8	>1	Yes	≥5

[1] Yrs Expr - Number of years of Dall sheep hunting experience in Alaska (1 or >1).
[2] Kill'83 - Dall sheep killed on 1983 hunt (yes or no).
[3] Yrs Res - Number of years of Alaska residency (<5 or ≥5).

Table 23. Median price by demographic division to WTS-1 by resident Dall sheep hunters who did not comment on the "priceless" quality of the hunt ("Value" group). Divisions are listed by rank, highest to lowest (Kruskal-Wallis test for multiple comparisons). Matrix shows which divisions had significantly different distributions ($p<0.01$). Key to demographic divisions found in Table 22. WTS-1 is "What is the lowest priced you'd charge for the sale of your opportunity to hunt Dall sheep in 1984 in your 1983 hunt area?"

Median Price	Demographic Division #	n	Percent Missing
$2,500	8	195	10%
$2,500	7	28	4%
$1,750	4	73	8%
$1,750	3	77	7%
$1,750	6	368	7%
$1,750	5	54	9%
$ 875	1	181	11%
$ 875	2	169	15%

Demographic Division Matrix
(Kruskal-Wallis Multiple Comparisons, $p<0.05$)

	1	2	3	4	5	6	7	8
1	-							
2	N	-						
3	Y	Y	-					
4	Y	Y	N	-				
5	Y	Y	N	N	-			
6	Y	Y	N	N	N	-		
7	Y	Y	N	N	N	N	-	
8	Y	Y	N	N	Y	N	N	-

Y - Yes, the pair are significantly different.
N - No, the pair are not significantly different.

x^2=25.540; p<0.01; n=380). This could be due to increased variability associated with spurious responses as well as due to the high number (27%-41%) of missing values associated with those who said "priceless" (Table 24).

The WTS-1 question employed a hunt area designation and this factor may have contributed to the variability in WTS bids. Significant differences were found in responses by hunt area (Table 25). A higher Kruskal-Wallis X^2 statistic was obtained using only the responses of hunters in the "Value" group, indicating a greater difference in the distribution of responses by hunt area in this group. The highest median value was associated with the Brooks Range, while the lowest median value was associated with the Kenai Mountains.

Nonresidents

No significant differences were found in the distribution of responses by either "Priceless" or "Value" group of median nonresident hunters (Mann-Whitney U=5041; p>0.05; n=286) (Table 20). However, many (38%) of those who said "priceless" declined to give a WTS-1 value and the smaller sample sizes may have influenced the analysis. No demographic groups were formed for nonresident hunters. The distribution of responses by hunt area was examined and no significant differences were found (Table 25).

Willingness to Sell 1984 Hunt in Any Area (WTS-2)

This question was similar to the previous question, WTS-1, but without a hunt area designation. A difference in the manner in which data for this question were collected (without dollar amount categories, Appendices A and B)

Table 24. Median price by demographic division to WTS-1 by resident Dall sheep hunters who commented on the "priceless" quality of the hunt ("Priceless" group). Divisions are listed by rank, highest to lowest (Kruskal-Wallis test for multiple comparisons). Matrix shows which divisions had significantly different distributions ($p<0.01$). Key to demographic divisions found in Table 22 WTS-1 is "What is the lowest price you'd charge for the sale of your opportunity to hunt Dall sheep in 1984 in your 1983 hunt area?"

Median Price	Demographic Division #	n	Percent Missing
$4,000	7	21	19%
$4,000	8	98	40%
$4,000	5	26	27%
$4,000	4	37	35%
$1,250	6	197	33%
$1,250	3	35	37%
$1,250	2	90	28%
$1,250	1	69	41%

Demographic Division Matrix
(Kruskal-Wallis Multiple Comparisons, $p<0.01$)

	1	2	3	4	5	6	7	8
1	-							
2	N	-						
3	N	N	-					
4	N	N	N	-				
5	Y	Y	N	N	-			
6	Y	N	N	N	Y	-		
7	Y	Y	N	N	N	N	-	
8	Y	Y	N	N	N	N	N	-

Y - Yes, the pair are significantly different.
N - No, the pair are not significantly different.

Table 25. Median price, by residency, by hunt area, and by hunter group, charged by residents and nonresidents who hunted Dall sheep in Alaska in 1983 for the sale of their future opportunity to hunt Dall sheep in the 1983 hunt area (WTS-1). Hunter groups based on the presence or absence of expression of the "pricelessness" of Dall sheep hunting.

	Residents		Nonresidents	
Hunt Area	All[1] (n)	"Value"[2] (n)	All[3] (n)	"Value"[4] (n)
ARE[5]	$1,750 (391)	$1,750 (268)	$4,000 (50)	$4,000 (50)
ARW[6]	$1,750 (97)	$1,750 (69)	$2,500 (53)	$2,500 (45)
BRR[7]	$2,500 (192)	$2,500 (114)	$4,000 (78)	$4,000 (63)
CMR[8]	$1,250 (254)	$ 875 (170)	$2,500 (40)	$2,500 (31)
KMR[9]	$ 875 (126)	$ 875 (85)	$1,750 (8)	$1,750 (7)
TCW[10]	$1,250 (174)	$1,250 (113)	$4,000 (27)	$4,000 (23)
THW[11]	$1,250 (40)	$1,250 (24)	- (2)	- (0)
WMR[12]	$1,750 (295)	$1,500 (295)	$4,000 (250)	$4,000 (227)
Statewide	$1,750 (1,420)	$1,750 (1,039)	$4,000 (284)	$4,000 (242)

Kruskal-Wallis:

1 $x^2=16.920$, $p<0.05$, $n=1376$

2 $x^2=30.302$, $p<0.01$, $n=1026$

Table 25. Continued.

[3] $x^2=9.729$, $p>0.05$, $n=269$

[4] $x^2=9.047$, $p>0.05$, $n=231$

[5] Alaska Range East of Denali Natl. Park

[6] Alaska Range West of Denali Natl. Park

[7] Brooks Range

[8] Chugach Mtns.

[9] Kenai Mtns.

[10] Talkeetna, Chulitna, Watana Mtns.

[11] Tanana Hills, White Mtns.

[12] Wrangell Mtns.

combined with a characteristic of the computer analysis program made it impossible to distinguish a missing value from a $0 response. As a result, these two responses were combined by the program and a large increase in $0 bids appeared to exist (26% for residents and 27% for nonresidents). The number of nonrespondents was assumed to be similar to that found in WTS-1 (18% for residents and 19% for nonresidents). The data were placed in demographic categories (residents, nonresidents; "Priceless", "Value"; demographic divisions) for comparative purposes.

Residents

Residents' responses to WTS-2 decreased in dollar value possibly due to an increase in the number of $0 protest bids (Figure 10, Table 26). A significant difference was found between "Priceless" and "Value" groups of resident hunters (Mann-Whitney U=163889; $p<0.01$; n=1435). The median value for residents who said "priceless" declined to the $175 category due to the influence of $0 bids. Most of the $0 or missing values can be attributed to hunters who said "Priceless", regardless of residency.

The responses of "Value" and "Priceless" groups of resident hunters were examined using the eight demographic divisions described above. A significant difference was found in the distribution of responses to WTS-2 by the eight demographic divisions of residents in the "Value" group, those who did not comment "priceless" on the questionnaires (Kruskal-Wallis $x^2=54.193$; $p<0.01$; n=1145) (Table 27). Again, higher median bids seemed to be associated with hunters who had than one year of hunting experience and/or were successful in killing a sheep on the 1983 hunt (Kruskal-Wallis test for multiple comparisons; $p<0.01$). No

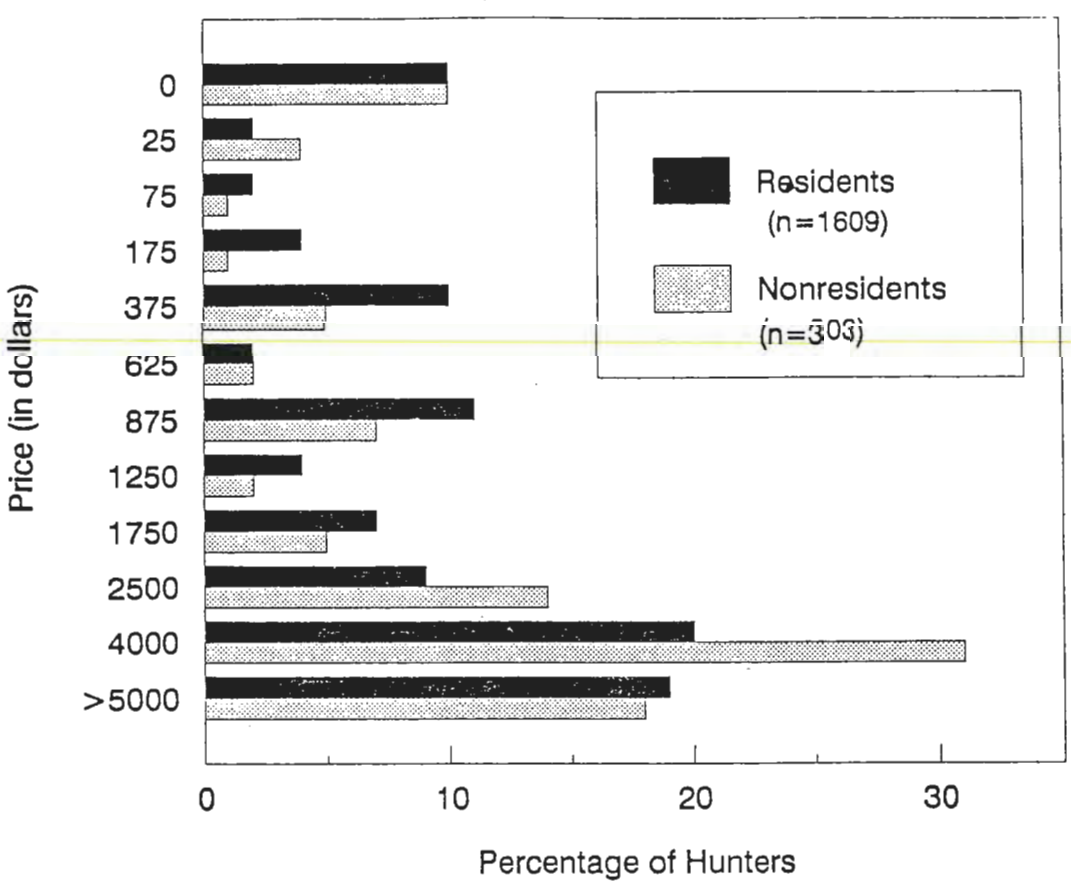


Figure 10. Dall sheep hunters' responses, by residency, to "What is the minimum price you would charge for the sale of your 1984 opportunity to hunt Dall sheep in any mountain range in Alaska?" (WTS-2). From survey of Dall sheep hunters in Alaska, 1983.

