Legislative Audit Division

State of Montana

Report to the Legislature

November 2002

Performance Audit

Big Game Inventory and Survey Process

Department of Fish, Wildlife and Parks

This report contains information on the processes used by biologists with the Department of Fish, Wildlife and Parks in conducting harvest management activities. The report concentrates on the inventory and survey process. Conclusions and recommendations in this report include:

- The department employs game management methods that compare to accepted standards, but can improve its process.
- The current techniques used to assess game population status have evolved from compromise among the needs for accuracy, financial restrictions, and personnel availability.
- The department could refine its techniques for all species to better incorporate strategies that relate to more thorough and objective analyses.

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PERFORMANCE AUDITS

Performance audits conducted by the Legislative Audit Division are designed to assess state government operations. From the audit work, a determination is made as to whether agencies and programs are accomplishing their purposes, and whether they can do so with greater efficiency and economy. The audit work is conducted in accordance with audit standards set forth by the United States General Accounting Office.

Members of the performance audit staff hold degrees in disciplines appropriate to the audit process. Areas of expertise include business and public administration, statistics, economics, political science, , criminal justice, logistics, computer science, and engineering.

Performance audits are performed at the request of the Legislative Audit Committee which is a bicameral and bipartisan standing committee of the Montana Legislature. The committee consists of six members of the Senate and six members of the House of Representatives.

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November 2002

The Legislative Audit Committee
of the Montana State Legislature:

This is our performance audit report of the big game inventory and survey process used by the Department of Fish, Wildlife and Parks.

This report provides information to the legislature regarding the gathering, analyses, and use of survey information in implementing the harvest management strategies of the department. Overall we found that department biologists use game management methods that compare to accepted standards, but they can improve their processes. The department could refine its techniques for all species to better incorporate strategies that relate to more thorough and objective analyses and understandable and concise presentation to the public.

We wish to express our appreciation to department personnel, Montana university system faculty members, and other states' and organizations' wildlife biologists for their cooperation and assistance during the audit.

Respectfully submitted,

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Legislative Audit Division

Performance Audit

Big Game Inventory and Survey Process

Department of Fish, Wildlife and Parks

Members of the audit staff involved in this audit were Lisa Blanford and Mike Wingard.

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Appointed and Administrative Officials

Department of Fish, Wildlife and Parks	M. Jeff Hagener, Director
	Don Childress, Administrator, Wildlife Division
	Glenn Erickson, Chief, Management Bureau
Fish, Wildlife and Parks Commission	Michael Murphy (Wolf Creek) District 1
	Tim Mulligan, Vice Chair (Whitehall) District 2
	John Lane (Cascade) District 3
	Darlyne Dascher (Fort Peck) District 4
	Dan Walker, Chair (Billings) District 5

Introduction

The Legislative Audit Committee requested a performance audit of Montana's Department of Fish, Wildlife and Parks (FWP) procedures used in counting ungulates (moose, sheep, goat, white-tailed deer, mule deer, elk, antelope) and predators not controlled by the federal government. Even though black bear and mountain lions are considered predators, in Montana they are classified as big game animals along with the ungulates.

Montana uses a harvest management strategy to develop big game hunting regulations. This process has three basic components. First, inventorying or determining game population numbers; second, identifying population and recreational goals and objectives; and, third, developing harvest management regulations. We concentrated on the first step in a harvest management strategy: inventory.

The objectives of the performance audit include:

- Determine how FWP biologists conduct game counts (surveys) and how the information and data are used.
- Determine the usefulness of the data collected during the surveys.
- Determine if the game counts are used in conjunction with game management plans to develop appropriate hunting quotas.
- Determine what methods are used to estimate the number of large predators not regulated by federal agencies.

Audit observations focused on the game counts conducted in 2001-02 for the 2002 hunting season. Justification forms completed by biologists, Fish, Wildlife and Parks Commission meeting minutes, and other documents for the 1999, 2000, and 2001 hunting seasons were reviewed.

Big Game Management Policy

The Department of Fish, Wildlife and Parks has established a big game management policy that outlines the primary objectives for its game management operations. Survey of game populations is an essential part of the harvest management strategy.

The Wildlife Division in FWP is responsible for wildlife management. Regional FTE include 40 management biologists and 5 research biologists. We identified 32 management biologists who conducted regular survey and inventory activities in 2001.

Fiscal year 2001-02 expenditures for the Wildlife Division were $8.2 million. Approximately $7.9 million of the total was expended for operations and personal services (day-to-day management). Survey and inventory activities account for just over $1.8 million of these expenses.

The department's wildlife program emphasizes hunting as a traditional strategy for managing Montana's game species. In general, when setting harvest levels, the department strives for a balance between hunting opportunity and landowner tolerance of the number of wildlife and hunters. Within this management strategy, the department intends to maintain the viability of wildlife populations.

The data gathered through survey and inventory, harvest surveys, and analyses are compared to elements of game management plans to form conclusions and recommendations as to the attainment of management objectives. Game population information and other data are gathered to help determine hunting quotas and set seasons for each managed species.

Survey and Inventory of Wildlife Populations

The survey and inventory process is basic in structure. The objective is to locate animals visually and count them based on sex, age, size, herd size, etc. The department has recognized surveys provide the basis by which the department influences policy decisions by the Legislature, decisions of the Fish, Wildlife and Parks Commission, or land use decisions by other government agencies and private landowners. Survey information is also used when sports people have questions about the animals in various hunting districts.

Biologists survey wildlife populations in particular hunting districts, geographical areas, and regions to count the number of animals seen

and to classify these animals as male, female, and young. Survey information is used to determine population composition ratios (i.e. fawns/does) and trends and, at times, to estimate the total population of a particular group of animals.

There are three primary modes of travel when surveying animals: fixed wing aircraft (i.e. Supercubs: two-seaters), helicopters, and trucks. The type of ungulate dictates when and why it will be counted.

Aerial surveys do not always occur. Weather is a big factor in counting game. If it is windy, foggy, cloudy, snowing heavily, etc. survey counts do not happen or do not occur in the established timeframe. Other significant factors in counting game are resources available and the availability of aircraft and pilots.

Information and Data

The biologists use the survey information to determine the makeup of big game populations by sex and age, which provides estimates of the abundance of both sexes of adults and annual recruitment of young. Recruitment is measured by the ratio of fawns to does. These ratios do not reflect the number of young produced, but those that survived through the end of the hunting season or through the first year of life. This information is used in conjunction with harvest data, habitat conditions, and animal health data to determine the characteristics and conditions of the herds and whether there should be changes in harvest seasons/quotas.

Age and sex ratios provide supplementary data that is used to interpret population trends. A ratio of fawns to does for example provides an index of recruitment. Sex ratios are used to determine the effect of harvests on adult males. The count information and the statewide harvest survey of hunters provide an estimate of the number of animals harvested statewide by region and hunting district. The age data can also be used to evaluate age distribution.

Mountain Lions and Black Bears

The information base for mountain lions and black bears is limited almost entirely to harvest information. Some survey work is conducted of black bears. Research is being conducted for both

species. The department is expecting to update its Bear Management Plan with the results of the study in 2009. The department intends to update its Lion Management Plan with the results of the study in 2007.

Adaptive Harvest Management

Since 1997 the department has been incorporating concepts of an adaptive harvest management plan (AHM) into its process of setting harvest regulations for mule deer hunting in Montana. This process includes a more focused, statistical, model-based, rigorous system of monitoring population status. The monitoring strategy includes repetitive aerial surveys to census deer in defined units that are representative of the population management units.

Wolf Management

Wolves are a federally regulated predator. FWP does not currently manage wolves. The department is working on a wolf management plan to implement after/when the wolf is de-listed (no longer federally regulated). The plan is scheduled for completion in 2003.