Table 26. Summary statistics for responses by residency to the question "What is the lowest price you'd charge for the sale of your opportunity to hunt Dall sheep in 1984 in any mountain range in Alaska?" (WTS-2). Statistics also given by hunter groups based on presence or absence of comments on the pricelessness of Dall Sheep hunting in Alaska. Percent of $0 bids (*) and missing data (*) estimated (see text)

	Residents	Nonresidents
All Hunters		
Median	$ 1,750	$ 4,000
Mean	$3 million	$ 18,820
SD	$51 million	$245,802
n	1,722	351
$0(%)*	139(8%)	29(8%)
Missing(%)* 67(19%)	302(18%)	
"Value" - Hunters did not comment "priceless"		
Median	$ 1,250	$ 4,000
Mean	$946,689	$ 22,669
SD	$20.9 million	$273,679
n	1,147	283
$0(%)*	108(9%)	20(8%)
Missing(%)* 41(15%)	64(6%)	
"Priceless" - Hunters did comment "priceless"		
Median	$ 175	$ 4,000
Mean	$7.5 million	$ 2,801
SD	$83.4 million	$ 6,570
n	575	68
$0(%)* 9(13%)	174(30%)	
Missing(%)* 26(38%)	194(34%)	

significant difference was found between bids of the eight demographic divisions of residents who said "Priceless" (Kruskal-Wallis x^2=12.0343; p>0.05; n=575) (Table 28). The median amount for all "Priceless" demographic divisions was $0, probably due to protest bids and missing values which could not be separated in analysis.

Nonresidents

Although nonresidents maintained a $4000 median response to WTS-2, there was a significant difference in the distribution of responses between the "Priceless" and "Value" groups (Mann-Whitney U=3659.0; p<0.01; n=262) (Figure 10, Table 26). It is notable that the responses of those in the nonresident "Value group" were higher than those in the "Priceless" group, suggesting, as in the results to the first WTS question, the definitions for the two groups do not adequately address extremely high bids from nonresidents.

Willingness to Sell All Future Hunts in 1983 Area (WTS-3)

The third question asked for the minimum dollar amount needed in trade (or compensation) for all future hunting opportunities in the hunters' 1983 hunt area. This type of question is appropriate when an alternative use for sheep habitat precludes the possibility of coexistence. An example of this (which was not given to questionnaire recipients) would be the transmission of debilitating or fatal diseases to wild sheep, resulting in heavy population losses and the elimination of future hunting opportunities.

The format for this questions allowed for the distinction between $0 bids and missing responses. Data

Table 27. Median price by demographic division to WTS-2 by resident Dall sheep hunters who did not comment on the "priceless" quality of the hunt ("Value" group). Divisions listed by rank, highest to lowest (Kruskal-Wallis test for multiple comparisons). Matrix shows which divisions had significantly different distributions ($p<0.01$). Key to demographic divisions found in Table 22. WTS-2 is "What is the lowest price you'd charge for the sale of your opportunity to hunt Dall sheep in 1984 in any mountain range in Alaska?"

Median Price	Demographic Division #	n	Percent Missing
$2,500	7	28	7%
$1,750	6	368	11%
$2,500	8	195	14%
$ 875	3	77	13%
$ 875	4	73	14%
$ 875	5	54	19%
$ 625	2	169	21%
$ 625	1	181	19%

Demographic Division Matrix
(Kruskal-Wallis Multiple Comparisons, $p<0.01$)

	1	2	3	4	5	6	7	8
1	-							
2	N	-						
3	Y	N	-					
4	N	N	N	-				
5	N	N	N	N	-			
6	Y	Y	N	Y	Y	-		
7	Y	Y	N	N	N	N	-	
8	Y	Y	N	N	Y	N	N	-

Y - Yes, the pair are significantly different.
N - No, the pair are not significantly different.

Table 28. Median price by demographic divisions to WTS-2 by resident Dall sheep hunters who commented on the "priceless" quality of the hunt ("Priceless" group). Key to demographic divisions found in Table 22. WTS-2 is "What is the lowest price you'd charge for the sale of your opportunity to hunt Dall sheep in 1984 in any mountain range in Alaska?"

Median Price	Demographic Division #	n	Percent Missing
$0	7	21	76%
$0	5	26	65%
$0	3	35	71%
$0	8	98	82%
$0	6	197	83%
$0	4	37	76%
$0	2	90	89%
$0	1	69	81%

were analyzed as above, dividing responses according to demographic categories (resident, nonresident; "Priceless", "Value"; demographic divisions) for comparative purposes.

Residents

The median value of all resident bids for WTS-3 was $6000 (Figure 11, Table 29). Mean bid values for residents declined while the variability around the mean (standard deviation) increased with the inclusion of extreme values when compared to responses to WTS-1. Thirty percent of all resident hunters declined to respond. Most (72%) of these also commented "priceless" although no significant difference was found between "Priceless" and "Value" groups (Mann-Whitney U=110950.0; $p>0.05$; n=1229). The percent of those answering $0 declined, suggesting hunters chose to forego responding rather than give a $0 protest bid.

There were significant differences in resident hunters' WTS-3 bids among the eight demographic divisions of the "Value" group (Kruskal-Wallis $x^2=66.7981$; $p<0.01$; n=1008) (Table 30). Higher bids seemed to be primarily associated with hunters who had more than one year of Dall sheep hunting experience. There were also significant differences in resident WTS-3 bids among the eight demographic divisions of the "Priceless" group (Kruskal-Wallis $x^2=28.3518$; $p<0.01$; n=220) (Table 31). A high percentage of missing values made similar analysis of those in the "Priceless" group questionable.

A significant difference was found between resident bids by hunt area, but only between those in the "Value" group (Table 32). Hunters who hunted the Brooks Range gave the highest bids while hunters from the Chugach Mountains

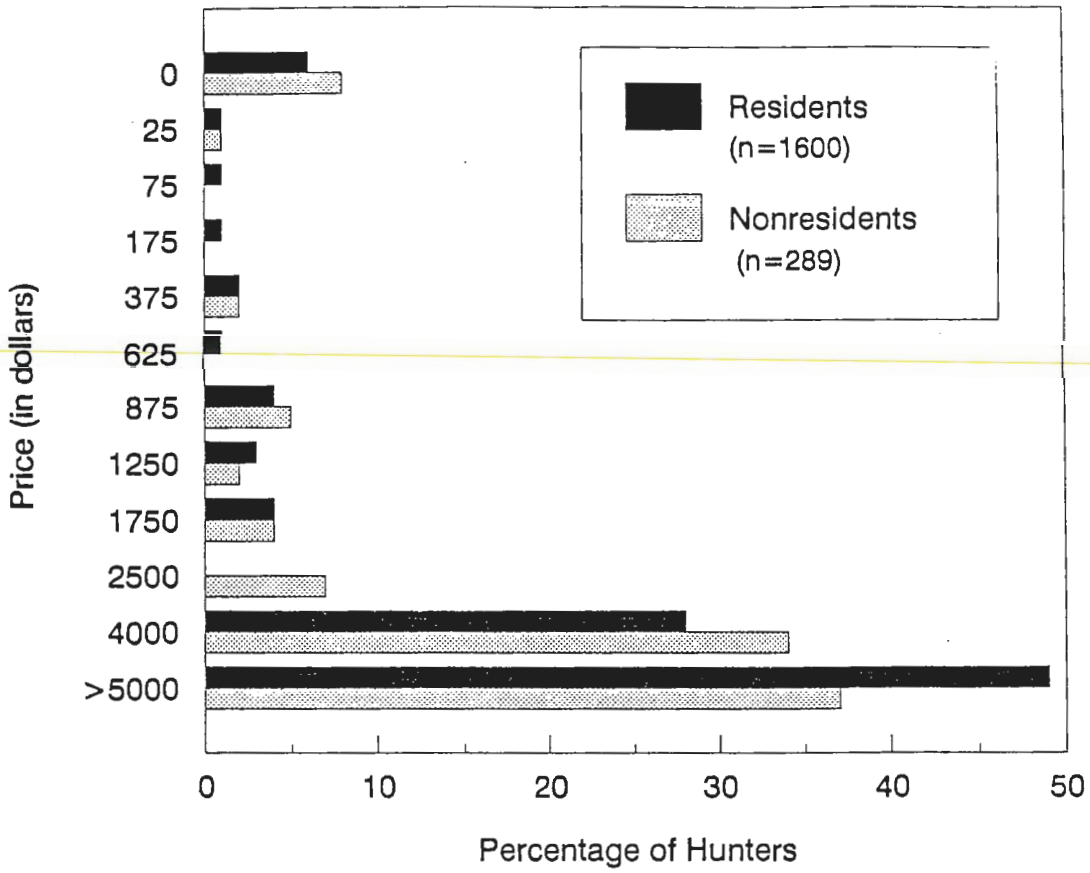


Figure 11. Dall sheep hunters' responses, by residency, to "What is the minimum price you would charge for the sale of all of your future opportunities to hunt Dall sheep in Alaska in your 1983 hunt area?" (WTS-3). From survey of Dall sheep hunters in Alaska, 1983.

Table 29. Summary statistics for responses by residency to the question "What is the lowest price you'd charge for the sale of all of your future opportunities to hunt Dall sheep in your 1983 hunting area?" (WTS-3). Statistics also given by hunter groups based on presence or absence of comments on the pricelessness of Dall sheep hunting in Alaska.

	Residents	Nonresidents
All Hunters		
Median	$ 6,000	$ 4,000
Mean	$13.5 million	$182,087
SD	$110 million	$2.2 million
n	1,722	351
$0(%)	74(4%)	20(6%)
Missing(%)	493(29%)	
101(29%)		
"Value" - Hunters did not comment "priceless"		
Median	$ 4,000	$ 4,000
Mean	$9.3 million	$175,164
SD	$91.5 million	$2.3 million
n	1,147	283
$0(%)	37(3%)	14(5%)
Missing(%)	139(12%)	
56(20%)		
"Priceless" - Hunters did comment "priceless"		
Median	$ 10,000	$ 4,000
Mean	$32.4 million	$249,717
SD	$169 million	$512,557
n	575	68
$0(%)	37(6%)	6(9%)
Missing(%)	354(62%)	
45(66%)		

Table 30. Median price by demographic divisions to WTS-3 by resident Dall sheep hunters who did not comment on the "priceless" quality of the hunt ("Value" group). Divisions listed by rank, highest to lowest (Kruskal-Wallis test for multiple comparisons). Matrix shows which divisions were significantly different ($p<0.01$). Key to demographic divisions found in Table 22. WTS-3 is "What is the lowest price you'd charge for the sale of all of your future opportunities to hunt Dall sheep in your 1983 hunting area?"

Median Price	Demographic Division #	n	Percent Missing
$10,000	8	195	14%
$10,000	6	368	10%
$ 4,000	7	28	4%
$10,000	4	73	11%
$ 4,000	5	54	13%
$ 4,000	3	77	8%
$ 4,000	2	169	18%
$ 4,000	1	181	12%

Demographic Division Matrix
(Kruskal-Wallis Multiple Comparisons, $p<0.01$)

	1	2	3	4	5	6	7	8
1	-							
2	Y	-						
3	Y	N	-					
4	Y	N	N	-				
5	Y	N	N	N	-			
6	Y	Y	Y	N	N	-		
7	Y	N	N	N	N	N	-	
8	Y	Y	Y	Y	Y	N	N	-

Y - Yes, the pair are significantly different.
N - No, the pair are not significantly different.

gave the lowest.