Other States Survey and Inventory Techniques

To establish the basis of a comparison of Montana's survey techniques to accepted standards we contacted other states and gathered information from studies that were completed on survey methodology by wildlife organizations and wildlife biologists. We contacted individuals in Montana not associated with the department who specialize in game management techniques to get their views on survey and inventory techniques. Using this information as a foundation, we observed the biologists conducting air and ground counts for various species. We compared the department's techniques to the survey and inventory methodologies we identified from these other sources.

None of the comparative states used only one survey method exclusively for a given species. The information suggests states use a variety of methods, depending upon the species and area surveyed, the biologists conducting a particular survey, and the specific survey needs.

Audit Analyses and Conclusions

A major conclusion from our audit analysis of survey counts is that survey and inventory techniques are only designed to identify

changes in game populations – not the causes of those changes. The biologists must use their experience, knowledge, research and other techniques to get at the causes.

Aerial Survey Techniques

All biologists used some system to identify survey areas and schedule flights so trend data would be as consistent as possible over the years surveyed. The method of counting animals and documenting the data, survey routes and methodologies were different among biologists. Entire hunting districts are not usually surveyed; just historical or trend areas. There are areas of a FWP region not surveyed every year; these areas may be surveyed on a rotational basis.

The pilot is an integral part of the survey process. Pilots (both department and contracted) are used for their knowledge of the areas and the ability to help count and classify. Knowledgeable pilots add an element of consistency to the survey process. The competition for and the scheduling of aircraft and pilots is an ongoing issue that has to be addressed each year to attempt to get necessary surveys completed.

Game counts are not a comprehensive recording of every applicable animal in a survey area. However, biologists attempt to make the data as accurate as possible. The counts are affected by weather, light conditions, ground cover, animal characteristics (such as size of fawns, antlers still visible, dispersement), observer proficiency, and aircraft movement. If animal characteristics or numbers are in question, the data is not included in the biologists' analysis of the composition of the herds.

An examination of game count numbers from biologists' tally sheets indicated a match of those numbers to their official flight report numbers.

Ground Survey Techniques

Ground survey techniques are not as rigorous, but the surveys are completed in similar areas from year to year and provide data about herd composition and are used in monitoring trends in game populations. There is an inherent bias in ground surveys conducted

from roads (white-tailed deer) since it is difficult to extend the results of road-based surveys to non-road areas. Ground survey locations have been established for white-tailed deer, elk, and bighorn sheep based upon the variation in habitat features, hunter access, habitat security, hunter densities, and the influence of private land on hunter access.

Visibility Bias Adjustment

Visibility bias, the error associated with the failure to observe all animals during a specific survey, occurs in all studies that attempt to count the numbers of animals in the field. How detectable or visible animals are depends on many factors, including animal behavior and dispersion, observers, weather, habitat type, equipment, and methodology. Biologists use visibility bias adjustments on a limited basis in Montana. Some states have more extensive programs that use visibility bias adjustments and sightability models to modify raw counts of animals. Most states, including Montana, use the adjustments in selected areas. The use of adjustments appears to be dependent on overall game management objectives and the related goals of the survey.

Sampling

In the comparative states and Montana non-random sampling was more common than random sampling. Random sampling was more prevalent in research studies rather than in ongoing survey techniques. Some statistical sampling methods are being employed for mule deer surveying in Montana.

Population Size and Modeling

Until recently Montana has not used statistically estimated population sizes or simulation models. The major focus is on trend analyses and herd composition of observed animals. The current Adaptive Harvest Management (AHM) Plan for mule deer incorporates simulation modeling. Mule deer are the only species in Montana managed with the help of simulation models.

Use of Herd Composition (Ratios)

The herd composition factors and ratios used by Montana are consistent with those of other states and are related to the management objectives of the various species surveyed. The information is used during discussions of herd health and structure. The ratios and counts are used to help evaluate the success of harvest

plans for hunting districts throughout the state. The factors are an integral part of the discussion and decisions leading up to season and quota recommendations.

Conclusion

The Western states we contacted and Montana conduct similar wildlife habitat management activities. States use survey and inventory and harvest survey information to gather information about wildlife populations, population trends, and population characteristics, such as sex distribution and age structure.

All Western states use population objectives and/or management plans for managing wildlife, although states do not necessarily have management plans for each species. The season setting process in the Western states relies a great deal on survey and inventory information.

Montana's FWP department employs game management methods that compare to accepted standards. The development of the Adaptive Harvest Management Plan and associated survey techniques has refined the department's approach for one species, mule deer. Even though Montana's FWP is comparable to other states in terms of survey methodology and use, it still can improve its process.

Our contacts with other states and the results of studies of survey methodologies in these states indicate these departments were evaluating the use of different game surveying techniques and models (some developed by neighboring states), as well as continuing to refine and pursue methods to assess size and trend of game populations, including mountain lion and black bear.

Improving the Survey Process

In today's public environment, there is more interest in natural resource management. This creates an atmosphere of changing public attitudes, new legislation, special interest groups, interagency involvement, etc. According to the Record of Decision for the state's Wildlife Programmatic EIS (April 1999), the need for the programmatic review included: the public's increased demand to be involved in resource decisions and increased FWP accountability.

FWP also faces expanded responsibilities and a need to define, coordinate, and defend management decisions.

Accountability Through Objectivity and Understanding

Harvest management for big game has been defined as the art of melding the objectivity of wildlife science and the subjectivity of public wants for the attainment of the management goal. Harvest management strategies should be based on objectives established as part of a comprehensive planned management program. The objective setting process must be based on a thorough analysis of inventory information that includes sociological (i.e. impact on land and people) as well as biological data.

According to other states' biologists and studies of game management, the most powerful negotiating tool a game manager has is the ability to provide the public with thorough and objective analysis of data about wildlife populations. Generally the techniques these agencies used to assess population status have evolved from compromise among management needs for precision, budget restrictions, and personnel availability.

To provide thorough and objective analyses, the studies of survey techniques strongly recommend inventories should be designed to sample the entire reproductive segment of the population with a standard, repeatable methodology. Thus, the need for comparative data makes surveying consistency extremely important. A game management process based on good repetitive monitoring provides decision makers with information to measure results in trying to meet the goals and thresholds that have been established through objectives. Experts in game management also emphasize the monitoring system include procedures that result in an easy transfer of the exact methodologies used in the collection of data.

Refine Survey Techniques for All Species

The department can improve its game inventory system by refining current survey techniques. In recent years the department has recognized the need for "a well-focused, rigorous system of monitoring to determine population status relative to population objectives and improved understanding of relationships between population dynamics of mule deer and harvest regulations." The

department noted aerial and ground surveys often lack design, rigor, and discipline to provide statistically reliable estimates. In addition, there also is some uncertainty with regard to observability of game and how this might be affected by the physical environment, weather conditions, timing of surveys, and variation in ability among various observers and pilots. This has confounded efforts to measure, with statistical reliability, any change ongoing within the game populations. Replicates of surveys (several surveys over the same area) can address variation in survey efficiency over short periods and also provide a reliable estimate of variance.

In refining survey procedures it is now equally important the hunting and general public understand why decisions were made and how the information that was used in making a decision was gathered and compiled. Any refinements to the documentation of the decision-making process should include materials that help in the understanding of count procedures and herd composition analysis. The use of GPS units, cameras, and mapping (besides helping insure consistent procedures) helps with data presentation.

We recommend the department refine its survey and inventory techniques for all species to better incorporate the concepts of:

A. Repetitive surveys of representative management areas;

B. Standardized and documented protocol that is easily transferable;

C. Use of visibility bias adjustments and required sample sizes;

D. Tying survey results directly to management objectives and subsequent recommendations; and

E. Understandable and concise presentation to the public based on objective analysis.

Is Predation Considered as a Factor?