Nonresidents

Nonresident hunters' median bid value for WTS-3 remained at $4000 which may be related to the intention of most nonresidents hunters to only hunt Dall sheep in Alaska once or twice more in their lifetime (Figure 11, Table 29). The values for the mean and standard deviation for all nonresidents increased indicating that some individuals submitted very large bids in response to this question.

One third of all nonresident respondents declined to respond to this question, the same percentage as resident hunters. Most of the nonrespondents commented "Priceless". Not all protest bids were confined to the "Priceless" group as indicated by the higher standard deviation ($2.3 million) for the "Value" group. There was no significant difference between bids from nonresident "Value" and "Priceless" groups (Mann-Whitney U=2507.0; $p>0.05$; n=250).

There was no significant difference in nonresident bids by hunting area (Table 32). One of the two nonresident hunters who hunted the Tanana Hills, White Mountains submitted a $0 bid accompanied by comments which indicated it was a protest bid, while the other nonresident did not respond.

Willingness to Sell All Future Hunts in Any Area (WTS-4)

This question, like the previous question, is appropriate to use when it is necessary to make choices which, for most purposes, result in a permanent change. It is difficult to imagine a situation which left no Dall sheep

Table 31. Median price by demographic division to WTS-3 by resident Dall sheep hunters who commented on the "priceless" quality of the hunt ("Priceless" group). Divisions listed by rank, highest to lowest (Kruskal-Wallis test for multiple comparisons). Matrix shows which divisions were significantly different ($p<0.01$). Key to demographic divisions found in Table 22. WTS-3 is "What is the lowest price you'd charge for the sale of all of your future opportunities to hunt Dall sheep in your 1983 hunting area?"

Median Price	Demographic Division #	n	Percent Missing
$30,000	7	21	67%
$20,000	4	37	73%
$ 7,500	5	26	58%
$17,500	6	197	60%
$10,000	3	35	57%
$10,000	8	98	63%
$ 2,125	2	90	62%
$ 4,000	1	69	58%

Demographic Division Matrix
(Kruskal-Wallis Multiple Comparisons, $p<0.01$)

	1	2	3	4	5	6	7	8
1	-							
2	N	-						
3	Y	Y	-					
4	Y	Y	N	-				
5	Y	Y	N	N	-			
6	Y	Y	N	N	N	-		
7	Y	Y	N	N	N	N	-	
8	Y	Y	N	N	N	N	N	-

Y - Yes, the pair are significantly different.
N - No, the pair are not significantly different.

Table 32. Median price, by residency, by hunt area, and by hunter group, charged by residents and nonresidents who hunted Dall Sheep in Alaska in 1983 for the sale of all of their future opportunities to hunt Dall sheep in the 1983 hunt area (WTS-3). Hunter groups based on the presence or absence of expression of the "pricelessness" of Dall sheep hunting.

	Residents		Nonresidents	
Hunt Area	All[1] (n)	"Value"[2] (n)	All[3] (n)	"Value"[4] (n)
ARE[5]	$10,000 (391)	$10,000 (268)	$4,000 (50)	$4,000 (50)
ARW[6]	$ 4,000 (97)	$ 8,000 (69)	$4,000 (53)	$4,000 (45)
BRR[7]	$10,000 (192)	$15,000 (114)	$4,000 (78)	$4,000 (63)
CMR[8]	$ 4,000 (259)	$ 4,000 (170)	$4,000 (40)	$4,000 (31)
KMR[9]	$ 4,000 (126)	$ 4,000 (85)	$4,000 (8)	$0,000 (7)
TCW[10]	$10,000 (174)	$10,000 (113)	$5,500 (27)	$4,000 (23)
THW[11]	$ 4,000 (40)	$ 4,000 (24)	- (2)	- (0)
WMR[12]	$ 4,000 (295)	$ 4,000 (295)	$4,000 (250)	$4,000 (227)

Kruskal-Wallis:

1 $x^2=12.992$, $p>0.05$, $n=1225$

2 $x^2=16.628$, $p<0.05$, $n=1005$

3 $x^2=9.305$, $p>0.05$, $n=247$

4 $x^2=7.896$, $p>0.05$, $n=224$

Table 32. Continued.

5 Alaska Range East of Denali

6 Alaska Range West of Denali

7 Brooks Range

8 Chugach Mtns

9 Kenai Mtns

10 Talkeetna, Chulitna, Watana Mtns

11 Tanana Hills, White Mtns

12 Wrangell Mtns

hunting opportunities anywhere in the state. A hypothetical example might make the situation more credible: If all sheep were protected by law from hunting (the animals were still living), there would be no opportunities to hunt, other than illegal ones. Disease outbreaks which could decimate sheep populations over time would be another possible situation resulting in a complete loss of hunting opportunities.

Again, a difference in the manner in which data for this question were collected (without dollar amount categories, Appendices A and B) combined with a characteristic of the computer analysis program made it impossible to distinguish a missing value from a $0 response. The number of nonrespondents was assumed to be similar to that found in WTS-3 (29% for residents and 29% for nonresidents). The data were analyzed as above, dividing responses into demographic categories (residents, nonresidents; "Priceless", "Value"; demographic divisions) for comparative purposes.

The distribution of responses tended toward the extreme ends of the range of responses (Figure 12). Nearly 40% of the hunters regardless of residency said either $0 or did not respond (Table 33).

Residents

The median price of all resident respondents was $4000 while the median bids for the "Priceless" and "Value" groups were $0 and $10,000, respectively (Table 33). Eighty-two percent of those in the "Priceless" group answered either $0 or did not respond, indicating the difficulty these hunters had with answering this question. There was a near total

failure of the question to elicit a response from this group. Hunters in the "Value" group tended to give a dollar figure greater than $0 rather than to give no response. Mean and standard deviation figures were high.

There was a significant difference in bids by demographic divisions for those within the "Value" group (Kruskal-Wallis x^2=59.1402; $p<0.01$; n=1145) (Table 34). Residents with more than one year of Dall sheep hunting experience or residents who had taken a sheep in 1983 tended to have higher bids than first-time hunters or those who did not take a sheep.

There was no significant difference in responses to WTS-4 of resident hunters by demographic division within the "Priceless" group (Kruskal-Wallis x^2=12.0343; $p>0.05$; n=573) (Table 35). More than 60% said either $0 or did not respond regardless of their level of hunting experience, success rate or years of residency in Alaska.

Nonresidents

Two-thirds of the nonresidents gave responses greater than $0 to WTS-4. As with resident hunters, most came from hunters who did not comment on the "priceless" quality of Dall sheep hunting. Only seven of the 68 in the "Priceless" group responded with a bid greater than $0. Nonresident responses did not have the magnitude of the resident responses, as seen in the means and standard deviations (Table 33). As with the previous question, future hunting opportunities may not be as important to most nonresidents as they are to Alaska resident hunters.

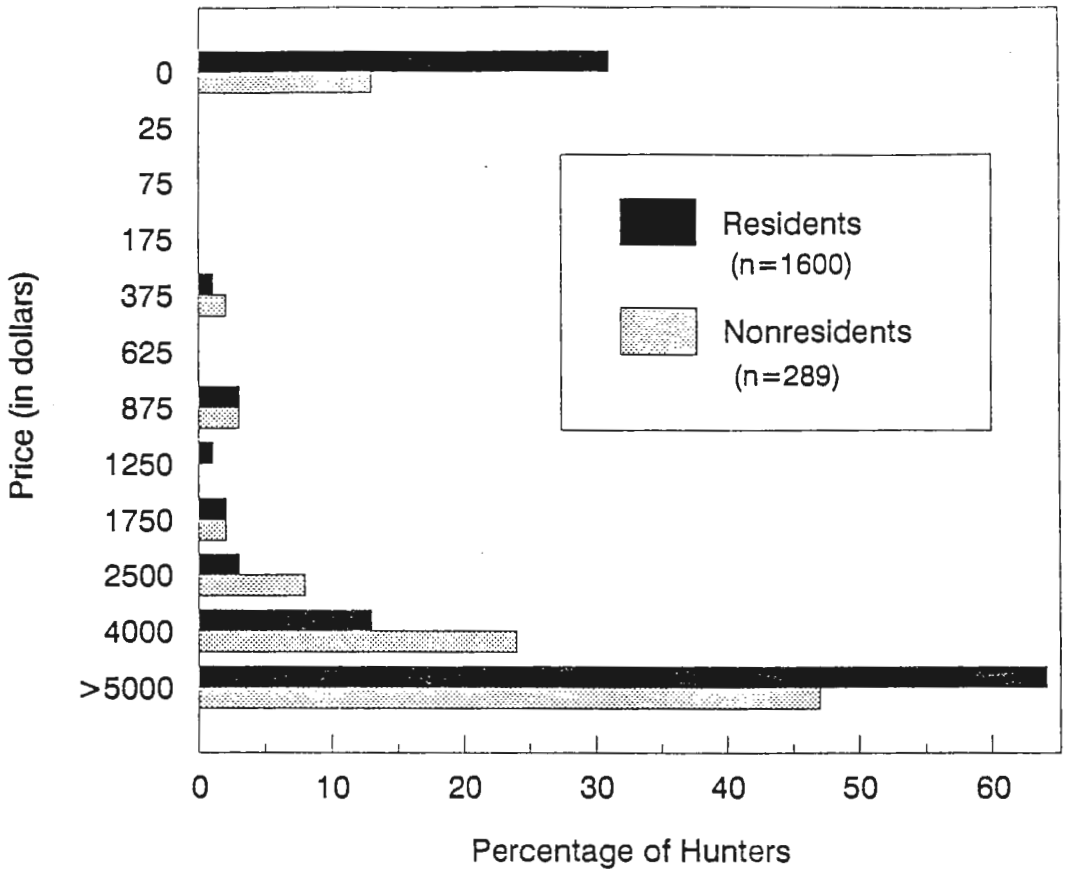


Figure 12. Dall sheep hunters' responses, by residency, to "What is the minimum price you would charge for the sale of all of your future hunting opportunities to hunt Dall sheep in Alaska in any mountain range?" (WTS-4). From survey of Dall sheep hunters in Alaska, 1983.

Table 33. Summary statistics for responses by residency to the question "What is the lowest price you'd charge for the sale of all of your future opportunities to hunt Dall sheep in Alaska?" (WTS-4). Statistics also given by hunter groups based on presence or absence of comments on the pricelessness of Dall sheep hunting in Alaska. Percent of $0 bids (*) and missing data (*) estimated (see text.)

	Residents	Nonresidents
All Hunters		
Median	$ 4,000	$ 2,500
Mean	$16.5 million	$129,551
SD	$123.6 million	$1.8 million
n	1,722	351
$0(%)*	175(10%)	32(9%)
Missing(%)*	493(29%)	101(29%)
"Value" - Hunters did not comment "priceless"		
Median	$ 10,000	$ 4,000
Mean	$17.5 million	$144,932
SD	$126 million	$2 million
n	1,147	283
$0(%)*	62(5%)	16(6%)
Missing(%)*	139(12%)	56(20%)
"Priceless" - Hunters did comment "priceless"		
Median	$ 0	$ 0
Mean	$14.4 million	$ 65,536
SD	$117.3 million	$240,350
n	575	68
$0(%)*	113(20%)	16(34%)
Missing(%)*	354(62%)	45(66%)

Table 34. Median price by demographic divisions to WTS-4 by resident Dall sheep hunters who did not comment on the "priceless" quality of the hunt ("Value" group). Divisions listed by rank, highest to lowest (Kruskal-Wallis test for multiple comparisons). Matrix shows which divisions were significantly different ($p<0.01$). Key to demographic divisions found in Table 22 WTS-4 is "What is the lowest price you'd charge for the sale of all of your future opportunities to hunt Dall sheep in Alaska?"