Predation is not included specifically in any game population size decisions that would be used in making season and quota recommendations. Natural mortality is only considered formally as a factor in estimating game populations for mule deer. Natural

mortality for other species has been taken into account at times through observable effects of disease and weather, and in some cases where predators have preyed on smaller herds.

Normal game management survey techniques are not designed to estimate the rate of predation on game populations. An analysis of trends in total observed counts and herd composition gives the biologist an indication of changes in the herds, but the causes of the changes have to be deduced using other information. Research provided the factors necessary to estimate the natural mortality rate for mule deer. Similar research would be necessary to analyze the effects of predation on all species.

Information Used by Commission/Biologists

Survey data is discussed and is a major component of the decision-making process for managing ungulates. Survey data is just one component biologists use to determine what, if any, changes need to be made to a season or quota.

FWP Commissioners do make new quota and season recommendations and modify department recommended changes. This occurred (over four years):

- 31 times (21 new) out of 253 season tentative proposals;
- 26 times (9 new) out of 105 season finals;
- 12 times (7 new) out of 169 for quota tentative proposals;
- 19 times (7 new) out of 124 for quota finals.

These recommended changes come from information at public hearings and from individual private citizens the commissioners represent. The discussions often revolve around the impact regulations are having on hunter opportunity and bringing about the desired outcomes. These discussions involve both the department and public's views on game population health and size. The Commission uses the process as it has been structured. Information sources and input from areas within and outside the department are solicited and used.

The process used by the department and the Commission follows the established accepted steps of a harvest management program. Biologists' survey data and other ecological information is used to inventory or determine population abundance, population and recreational goals and objectives are established at the state or regional level, and the harvest management regulations are directed at meeting those two types of goals and objectives. The regulations recommended by biologists are based upon data they have available, taking into account social factors such as landowner tolerance of game and hunter numbers. Discussions and documentation on season and quota setting included information on game damage.

In the absence of objective and scientific data the decision makers relied upon judgment, personal knowledge, and public opinion. This added a level of subjectivity to the process.

Chapter I - Introduction

Introduction

The Legislative Audit Committee requested a performance audit of Montana's Department of Fish, Wildlife and Parks (FWP) procedures used in counting ungulates (moose, sheep, goat, white-tailed deer, mule deer, elk, antelope) and predators not controlled by the federal government. Even though black bear and mountain lions are considered predators, in Montana they are classified as big game animals along with the ungulates.

Montana uses a harvest management strategy to develop big game hunting regulations. This process has three basic components. First, inventorying or determining game population numbers; second, identifying population and recreational goals and objectives; and, third, developing harvest management regulations.

We concentrated on the first step in a harvest management strategy: inventory.

Audit Objectives

The objectives of the performance audit include:

1. Determine how FWP biologists conduct game counts (surveys) and how the information and data are used.
2. Determine the usefulness of the data collected during the surveys.
3. Determine if the game counts are used in conjunction with game management plans to develop appropriate hunting quotas.
4. Determine what methods are used to estimate the number of large predators not regulated by federal agencies.

We also looked at how the damage done to crops, property, and other resources by big game animals is factored into season and quota recommendations made by biologists.

Since department-related statutes and administrative rules do not specifically address survey and inventory procedures, there was no statutory compliance testing performed.

Audit Scope and Methodology

Audit observations focused on the game counts conducted in 2001-02 for the 2002 hunting season. Justification forms completed by biologists, Fish, Wildlife and Parks Commission meeting minutes, and other documents for the 1999, 2000, and 2001 hunting seasons were reviewed. We obtained hunting season quota change recommendations for 2002 and survey results from 2000-01 to gain an understanding of the effect of surveys on decisions.

We gained a general understanding of the procedures followed by biologists when surveying game. We gathered background information on what FWP does in regard to surveying bears and lions. We also reviewed the 2001 hunting regulations for ungulates, bears and lions for reference purposes.