Median Price	Demographic Division #	n	Percent Missing
$20,000	7	28	11%
$20,000	6	368	15%
$20,000	4	73	14%
$10,000	8	195	19%
$10,000	5	54	17%
$ 4,000	3	77	14%
$ 4,000	2	169	24%
$ 4,000	1	181	19%

Demographic Division Matrix
(Kruskal-Wallis Multiple Comparisons, $p<0.01$)

	1	2	3	4	5	6	7	8
1	-							
2	N	-						
3	Y	N	-					
4	Y	Y	N	-				
5	Y	N	N	N	-			
6	Y	Y	Y	N	N	-		
7	Y	Y	Y	N	N	N	-	
8	Y	Y	N	N	N	N	N	-

Y - Yes, the pair are significantly different.
N - No, the pair are not significantly different.

Table 35. Median price by demographic divisions to WTS-4 by resident Dall sheep hunters who commented on the "priceless" quality of the hunt ("Priceless" group). Key to demographic divisions found in Table 22. WTS-4 is "What is the lowest price you'd charge for the sale of all of your future opportunities to hunt Dall sheep in Alaska?"

Median Price	Demographic Division #	n	Percent Missing
$0	5	26	65%
$0	3	35	71%
$0	4	37	76%
$0	7	21	76%
$0	1	69	81%
$0	8	98	82%
$0	6	197	83%
$0	2	90	89%

Discussion of Willingness to Sell Results

The overall response rate to the WTS questions was high (71% or more) which lends reliability to the survey data. However, the high amount of unexplained variability in responses brought the validity of these data into question.

This variability was explored using demographic variables. An assumption was made that those who commented on the "pricelessness" of Dall sheep hunting tended to issue protest bids. This assumption allowed isolation of a large number of missing values, $0 bids and some extreme dollar values, especially those from resident hunters.

Other demographic information was used to explain the variability in WTS responses. Analysis of the data using multiple regression was not successful, so nonparametric procedures were used to divide responses according to demographic categories (residents, nonresidents; "Priceless", "Value"; demographic divisions) for comparative purposes.

Residents

The responses to the WTS questions by residents in the "Value" group appeared to be the most credible. As compared to residents in the "Priceless" group, residents in the "Value" group gave more consistent bids (had less variability), had fewer non-responses, and their bids seemed related to a pattern based on three demographic variables. Resident hunters who had more than one year of Dall sheep hunting experience or who were successful in taking a sheep (or both) generally had higher bids than first-time hunters who did not kill a sheep. Residents of Alaska for five or more years also tended to give higher bids. This pattern

became more obscured (as seen in the lower Kruskal-Wallis test statistics) as the variability increased through the progression of WTS questions. The choice of hunt area also contributed to the variability in residents' WTS bids. Without multiple regression analysis it is not known how much of the total variability in "Value" WTS responses can be explained by hunting experience, success in taking a sheep in 1983, years residency in Alaska, and area hunted.

Nonresidents

Nonresidents had a lower percentage of nonrespondents than did resident hunters. Nonresidents may have more easily viewed Dall sheep hunting as a priced commodity because of the high cost of goods and services directly related to their hunt. The median response to all nonresident WTS questions was $4000 which is the approximate minimum cost of a guide, the most identifiable cost of nonresidents hunting sheep in Alaska. However, the assumption regarding expressions of pricelessness did not work nearly as well. Nonresponse, extreme bids and $0 bids from nonresident hunters did not necessarily correspond to expressions of pricelessness. In addition, the total number of nonresidents sample size was small, making further analysis by demographic divisions difficult to interpret. Most importantly, the amount of variability in the backgrounds of the individual nonresident hunters may have obscured any attempts to determine how their WTS bids were made.

Projected Total Net Benefit Estimates

The projected total amount hunters of 1983 requested for compensation of lost hunting opportunities is summarized

in Table 36. The amount for resident hunters was determined by the sum of the responses from the "Value" group of residents hunters plus the multiplication of the median "Value" response times the number of nonrespondents and "Priceless" group respondents. The amount for nonresidents was determined by the total of the median nonresidents' response multiplied by the number of nonresidents. The amounts by residency were added to determine a total for all hunters.

Comparisons to Other Studies

Comparable studies which estimated the net benefit of sheep hunting using WTS techniques were not available.

Table 36. Projected total willingness to sell values for all Dall sheep hunters for their future opportunity to hunt sheep under specific time and area conditions[1].

	Residents (n=2107)	Nonresidents (n=412)	Total (n=2519)
WTS-1[2]	$28,128,525	$1,648,000	$29,776,525
WTS-2[3]	$1,087,188,050	$515,000	$1,087,703,050
WTS-3[4]	$9,381,546,800	$1,648,000	$9,383,194,800
WTS-4[5]	$20,160,900,000	$1,648,000	$20,162,548,000

1 Figures generally based on the sum of responses, by residency, to the survey of Dall sheep hunters in Alaska, 1983. Resident outliers, as defined by "Priceless" responses, and nonrespondents were assigned the median amount and summed with remaining resident responses. Nonresident figures based on the total of the median nonresident response times the number of hunters.

2 "What is the lowest price you'd charge for the sale of your opportunity hunt Dall sheep in 1984 in your 1983 hunt area?"

3 "What is the lowest price you'd charge for the sale of your opportunity in 1984 to hunt Dall sheep in any mountain range in Alaska?"

4 "What is the lowest price you'd charge for the sale of all of your future opportunities to hunt Dall sheep in your 1983 hunt area?"

5 "What is the lowest price you'd charge for the sale of all of your future opportunities to hunt Dall sheep in Alaska?"

SUMMARY AND CONCLUSIONS

The purpose of this study was to estimate economic values for Alaska's Dall sheep and their habitat by describing economic benefits associated with hunting, which is but one use of sheep. Three objectives were employed to accomplish this goal: to determine the amount Dall sheep hunters spent on one year's hunt and what portion of that amount contributed to the economy of Alaska, to estimate the benefit of sheep hunting to hunters using contingent valuation methods (CVM), and to obtain sociological and demographic information about sheep hunters for interpretation of the economic information and for improved understanding of those who hunt Dall sheep. Other indications of the relative importance of Dall sheep hunting obtained through this work included the high response rate, the strong interest in hunting Dall sheep as compared to other species, the intent to hunt Alaska's Dall sheep in the future and the expressions of value that were written in the margins of many questionnaires (Table 37, Appendix F). All of these measures of value can be useful to interested individuals, government agencies or members of the business community.

The techniques associated with natural resources economic valuation are relatively new and are still being refined. Consequently, a high level of cooperation from the hunters was necessary to obtain reliable estimates of economic value. Hunters of Dall sheep were selected in part because historically they have been willing to cooperate with state wildlife biologists by providing information about their hunts. Eight-two percent of all hunters who

Table 37. Summary of results for selected variables from survey of Dall sheep hunters in Alaska in 1983, by residency.

Variable	Residents (n=1722)	Non-Residents (n=351)	All Hunters (n=2073)
Mean Years Residency in Alaska	11	--	--
Median Age (in years)	35	45	35
Median Income	$ 45,000	$75,000	$45,000
% 1st time Dall sheep hunters in 1983	42	77	49
% Who plan to hunt Dall sheep in future	95	67	90
% Freq. future hunts = every or every other year	74	12	59
% Freq. future hunts = only once or twice	12	65	17
% Primary reason for Alaska trip was to hunt big game	--	93	--
% Primary reason for Alaska trip was to hunt Dall sheep	--	60	--
% Who would not have come to Alaska if could not hunt sheep	--	63	--
% Killed sheep on 1983 hunt	33	70	39
Median cost of hunt	$977	$8150	$1232
Median cost/income (%)	2.8	13.3	3.5
Median WTP	$375	$875	$625
Median "Value" WTS-1	$1750	$4000	$1750
Median "Value" WTS-2	$1250	$2500	$1250

Table 37. Continued.

Variable	Residents (n=1722)	Non-Residents (n=351)	All Hunters (n=2073)
Median "Value" WTS-3	$4000	$4000	$4000
Median "Value" WTS-4	$10,000	$4000	$10,000

reported hunting Dall sheep in Alaska in 1983 responded to the mailed questionnaire used in this study.

Hunters were assumed to have followed instructions and given accurate responses to questions to the best of their knowledge. Their anonymous answers were not directly verifiable, but information from ADF&G and the U.S. Department of Commerce corroborated the distribution of responses according to hunt area, success rate, and demographic information.

The amount hunters spent on their hunt was determined by expenditures analysis, measuring what was spent (financial value) in association with travel to the hunt area and the actual hunt. Dall sheep hunters were estimated to have spent over $7 million in 1983, with $3.3 million and $3.8 million spent by residents and nonresidents, respectively (Table 13). The estimated total contribution of "new money" into Alaska's economy from all nonresident hunters was $2.5 million. The amount was substantial in consideration of the number of nonresident Dall sheep hunters (412). Recent data from ADF&G (1990) show the number of nonresident sheep hunters to have increased 46% by the 1989 hunting season thereby increasing the amount of benefit to the state economy. Dall sheep is but one of many hunted species in Alaska that draw funds from sources outside of the state. Many other wildlife species, though not hunted, also are important to Alaska's economy.

A Dall sheep hunter's total expenditures in 1983 varied according to several factors, but residency was the most influential variable. Resident hunters typically had lower

costs than nonresidents because they had lower license fees, no tag fees, no requirement to purchase the services of a guide, and usually had no costs associated with travel to Alaska (Table 9). Nonresidents often combined their sheep hunt with other activities and purchased additional goods and services. Hunter experience was also a factor. Experienced resident hunters spent more on average for every item except guide fees, firearms and funds paid to businesses outside of Alaska. The mean total costs of inexperienced resident hunters was 64% of the mean total costs of experienced resident hunters. Total expenditures also varied in relation to income. Residents spent an average of 2.8% of their annual household income on their sheep hunt while nonresidents were willing to pay a much larger portion of their annual income (13.3%). Less wealthy nonresidents spent a greater percentage of their income on their hunt rather than curb expenses. The total cost of the hunt was also related to its location, with the distant Brooks Range being on average the most expensive area for all hunters.

These estimates of cost to the hunter and benefit to the state's economy were incomplete for several reasons. Hunters were not asked to include the pro-rated value of used hunting equipment. This was done in order to maintain a high response rate. In addition, hunters who participated in the late season subsistence hunt were not surveyed in accordance with recommendations from the Subsistence Division of ADF&G. These costs would have added to the total figures obtained here.

In general, expenditures analysis is limited because total costs are not a reflection of value to the purchaser, but rather of contributions to the local economy. Consequently, the technique often underestimates the value of inexpensive activities associated with important resources. The theoretical measure of net economic benefit (represented by total willingness to pay, WTP) of a commodity (e.g., a sheep hunt) to the consumer (hunter) may be determined by total benefit received less actual expenditures.