We reviewed our previous working papers from the Wildlife Division performance audit (#98P-11) issued in March 2000. This provided information on game count procedures, use of survey information by the Fish, Wildlife and Parks Commission, and information from other states. This previous report also contained recommendations addressing the information used in the season setting and wildlife management processes.

Interviews and correspondence with wildlife managers and wildlife biologists in each FWP region were used to determine what animals are surveyed, when the surveys are conducted, why specific procedures were used, how actual surveys are conducted, and who is involved.

We attended wildlife manager and FWP Commission meetings to determine survey data use and what is discussed regarding season setting changes. Copies of applicable environmental impact statements, management plans, and study results for ungulates, bears, lions, and coyotes were reviewed. We also obtained and reviewed copies of the proposals for bear and lion studies and the final results of a coyote research study. We evaluated FWP and other agencies' activities in terms of predator control, tracking the numbers of game animals killed by predators, and whether those numbers are used by

biologists to help determine ungulate harvest levels, and population densities.

We attended public meetings to determine what season and harvest level changes were recommended by sports persons, commission members and biologists, and the outcomes of the recommendations.

We observed FWP biologists conducting air and ground counts for various species. We reviewed files maintained by the biologists in all the regions to determine what information is gathered and how it is used. We verified the use of the information when reviewing justification forms for season and quota changes. We gathered information on FWP contacts with landowners, sports persons, sporting groups, and the public. Game harvest statistics, harvest survey methodology, and hunter effort information (how long it took to find and harvest an animal) were reviewed. We focused on whether surveys were conducted at the same time of year, same time of day (morning, evening), type of aircraft used, pilot, areas surveyed, weather conditions, and ground cover. We looked for any data gaps or major decreases or increases in game numbers and determined (through interviews or comments in the survey summary) why the gaps/changes existed.

We reviewed executive and legislative budget and expenditure information. We reviewed department cost data and contacted private contractors to determine the cost per hour for airplanes, helicopters, and pilots used for survey work.

To establish a basis for comparison we sent letters to surrounding states to determine how they conduct game survey counts and for what species. We obtained information on Arizona, Washington, Idaho, Colorado, Wyoming, Oregon, North and South Dakota, New Mexico, and Utah to understand how they use surveys in the season setting process. We obtained studies of survey techniques conducted by other states and organizations. We contacted the Animal and Range Sciences department at Montana State University and the Wildlife Biology program at The University of Montana regarding

survey and inventory techniques. We also contacted a biologist working with a private organization to discuss survey techniques.

Report Organization

The report is presented in five chapters. The first chapter was introductory. The remaining chapters address:

- Chapter II – An essential part of the harvest management strategy is survey and inventory of big game animals.
- Chapter III – A comparison of inventory techniques and processes to those that are considered accepted practice.
- Chapter IV – Can there be improvements to the current process?
- Chapter V – The use of information collected during surveys and the extent to which the FWP Commission uses the data when setting seasons and quotas.

Chapter II - Harvest Management Strategy

Introduction

The Department of Fish, Wildlife and Parks has established a big game management policy that outlines the primary objectives for its game management operations. Survey of game populations is an essential part of the harvest management strategy. According to FWP administrative rules, "... in order to properly manage the big game resource of Montana and to allow full hunter harvest opportunity the department intends to:

- Produce and maintain a maximum breeding stock of the game on all suitable lands of Montana, public and private,
- Maintain for big game the best possible range conditions by keeping populations in balance with their forage supply with consideration given to multiple land use and conflicting use,
- Encourage harmonious relationships between landowners and hunters to permit the harvest of surplus big game and to control populations causing appreciable damage to cultivated crops and forest or range lands,
- Manage big game on the basis of natural forage without recourse to artificial feeding,
- Encourage big game predator control chiefly on under-stocked ranges or on ranges where hunters are able to fully use the annual harvestable crop of animals, or ranges where rare species of the game are being introduced,
- Make impartial, objective surveys and investigations of the game populations and their range in order that authentic information may be available to guide the establishment of hunting regulations and other aspects of game management."

Wildlife Division

The Wildlife Division in FWP is responsible for wildlife and habitat management. Division programs are intended to protect, regulate, and perpetuate wildlife populations; maintain and enhance wildlife habitat; provide wildlife recreational opportunities; and provide information on conservation of wildlife populations and habitats.

There are a total of 97 FTE within the Wildlife Division. Wildlife managers and biologists in the regions are responsible for conducting day-to-day activities regarding wildlife and habitat management.

The Wildlife Division has two types of biologists: management and research. Management biologists have general responsibilities for numerous wildlife and habitat activities. Research biologists conduct special studies of individual species in specific areas. Regional FTE include 40 management biologists and 5 research biologists. We identified 32 management biologists who conducted regular survey and inventory activities in 2001.

The division monitors the status of wildlife through biologists' daily activities, which include game surveys, and several established programs:

- Long-term Research. Research biologists are responsible for long-term research. Research proposals are submitted from the regions to the department for prioritization based on subject, funding and resources. Research results are used for wildlife and habitat management. Most research projects last anywhere from seven to ten years.

- Wildlife Laboratory. The lab, located in Bozeman, is involved in various activities such as wildlife age analysis, disease surveillance, biological collection, court testimony, etc. The lab is also involved with research projects.

- Hunting and Harvest Survey. The department surveys resident hunters by telephone and non-resident hunters by mail to obtain harvest information. Information obtained from surveys is published, by species, in annual reports. This data, along with data gathered at game check stations during hunting seasons, is provided to FWP personnel for use in managing wildlife.

There are three major activities conducted by division and regional personnel regarding wildlife management: 1) survey and inventory, 2) season setting, and 3) technical guidance for the general public, hunters, landowners and other parties. Survey and inventory involves counting and classifying various species, and collecting and analyzing data on the characteristics, interrelationships, and dynamics of wildlife populations. Biologists are involved in numerous activities to accomplish these responsibilities. The main activities include aerial and ground surveys, data and trend analysis,

check station monitoring, and discussions with landowners, hunters, and the general public.

Wildlife Division Funding

A mix of federal and state special revenue funds the Wildlife Division. State special revenue funding consists primarily of hunting and fishing license revenue, while federal funding mostly comes from Pittman-Robertson Act funds.

Fiscal year 2001-02 expenditures for the Wildlife Division were $8.2 million. Approximately $7.9 million of the total was expended for operations and personal services (day-to-day management).

Survey and inventory activities account for just over $1.8 million of day-to-day expenses. Survey and inventory expenditures as reported in comparable Western states include $1.4 million in Utah and about $1.0 million in Colorado. Utah's expenditures do not include moose and mountain goat surveys.

FWP Commission

The Fish, Wildlife and Parks Commission consists of five members. The governor appoints all members who represent different regions of the state. The Commission sets policies for the protection, preservation, and propagation of the state's wildlife, fish, game, furbearers, waterfowl, non-game species, and endangered species. The Commission also establishes various rules concerning hunting, fishing, and trapping, and reviews and approves certain actions of the department.

Hunting is FWP's Main Game Management Strategy

The Wildlife Programmatic Environmental Impact Statement (EIS) indicates the current wildlife program emphasizes hunting as a traditional strategy for managing Montana's game species. Even though there are other methods of management, such as habitat protection and trapping/transplanting, hunting is the department's main strategy. In general, when setting harvest levels, the department strives for a balance between hunting opportunity and landowner tolerance of the number of wildlife and hunters. Within this management strategy, the department intends to maintain the viability of wildlife populations.