Hunters were willing to pay an estimated additional $2,126,325 (n=2519) for their Dall sheep hunt in Alaska in 1983 (Table 15). The total net benefit for residents was estimated to be $1,523,075 (n=2107), while total net benefit for nonresidents was $603,250 (n=412). Theoretically, the responses represented an economic expression of the benefit of the sheep hunt to these hunters.

WTP responses were found to be influenced by the demographic characteristics of residency, hunt area and income group. In regression analyses, residents' values for WTP had a positive linear relationship with total expenditures, income, and a history of successful hunts. Nonresidents values for WTP were more varied and income was the only determination found to be associated with increasing values of WTP. Correlation coefficients for regression analysis were not high possibly due to the categorical nature of the original data and its skewed distribution. Higher correlation coefficients may have been obtained if continuous data were available, but response rates may have decreased with such a change in questionnaire

design. WTP values found in this study were similar to values obtained in other studies that valued sheep hunting under similar conditions. High values of WTP in those studies were associated with rare opportunities to hunt sheep.

Net benefit to the hunter also was measured using another technique, willingness to sell (WTS), and was applied through a series of questions asking what price hunters would charge for the sale of their opportunity to hunt Dall sheep in Alaska under certain time and area-specific conditions. Response rates showed a large portion of hunters were willing to respond to WTS questions, but indicated respondents had increasing difficulty as the commodity being value became more complicated with each succeeding question. Eighty-two percent of all respondents (n=2073) answered the first question (WTS-1) and about 71% answered the last question (WTS-4). Nonresidents had a lower percentage of nonrespondents than did resident hunters. Nonresidents may have more easily viewed Dall sheep hunting as a priced commodity because they had many costs of goods and services directly related to their hunt. Further examination found that not all responses were credible with some extreme dollar amounts, $10 million or $0, used to protest the questions. Because no money was actually exchanged in this mail survey, the bids could not be verified to determine which dollar bids were legitimate and which were measurements of additional and more closely held values. The variability of WTS responses was explored using demographic variables. An assumption was made that those who commented on the "pricelessness" of Dall sheep hunting tended to issue protest bids. This assumption

allowed isolation of a large number of missing values, $0 bids and some extreme dollar values, especially those from resident hunters.

Hunters were willing to sell next year's (1984) opportunity to hunt Dall sheep in the same hunt area for nearly $30 million (n=2519) (Table 36). The price for all of their future opportunities to hunt Dall sheep in Alaska was over $20 billion (n=2519). Higher median values for residents' WTS corresponded to those hunters who had more than one year of Dall sheep hunting experience and/or killed a sheep on their 1983 hunt. Nonresidents' median WTS bids hardly varied despite the change in area and time conditions and could not be explained by the demographic data collected in the survey. It is possible that because most nonresidents do not plan to hunt Dall sheep often, their price charged for compensation should not be expected to increase with the corresponding increase in lost opportunities.

Theoretically, the two CVM techniques, WTP and WTS, used as measures of net benefit should be equivalent. Increasing evidence, including from this study, shows the measures are far apart. Although some of the variability in bids could be attributed to specific factors and decreased variability may have increased the validity of the results, it is unknown how much error in measurement was contained in the results due to error inherent in the technique. The number of studies testing the accuracy of responses under such conditions are few, but accuracy is said to improve when the resource is well-defined and respondents can draw on recent personal experience to make assessments (Cummings et al.

1988). These conditions were met in this study. The disparity may be attributed to the psychological aspects of possession, lack of knowledge of a market framework (how does one scale importance?) and strategic behavior (gamesmanship). Bishop and Heiberlein (1979) concluded from their study of pricing permits for hunting geese that WTP and WTS values bracketed the hunters' true values. Similarly, Coursey et al. (1987) concluded that when the hypothetical situation appeared real, WTP and WTS values converged and represented market-like actions. But when the setting appeared implausible, WTS values were likely to be biased upwards due to psychological factors. They thought WTP values to be more credible and even approach market values because of few associated psychological factors. In their recommendations, Cummings et al. (1988) also selected WTP as a preferred method. Although the WTS method seems to be appropriate in its intention to capture values associated with loss of hunting opportunities, it may not be possible to create a universally credible hypothetical situation because recreationists, like most individuals, are not accustomed to the concept of the prices being associated with publicly provided environmental amenities.

Paralleling the increase in the use of contingent valuation to measure nonmarket values, there has been a growing body of literature expressing concern that such techniques are inappropriate and even dangerous. Sagoff (1988) expressed strong concern for "expanded cost-benefit analysis" replacing policy debate, thereby substituting democratic tradition with government by experts. Socolow (1976) wrote why formal analyses hardly ever do justice to the values at stake and how they essentially fail to assist

in the resolution of environmental controversies. Dorfman (1976) wrote that decision makers (and society) do not face a technical problem, but a philosophical one. Bakus et al. (1982) and Shafer and Davis (1989) among others proposed that a decision making method is needed that includes and evaluates perceived quantitative and qualitative values.

The techniques for defining non-market values are new and imprecise. The economic values obtained in this study are temporally dynamic, therefore land use decisions can not be made by them alone. The expectation of resource valuation to be the foremost deciding factor in resource allocation, is to commit the same mistake as do those who expect any other single factor to provide the key to difficult choices. In this study, the application of contingent valuation techniques and particularly the "what if" questions brought out interesting reactions that are useful for acknowledgement and discussion of values outside of expenditures analysis. Many persons gave answers to the valuation questions that appeared reliable. In addition, there were many other statements of value contained in this study. These statements can help bring such values to the attention of the public and to those whose priorities for natural resource development are likely to be based on "public interest", "beneficial uses" and for "maximum benefit of its [Alaska's] people" (Article VIII, Alaska constitution). Though some responses may have been easier to handle in analysis, those respondents who called Dall sheep hunting in Alaska "priceless" have values that should not be overlooked.

This study was designed to provide information about the value of Dall sheep hunting in Alaska and promote increased recognition of the importance of wildlife and wildlife habitat in decision making forums. Dall sheep are currently the most abundant wild sheep in North America, and possibly in the world (Valdez 1982). Unlike the remnant populations of wild sheep in the western portion of continental North America, Dall sheep have been the least affected by human impacts due to their relatively remote habitat. In 1983, about 70% of Alaska's Dall sheep populations were open to hunting while elsewhere in the United States it was not uncommon to find hunting restricted solely to the chance drawing of a limited entry permit for a one time opportunity to hunt (Hoefs 1985) (Table 1). To date, those who hunt sheep in Alaska enjoy a greater array of hunting opportunities than anywhere else in North America. But as land ownership changes and interest in development of Alaska's resources increases, land use conflicts will occur and hard choices will have to be made between wildlife and other industries. Portions of sheep habitat may be designated for alternative uses that will result in a decline in numbers of Dall sheep, affecting nonconsumptive users as well as hunters. The maintenance of the current range of recreational opportunities associated with Dall sheep is largely dependent upon cooperative agreements among administrative agencies and the cumulative effect of their decisions regarding future uses of sheep habitat.

Wildlife habitat is often at a disadvantage when considered in discussions of resource development because its importance is rarely expressed in terms that are comparable to the benefits of housing, agriculture or other

industrial options. The latter are often seen as producers of income and jobs to communities which, in turn, can lend support to local, state and federal government. It is difficult to describe the relative importance of wildlife outside of a market framework. However, because many values are associated with wildlife, it is clear that wildlife have considerable worth. This study is an attempt to recognize and encourage discussion of those more difficult values outside assessment of expenditures.

An important contribution of resource valuation is its attempt to define more difficult values and, in that process, give those values recognition and standing. Increased public awareness of contingent valuation and other methods may, over time, lead to improved techniques and better measures which give even greater recognition to those values that seem so difficult to define, but when done so, can enhance the potential for conflict resolution. There is no known solution to the philosophical dilemma of measuring that which cannot be defined. However, land use plans and the decision making forum that acknowledges and encourages discussion of benefits associated with market and nonmarket land uses can provide a broader range of alternative land uses and can help derive creative solutions to land use conflicts.

APPENDIX A

Alaska Resident Dall Sheep Hunter Questionnaire

Alaska Resident Dall Sheep Hunter Survey

ALASKA DEPARTMENT OF FISH AND GAME

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF GAME

BILL SHEFFIELD, GOVERNOR

P.O. BOX 3-2000
JUNEAU ALASKA 99802
PHONE (907) 465-4190

February 10, 1984

Dear Sheep Hunter:

Thanks for returning your sheep hunter report form to us at the Alaska Department of Fish and Game. According to your report, you hunted Dall sheep in Alaska in 1983. We hope you are willing to participate in an important survey about sheep hunting in Alaska.

This survey is designed to estimate the economic value of Dall sheep hunting by asking how much hunters spend to hunt sheep and how much they value this experience. With this information we can estimate the importance of sheep hunting to Alaska's economy.

There is a critical need for this information. As Alaska moves ahead with programs that designate land for uses such as agriculture, housing, industry, and recreation, it makes sense to compare these potential land uses in terms of their economic value to the State. At present we do not have enough information on the value of sheep hunting to make fair comparisons between it and other land uses. With this information land allocation decisions may be improved by being based on more complete information.

We are <u>not</u> attempting to measure <u>all</u> economic values of Dall sheep. Certainly, other values exist such as the worth of unhunted sheep, but those values are more difficult to measure.

As you fill out the enclosed questionnaire, you will find some questions similar to those on your hunter report form. There are also questions about how you traveled to and from your hunting area. The purpose of these questions is to apply a travel-cost analysis technique used in resource economics. We then ask how much you spent on your 1983 sheep hunt and what, in general, you purchased. The answers to these questions will help show sheep hunting's value to the State's economy. To determine the value of sheep hunting to <u>you</u>, the hunter, we then ask questions that place you in imaginary situations of being able to buy and sell sheep hunting opportunities. These questions are very important, and we hope you will enjoy answering them.

Please take this opportunity to provide information that will help assure adequate evaluation of Dall sheep hunting in Alaska. Please complete this questionnaire <u>today</u> and return it in the postage-paid envelope provided for your convenience. Your answers <u>will</u> be kept confidential and anonymous and released only as part of total figures in a comprehensive report.

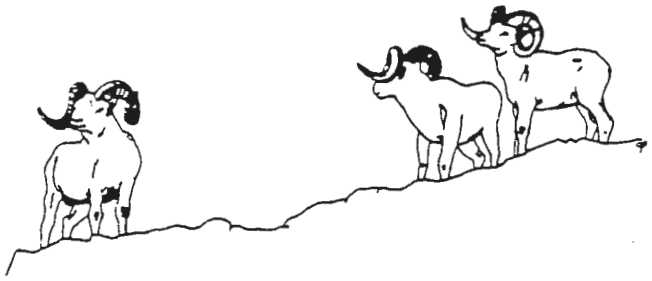
Should you have any questions about this questionnaire or its use, please telephone Wayne Heimer or Sarah Watson at (907) 456-5156.

Thank you.

Sincerely,

W. Lewis Pamplin, Jr.

W. Lewis Pamplin, Jr.
Director
Division of Game
(907) 465-4190



This questionnaire is being sent to those who hunted Dall sheep in Alaska in 1983. Your answers to this questionnaire are very important. They will help define an economic value for Dall sheep hunting which will be used to help plan for the future availability of Dall sheep hunting opportunities in Alaska.

Directions:

Most questions require a simple check mark (✓) to answer. Please write your answers clearly in dark pen or pencil. Your answers will be kept anonymous and confidential, released only as part of total figures in a comprehensive report.

Please answer this questionnaire and return it today in the postage-paid envelope provided for your convenience. We appreciate your help.

First, we would like to know a little about you as a Dall sheep hunter.

1. Please list all the years you have gone sheep hunting in Alaska up to 1983. _____

_____

2a. How many times have you killed a Dall sheep in Alaska including your 1983 hunt? _____times

2b. Did you kill a Dall sheep in Alaska in 1983? ____yes ____no

3a. Do you plan to hunt Dall sheep in Alaska in the future?
____yes ____no ____don't know

3b. If yes, about how often in your life do you expect to go? (Check (✓) one.)

____one or twice more in my life
____once every 5 years of my life
____once every 3-4 years of my life
____every other year
____every year

Now we would like to know a little about your 1983 Dall sheep hunt.

4. Where was your hunting area? Please check (✓) the mountain range location(s) where you hunted Dall sheep in 1983. The map of Alaska may help you.

____Alaska Range, east of Denali National Park
____Alaska Range, west of Denali National Park
____Brooks Range
____Chugach Mountains
____Kenai Mountains
____Talkeetna, Chulitna, Watana Mountains
____Tanana Hills-White Mountains
____Wrangell Mountains

5. What type(s) of transportation did you use to get to and from your hunting area (before you started walking)?

____commercial airplane
____single engine "bush" plane
____horse
____off-road vehicle
____snow machine
____highway vehicle
____other _____
(please specify)

6. About how long did you spend traveling round-trip to your hunting area (not including walking time)? _____days traveling

7a. If you couldn't have gone to the moutain range where you hunted in 1983, would you have gone sheep hunting? ____yes ____no ____don't know

7b. If yes, where would you have gone?

_____
(Pick one from the list in Question 4.)

8. At the time of your Dall sheep hunt, were you

____self-employed
____employed by someone else (please check (✓) one to answer)
____unemployed

9a. If you were employed or self-employed, did you take time off from your work to go sheep hunting? ____yes ____no

9b. If yes, how many days? _____days

9c. Were any of those days off from work covered by paid vacation? ____yes ____no

9d. If yes, how many days? _____days

10. About how much more could you have earned not including paid vacation had you not gone sheep hunting? $_____.00

11. How much did your Dall sheep hunt cost? We are interested in how much you spent and how you spent your money on your 1983 Dall sheep hunt in Alaska. Your answers to these questions will help us evaluate what Dall sheep hunting is worth and, specifically, its worth to Alaska's economy.

Please estimate your total expenses for the following categories. The cost of your guide's services, if any, may have included some of the other services as a "package hunt." Please account for as many separate costs as possible.

A. Guide fee: $_____.00
Tips and bonuses: $_____.00

B. Additional expenses to your sheep hunt:
License and tag fees: $_____.00
Transportation to and from your sheep hunting area: $_____.00
Lodging: $_____.00
Restaurants and entertainment: $_____.00
Tourism and gifts: $_____.00

C. You may have bought equipment and services from businesses outside of Alaska. Please estimate your expenses to businesses in and outside of Alaska in the space given below. This will help us evaluate sheep hunting's effect on the economy. Please include only your 1983 expenditures.

Paid to businesses outside of Alaska		Paid to businesses inside of Alaska
$_____.00	Guns, ammunition, scope	$_____.00
$_____.00	Binoculars, camera, film	$_____.00
$_____.00	Camping equiment and supplies	$_____.00
$_____.00	Taxidermy and butchering	$_____.00
	Please list any other expenses:	
$_____.00	_____	$_____.00
$_____.00	_____	$_____.00
$_____.00	_____	$_____.00
$_____.00	_____	$_____.00

Total cost (A + B - C) = $_____.00 (This is optional. We will add this for you if you would like.)

As long as we are talking about costs, we would like to ask you some "what if" questions. These questions involve entirely imaginary situations; they are the best way we know to determine the economic value of sheep hunting to YOU, the hunter. The questions may seem long, but we think you'll find them an enjoyable challenge. Please give us your best estimate.

12. "What if" all of your 1983 sheep hunting costs were greater than your estimate in Question 11? Assume your hunt was exactly the same, but costs were higher. (We have no intention of increasing license or tag fees. This is an entirely imaginary situation to help determine the economic value of sheep hunting.) HOW MUCH GREATER (over and above what you paid in Question 11) WOULD YOUR TOTAL 1983 COSTS HAVE TO HAVE BEEN BEFORE YOU WOULD HAVE DECIDED NOT TO GO SHEEP HUNTING?

$ 0.00	____	$ 751.00-1,000.00	____
$ 1.00- 50.00	____	$1,001.00-1,500.00	____
$ 51.00-100.00	____	$1,501.00-2,000.00	____
$101.00-250.00	____	$2,001.00-3,000.00	____
$251.00-500.00	____	$3,001.00-5,000.00	____
$501.00-750.00	____	more than $5,000.00	$_____.00 (Please specify)

Here is another "what if" situation:

13a. "What if" you could sell your 1984 opportunity to hunt Dall sheep in your hunting area (where you hunted in 1983)? (This is not possible to do. This is just an imaginary situation to help determine economic value.) We want to know what price you'd charge. If you were given this amount of money, you'd sell! And if you sold your hunting opportunity, you could not hunt Dall sheep in 1984 in your hunting area. WHAT IS THE LOWEST PRICE YOU'D CHARGE FOR THE SALE OF YOUR OPPORTUNITY TO HUNT DALL SHEEP IN 1984 IN YOUR 1983 HUNTING AREA?

$ 0.00	____	$ 751.00-1,000.00	____
$ 1.00- 50.00	____	$1,001.00-1,500.00	____
$ 51.00-100.00	____	$1,501.00-2,000.00	____
$101.00-250.00	____	$2,001.00-3,000.00	____
$251.00-500.00	____	$3,001.00-5,000.00	____
$501.00-750.00	____	more than $5,000.00	$_____.00 (Please specify)

(Note: we have no intention of increasing license or tag fees based on your answer.)

13b. We'd like to slightly change the question. WHAT IS THE LOWEST PRICE YOU'D CHARGE FOR THE SALE OF YOUR OPPORTUNITY IN 1984 TO HUNT DALL SHEEP IN ANY MOUNTAIN RANGE IN ALASKA? $_____.00

Here is the last "what if" situation:

14a. "What if" you could sell all of your future opportunities to hunt Dall sheep in your 1983 hunting area? We want to know what price you'd charge. If you were given this amount of money, you'd sell! And if you sold your hunting opportunities, you could not hunt Dall sheep in your hunting area in the future. WHAT IS THE LOWEST PRICE YOU'D CHARGE FOR THE SALE OF ALL OF YOUR FUTURE OPPORTUNITIES TO HUNT DALL SHEEP IN YOUR 1983 HUNTING AREA?

$ 0.00	____	$ 751.00-1,000.00	____
$ 1.00- 50.00	____	$1,001.00-1,500.00	____
$ 51.00-100.00	____	$1,501.00-2,000.00	____
$101.00-250.00	____	$2,001.00-3,000.00	____
$251.00-500.00	____	$3,001.00-5,000.00	____
$501.00-750.00	____	more than $5,000.00	$_____.00 (Please specify)

(Note: we have no intention of increasing license or tag fees based on your answer.)

14b. Again, we'd like to slightly change the question. WHAT IS THE LOWEST PRICE YOU'D CHARGE FOR THE SALE OF ALL OF YOUR FUTURE OPPORTUNITIES TO HUNT DALL SHEEP IN ALASKA? $_____.00

Finally, we would like to know a little about you. As with all answers in this questionnaire, your responses will be kept anonymous.

15. How many years have you been a resident of Alaska? _____years

16. Where do you live? _____(City, town, or village)

17. Which group below best describes your age?

____under 20	____50-59
____20-29	____60-69
____30-39	____70-79
____40-49	____80 and over

18. Which of the following categories best describes your household income, before taxes, in 1983? Please check one.

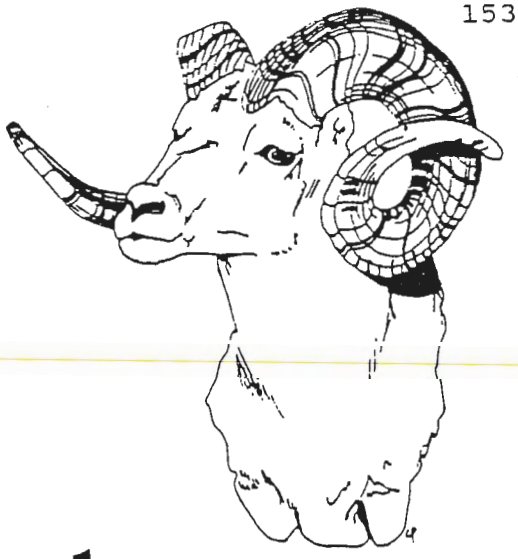
____under $10,000	____$50,000 - 59,999	____$100,000 - 109,999
____$10,000 - 19,999	____$60,000 - 69,999	____$110,000 - 119,999
____$20,000 - 29,999	____$70,000 - 79,999	____$120,000 - 129,999
____$30,000 - 39,999	____$80,000 - 89,999	____$130,000 - 139,999
____$40,000 - 49,999	____$90,000 - 100,999	____$140,000 and higher

Thank you very much for your help. If there is anything you would like to comment on or suggest, please let us know on the back of this page.

PLEASE RETURN THIS QUESTIONNAIRE IN THE POSTAGE-PAID ENVELOPE PROVIDED. THANK YOU!

APPENDIX B

Alaska Nonresident Dall Sheep Hunter Questionnaire



Alaska Nonresident Dall Sheep Hunter Survey

ALASKA DEPARTMENT OF FISH AND GAME

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
DIVISION OF GAME

BILL SHEFFIELD, GOVERNOR

P.O. BOX 3-2000
JUNEAU, ALASKA 99802
PHONE: (907) 465-4190

February 10, 1984

Dear Sheep Hunter:

Thanks for returning your sheep hunter report form to us at the Alaska Department of Fish and Game. According to your report, you hunted Dall sheep in Alaska in 1983. We hope you are willing to participate in an important survey about sheep hunting in Alaska.

This survey is designed to estimate the economic value of Dall sheep hunting by asking how much hunters spend to hunt sheep and how much they value this experience. With this information we can estimate the importance of sheep hunting to Alaska's economy.

There is a critical need for this information. As Alaska moves ahead with programs that designate land for uses such as agriculture, housing, industry, and recreation, it makes sense to compare these potential land uses in terms of their economic value to the State. At present we do not have enough information on the value of sheep hunting to make fair comparisons between it and other land uses. With this information land allocation decisions may be improved by being based on more complete information.

We are <u>not</u> attempting to measure <u>all</u> economic values of Dall sheep. Certainly, other values exist such as the worth of unhunted sheep, but those values are more difficult to measure.

As you fill out the enclosed questionnaire, you will find some questions similar to those on your hunter report form. There are also questions about how you traveled to and from your hunting area. The purpose of these questions is to apply a travel-cost analysis technique used in resource economics. We then ask how much you spent on your 1983 sheep hunt and what, in general, you purchased. The answers to these questions will help show sheep hunting's value to the State's economy. To determine the value of sheep hunting to <u>you</u>, the hunter, we then ask questions that place you in imaginary situations of being able to buy and sell sheep hunting opportunities. These questions are very important, and we hope you will enjoy answering them.

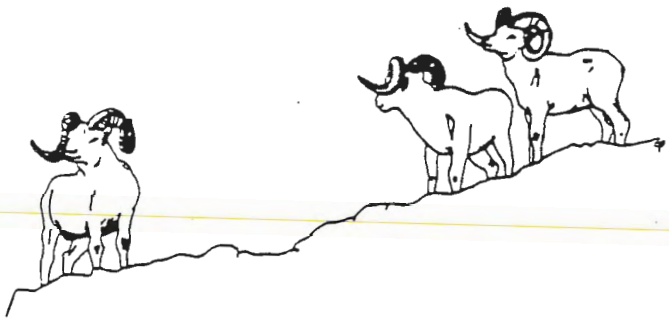
Please take this opportunity to provide information that will help assure adequate evaluation of Dall sheep hunting in Alaska. Please complete this questionnaire <u>today</u> and return it in the postage-paid envelope provided for your convenience. Your answers <u>will</u> be kept confidential and anonymous and released only as part of total figures in a comprehensive report.

Should you have any questions about this questionnaire or its use, please telephone Wayne Heimer or Sarah Watson at (907) 456-5156.

Thank you.

Sincerely,

W. Lewis Pamplin, Jr.
Director
Division of Game
(907) 465-4190



This questionnaire is being sent to those who hunted Dall sheep in Alaska in 1983. Your answers to this questionnaire are very important. They will help define an economic value for Dall sheep hunting which will be used to help plan for the future availability of Dall sheep hunting opportunities in Alaska.

Directions:

Most questions require a simple check mark (✓) to answer. Please write your answers clearly in dark pen or pencil. Your anwswers will be kept anonymous and confidential, released only as part of total figures in a comprehensive report.

Please answer this questionnaire and return it today in the postage-paid envelope provided for your convenience. We appreciate your help.

First, we would like to know a little about you as a Dall sheep hunter.

1. Please list all the years you have gone sheep hunting in Alaska:
1983,_____
_____

2a. How many times have you killed a Dall sheep in Alaska including your 1983 hunt? _____times

2b. Did you kill a Dall sheep in Alaska in 1983? _____yes _____no

3a. Do you plan to hunt Dall sheep in Alaska in the future?
_____yes _____no _____don't know

3b. If yes, about how often in your life do you expect to go? (Check (✓) one.)

____once or twice more in my life
____once every 5 years of my life
____once every 3-4 years of my life
____every other year
____every year

Now we would like to know a little about your 1983 Dall sheep hunt.

4a. Why did you visit Alaska in 1983? Rank the reasons which apply to you, letting #1 be the most important reason for visiting Alaska.

____visit relatives
____tourism/vacation
____hunt Dall sheep only
____hunt big game
____other_____
(please specify)

4b. If you came to Alaska in 1983 to hunt big game, rank in order of preference the species you hunted. Let #1 be the species you most wanted to hunt.

____black bear
____brown bear (grizzly)
____caribou
____Dall sheep
____deer
____elk
____moose
____mountain goat
____muskoxen
____wolf
____wolverine

5. Would you have made your 1983 trip to Alaska if you couldn't have hunted Dall sheep? ____yes ____no ____don't know

6a. What type(s) of transportation did you use to travel round-trip to Alaska?

____commercial airline
____highway vehicle
____boat
____other _____
(please specify)

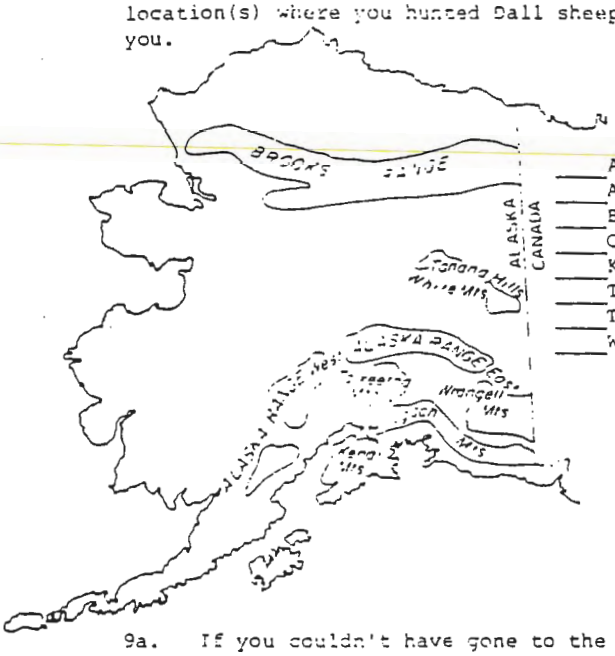
6b. About how long did you spend traveling round-trip to Alaska?
_____days traveling

7a. Once in Alaska, what type(s) of transportation did you use to get to and from your sheep hunting area (before you started walking)?

____commercial airline
____single engine/"bush" plane
____horse
____off-road vehicle
____snow machine
____highway vehicle
____other _____
(please specify)

7b. Once in Alaska, how long did you spend traveling round-trip to your sheep hunting area (not including walking time)? _____days traveling

8. Where was your hunting area? Please check (✓) the mountain range location(s) where you hunted Dall sheep in 1983. The map of Alaska may help you.



____Alaska Range, east of Denali National Park
____Alaska Range, west of Denali National Park
____Brooks Range
____Chugach Mountains
____Kenai Mountains
____Talkeetna, Chulitna, Watana Mountains
____Tanana Hills-White Mountains
____Wrangell Mountains

9a. If you couldn't have gone to the mountain range where you hunted in 1983, would you have gone sheep hunting? ____yes ____no ____don't know

9b. If yes, where would you have gone?

_____
(Pick one from the list in Question 8.)

10. At the time of your Dall sheep hunt, were you

____self-employed
____employed by someone else (please check (✓) one to answer)
____unemployed

11a. If you were employed or self-employed, did you take time off from your work to go sheep hunting? ____yes ____no

11b. If yes, how many days? _____days

11c. Were any of these days off from work covered by paid vacation? ____yes ____no

11d. If yes, how many days? _____days

12. About how much more could you have earned not including paid vacation had you not gone sheep hunting?

$_____.00

13. How much did your Dall sheep hunt cost? We are interested in how much you spent and how you spent your money on your 1983 Dall sheep hunt in Alaska. Your answers to these questions will help us evaluate what Dall sheep hunting is worth and, specifically, its worth to Alaska's economy.

Please estimate your total expenses for the following categories. The cost of your guide's services may have included some of the other services as a "package hunt." Please account for as many separate costs as possible

A. Transportation to and from Alaska: $_____.00
Guide fee: $_____.00
Tips and bonuses: $_____.00

B. Additional expenses to your sheep hunt:
License and tag fees: $_____.00
Transportation within Alaska to and from your sheep hunting area: $_____.00
Lodging: $_____.00
Restaurants and entertainment: $_____.00
Tourism and gifts: $_____.00

C. You presumably bought equipment and services from businesses outside of Alaska. Please estimate your expenses to businesses in and outside of Alaska in the space given below. This will help us evaluate sheep hunting's effect on the economy. Please include only your 1983 expenditures.

Paid to businesses outside of Alaska		Paid to businesses inside of Alaska
$_____.00	Guns, ammunition, scope	$_____.00
$_____.00	Binoculars, camera, film	$_____.00
$_____.00	Camping equiment and supplies	$_____.00
$_____.00	Taxidermy and butchering	$_____.00
	Please list any other expenses:	
$_____.00	_____	$_____.00
$_____.00	_____	$_____.00
$_____.00	_____	$_____.00
$_____.00	_____	$_____.00

Total cost (A + B + C) = $_____.00 (This is optional. We will add this for you if you would like.)

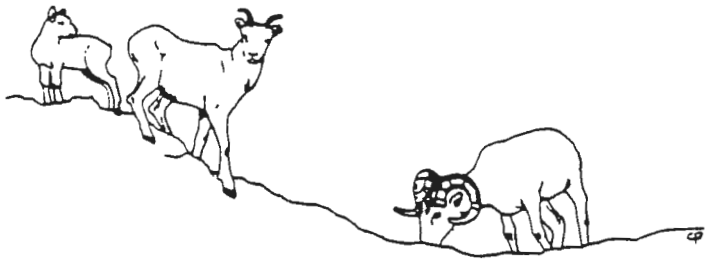
14. If you came to Alaska for reasons other than to hunt Dall sheep, what fraction of your expenses can you attribute to your Dall sheep hunt? Circle one.

1/8 1/4 3/8 1/2 5/8 3/4 7/8

As long as we are talking about costs, we would like to ask you some "what if" questions. These questions involve entirely imaginary situations; they are the best way we know to determine the economic value of sheep hunting to you, the hunter. The questions may seem long, but we think you'll find them an enjoyable challenge. Please give us your best estimate.

15. "What if" all of your 1983 sheep hunting costs were greater than your estimate in Question 13? Assume your hunt was exactly the same, but costs were higher. (We have no intention of increasing license or tag fees. This is an entirely imaginary situation to help determine the economic value of sheep hunting.) HOW MUCH GREATER (over and above what you paid in Question 12) WOULD YOUR TOTAL 1983 COSTS HAVE TO HAVE BEEN BEFORE YOU WOULD HAVE DECIDED NOT TO GO SHEEP HUNTING?

$ 0.00	____	$ 751.00 - 1,000.00	____
$ 1.00 - 50.00	____	$1,001.00 - 1,500.00	____
$ 51.00 - 100.00	____	$1,501.00 - 2,000.00	____
$101.00 - 250.00	____	$2,001.00 - 3,000.00	____
$251.00 - 500.00	____	$3,001.00 - 5,000.00	____
$501.00 - 750.00	____	more than $5,000.00 $_____.00 (Please specify)	



Here is another "what if" situation:

16a. "What if" you could sell your 1984 opportunity to hunt Dall sheep in your hunting area (where you hunted in 1983)? (This is not possible to do. This is just an imaginary situation to help determine economic value.) We want to know what price you'd charge. If you were given this amount of money, you'd sell! And if you sold your hunting opportunity, you could not hunt Dall sheep in 1984 in your hunting area. WHAT IS THE LOWEST PRICE YOU'D CHARGE FOR THE SALE OF YOUR OPPORTUNITY TO HUNT DALL SHEEP IN 1984 IN YOUR 1983 HUNTING AREA?

$ 0.00	____	$ 751.00 - 1,000.00	____
$ 1.00 - 50.00	____	$1,001.00 - 1,500.00	____
$ 51.00 - 100.00	____	$1,501.00 - 2,000.00	____
$101.00 - 250.00	____	$2,001.00 - 3,000.00	____
$251.00 - 500.00	____	$3,001.00 - 5,000.00	____
$501.00 - 750.00	____	more than $5,000.00 $_____.00 (Please specify)	

(Note: we have no intention of increasing license or tag fees based on your answers.)

16b. We'd like to slightly change the question. WHAT IS THE LOWEST PRICE YOU'D CHARGE FOR THE SALE OF YOUR OPPORTUNITY IN 1984 TO HUNT DALL SHEEP IN ANY MOUNTAIN RANGE IN ALASKA? $_____.00

Here is the last "what if" situation:

17a. "What if" you could sell ALL of your future opportunities to hunt Dall sheep in your 1983 hunting area? We want to know what price you'd charge. If you were given this amount of money, you'd sell! And if you sold your hunting opportunities, you could not hunt Dall sheep in your hunting area in the future. WHAT IS THE LOWEST PRICE YOU'D CHARGE FOR THE SALE OF ALL OF YOUR FUTURE OPPORTUNITIES TO HUNT DALL SHEEP IN YOUR 1983 HUNTING AREA?

$ 0.00	____	$ 751.00 - 1,000.00	____
$ 1.00 - 50.00	____	$1,001.00 - 1,500.00	____
$ 51.00 - 100.00	____	$1,501.00 - 2,000.00	____
$101.00 - 250.00	____	$2,001.00 - 3,000.00	____
$251.00 - 500.00	____	$3,001.00 - 5,000.00	____
$501.00 - 750.00	____	more than $5,000.00	$_____.00
			(Please specify)

(Note: we have no intention of increasing license or tag fees based on your answers.)

17b. Again, we'd like to slightly change the question. WHAT IS THE LOWEST PRICE YOU'D CHARGE FOR THE SALE OF ALL OF YOUR FUTURE OPPORTUNITIES TO HUNT DALL SHEEP IN ALASKA? $_____.00

Finally we would like to know a little about you. As with all answers in this questionnaire, your responses will be kept anonymous.

18. Where do you live? _____ _____
City State

19. Which group below best describes your age?

____under 20	____50-59
____20-29	____60-69
____30-39	____70-79
____40-49	____80 and over

20. Which of the following categories best describes your household income, before taxes, in 1983? Please check one.

____under $10,000	____$50,000 - 59,999	____$100,000 - 109,999
____$10,000 - 19,999	____$60,000 - 69,999	____$110,000 - 119,999
____$20,000 - 29,999	____$70,000 - 79,999	____$120,000 - 129,999
____$30,000 - 39,999	____$80,000 - 89,999	____$130,000 - 139,999
____$40,000 - 49,999	____$90,000 - 99,999	____$140,000 and higher

Thank you very much for your help. Are there any further comments you'd like to make? Please put them on a separate sheet and mail them to us in the envelope provided.

PLEASE RETURN THIS QUESTIONNAIRE IN THE POSTAGE-PAID ENVELOPE PROVIDED. THANK YOU!

APPENDIX C

Survey Methods and Procedures

The survey of Alaska's Dall sheep hunters of 1983 was designed to obtain the highest response rate possible for the least cost. A mailed questionnaire was chosen as the survey instrument because the alternative, personal interviews of over 2500 individuals, was thought to be too difficult and expensive to conduct, though the quality of the data might have been higher (Filion 1980). Because sheep hunters had demonstrated high rates of reporting harvest information (W. Heimer, pers commun.), it was thought that a high number of responses could be obtained using a census technique. In, addition, the costs associated with conducting a census of the population of sheep hunters were estimated to be less than costs associated with designing and conducting a sampling regime. Consequently, the census technique was chosen and much effort was placed on obtaining a high response rate.

The questionnaire was designed using a cyclic review process, starting with general ideas that developed into a specific plan after many revisions. This process allowed the incorporation of the ideas from many individuals with different expertise.

Initial drafts of the questionnaire were based on preconceptions of sheep hunters as a group plus social research references that addressed four topics important to obtaining a high response rate: the process of conducting the survey, questionnaire appearance, content, and motivational aids.

The timing of the mailing of questionnaire and followup correspondence, including motivational aids such as reminder letters and second mailings of the questionnaire are important to the process of conducting mailed surveys. Filion (1978) recommends that the questionnaire be sent while the respondent can still recall details. Timing any followup correspondence balances the element of encouragement against the element of harassment (Filion 1978, 1980, Heberlein and Baumgartner 1978, 1981).

Because the questionnaire must "sell itself", its appearance is important to obtaining a high response rate (Linksy 1975). Cosmetic options considered for this survey included the overall attractiveness of the questionnaire, use of colored ink and illustrations, even the type of postage used on the envelope (Filion 1978, 1980, Heberlein and Baumgartner 1978). The use of state government letterhead and similar symbols are related to increased public respect for the survey and prompt responses (Heberlein and Baumgartner 1978). Though this may have not have been necessarily true for Alaska resident hunters, the ideas were considered.

Wording of questions is extremely important not only to obtaining a high response rate, but also for the validity of the data. Nouelle-Neumann (1970) notes that "monotony lames respondents good will" and suggests length of questions, length of entire survey, as well as precise wording are all important considerations.

Motivational aids are numerous and range from precontact and publicity to cash reward incentives. Appeals to the respondent "for help" and their sense of importance need to be balanced against respondents desire to remain anonymous. Anonymity is seen as a two-edged sword by Linsky (1975).

These considerations were incorporated into early drafts of the sheep hunter questionnaire and presented to ADF&G and University of Alaska reviewers. Their suggestions were included to prepare for a pretest of the questionnaire.

Members of the Alaska chapter of the Foundation for North American Wild Sheep (FNAWS) were sent the pretest form of the questionnaire on December 21, 1983. Despite the holiday season, 50% of the members responded regardless of whether they had hunted during the 1983 season. The suggestions from these "real sheep hunters" brought a new perspective to design of the survey and particularly influenced the wording of questions.

Before the final version of the survey was mailed, some precontact techniques were used. Posters announcing the survey were delivered to hunting supply stores in the greater Fairbanks and Anchorage areas and displayed before and after the 1983 hunting season. Radio and television public service announcements were aired before and during the survey period.

The final version of the questionnaire was written in two forms, one for resident hunters and one for nonresident hunters (see Appendices A and B). The resident questionnaire contained 18 questions and the nonresident contained 20. Hunters were assured of anonymity.

The nonresident form was done in colored ink to improve the visual impact of the questionnaire. Illustrations of Dall sheep were placed on the questionnaire cover and throughout to improve overall attractiveness. The ADF&G symbol was printed on the cover and a letter explaining the importance of the survey and of each hunter's response was signed by the Director of Game Division (now Wildlife Conservation Division), ADF&G, and printed on the inside page. Hunters were also given the names of two persons and a telephone number to call for more information about the survey.

The questionnaires were mailed unfolded between 20-27 February 1984. The outside envelopes were stamped with an ADF&G return address, inked "First Class", and stamped with colorful, first class (unmetered) postage. The first class postage ensured return of undeliverable questionnaires. A preaddressed and stamped return envelope (with colorful, first class postage) was enclosed. The envelopes were numbered to separate respondents from nonrespondents.

Three weeks later, a colored and illustrated reminder postcard was sent (see Appendix C) to all nonrespondents. Three weeks after the postcards were sent a second mailing of the questionnaire with a reminder letter signed by the Director of Game Division was sent to all nonrespondents to prompt additional responses.

APPENDIX D

Reminder Postcard

Dear Sheep Hunter:

We haven't yet heard from you!

We sent questionnaires to everyone who hunted Dall sheep in 1983, and the replies are coming in. We haven't received yours. Please fill it out and mail it in today.

Thanks for your interest in Dall Sheep.

Wayne E. Heimer

Wayne E. Heimer
Sheep Biologist
Sarah M. Watson
Game Technician
Division of Game
(907) 456-5156

Sarah M. Watson

APPENDIX E

Reminder Letter

DEPARTMENT OF FISH AND GAME

1300 COLLEGE ROAD
FAIRBANKS, ALASKA 99701

March 28, 1984

Dear Sheep Hunter:

This is your second copy of our questionnaire to Alaska's 1983 Dall sheep hunters. We are sending you another copy because we have not received the specially numbered envelope containing your completed questionnaire.

Please take a few minutes to recall your 1983 Dall sheep hunt and then read our questionnaire. You'll probably enjoy answering the questions.

Won't you take this opportunity to provide information that will help assure adequate evaluation of Dall sheep hunting in Alaska? Please complete this questionnaire today and return it in the postage-paid envelope provided for your convenience. Your answers will be kept confidential and anonymous and released only as part of total figures in a comprehensive report.

Should you have any questions about this questionnaire or its use, please telephone Wayne Heimer or Sarah Watson at (907) 456-5156.

Thank you.

Sincerely,

W. Lewis Pamplin, Jr.
Director
Division of Game
(907) 465-4190

APPENDIX F

Additional Information Provided by Hunters

Table F. Frequency of comments made on hunter questionnaires by Alaska residents (n=1722) and nonresidents (n=351) who hunted Dall sheep in Alaska, 1983.

Comment	Residents	Nonresidents	Total
Permit hunter	135	3	138
Student	28	3	31
Retired	17	9	26
Guide	10	-	10
Unemployed, quit job to hunt sheep	2	-	2
Years hunted pre-1944	1	-	1
Years hunted not specific	22	1	23
Hunt area not area of choice	5	-	5
Did not like hunt area, so worth little	15	4	9
Does not plan to hunt sheep in 1984	4	2	6
Does not plan to hunt sheep in Alaska again	2	6	8
Wants only one sheep, affects value of future hunts	-	1	1
Sheep not primary reason for hunt	18	2	20
Someone else paid for hunt	31	7	38
Sheep hunting is priceless	579	57	636
Hunting is right, not for sale	24	4	28
Answers to contingent valuation >$999,999,999	27	-	27
Refuses to answer contingent valuation	51	14	65
Give nonresidents a break	2	12	14
Don't give nonresidents a break	13	-	13
Don't raise prices, period.	1	5	6
Describes personal value of sheep hunting	97	16	113

Appendix F. Continued.

Comment	Residents	Nonresidents	Total
Nonconsumptive value of sheep hunting	28	2	30
Hunting for meat, not a trophy	9	-	9
Hunting for a trophy, sheep hunting isn't a subsistence activity.	36	7	43
Hunt description	26	5	31
Change legal limit to full curl	30	-	30
Open hunting in national parks	33	2	35
Advice regarding other sheep regulations	59	6	65
Advice regarding regulations on other species	16	2	40
Improve access for offroad vehicles	2	-	2
Do not improve access for offroad vehicles	8	-	8
Praise for ADF&G* or FWP**	144	6	150
Negative comments ADF&G* or FWP**	6	-	6
Praise for guide, guide law, guide industry	-	1	1
Negative comments for guide, guide law, guide industry	12	7	19
Give military personnel a break	1	-	1
Don't give military personnel a break	1	-	1
Likes questionnaire, general	19	-	19
Dislikes questionnaire, general	40	-	40
Wants to see survey results	14	1	15
Miscellaneous	101	12	113
No comment	611	188	802

* Alaska Department of Fish and Game (research and management)
**FWP: Fish and Wildlife Protection (enforcement)

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