The department and Commission establish rules and policies for wildlife management. Biologists survey wildlife populations, compile information on population trends and hunter harvest, talk with hunters and landowners, and make recommendations to regional supervisors, who ultimately form department recommendations to the Commission regarding changes to hunting seasons and quotas. The process also includes public input.

Statewide management plans exist for mule deer (established in 2001) and elk (1992, updated 2001). Management plans in the form of Environmental Impact Statements exist for black bear (1994) and mountain lions (1996). There are some regional plans for other species. The management plans include objectives for animal population size, population trends and composition, harvest, and/or habitat. The data gathered through survey and inventory, harvest surveys, and analyses are compared to elements of the management plans to form conclusions and recommendations as to the attainment of management objectives.

Season and Quota Setting Process

Survey and inventory relates to season and quota setting. Hunting and trapping seasons and quotas are established for all big game species managed by the department. Biologists use data and information collected during the survey and inventory process to determine whether changes are needed in current hunting seasons and quotas. Recommendations for changes then proceed through various levels of review and approval. The Fish, Wildlife and Parks Commission has final approval over hunting seasons and quotas.

Population information and other data are gathered to help determine hunting quotas and set seasons for each managed species. The department has hunting and/or trapping seasons for the following species:

- Deer
- Elk
- Antelope
- Moose
- Bighorn sheep
- Mountain goat

- Mountain lion
- Black bear
- Upland game birds
- Migratory birds
- Furbearers

For big game species and furbearers, biologists initially document their recommendations for changes in seasons or quotas on justification forms. The justification form is used to document:

- Proposed change and summary of prior years.
- Reason for proposed change and how it relates to population and habitat objectives.
- Pertinent information related to weather, habitat, access, etc.
- Contacts made with landowners, sportsmen, or organized groups.

The wildlife manager and regional supervisor review and approve regional recommendations. Regional recommendations are reviewed and approved by Wildlife Division central office personnel and the FWP Director. Finally, the Commission reviews and makes decisions on all recommendations.

The Commission establishes hunting season regulations and harvest quotas on an annual or biennial basis in response to various factors. Deer, elk, antelope, black bear, moose, sheep and goat tentative hunting regulations are established in December and finals are set in February. Mountain lion tentative regulations are set in April and the finals are established in June. Quota levels are established following winter and summer surveys so animal survival and reproduction are taken into consideration. Final quotas are adopted in August for deer, elk and antelope, and in June for moose, sheep, mountain lion and goat for the subsequent fall season. Public participation is received through the mail, via the department web site, public meetings and open houses conducted during January before final season regulations are established. Written comments and public testimony are also received during Commission meetings prior to all tentative seasons and quotas being finalized.

Survey and Inventory of Wildlife Populations

The survey and inventory process is basic in structure. Its objective is to locate animals visually and count them based on sex, age, size, herd size, etc. The department has recognized surveys provide the basis by which the department influences policy decisions by the Legislature, decisions of the Fish, Wildlife and Parks Commission, or land use decisions by other government agencies and private landowners. Survey information is also used when sports people have questions about the animals in various hunting districts.

Biologists survey wildlife populations in particular hunting districts, geographical areas, and regions to count the number of animals seen and to classify these animals as male, female, and young. Survey information is used to determine population composition ratios (i.e. fawns/does) and trends and, at times, to estimate the total population of a particular group of animals. The biologists use the survey information to determine the makeup of big game populations by sex and age, which provides estimates of the abundance of both sexes of adults and annual recruitment of young. Recruitment is measured by the ratio of fawns to does. This information is used in conjunction with harvest data, habitat conditions, and animal health data to determine the characteristics and conditions of the herds and whether there should be changes in harvest seasons/quotas.

The following is an example of survey information a biologist used to make a recommended change in mule deer hunting season regulations for a single hunting district. In the example we did not include discussions of habitat and landowner tolerance that occurred.

Example of Mule Deer Survey Information

Mule deer trend data indicates an overall observed population increase of 25 percent above the long-term average.

Year:	*1997*	*1998*	*1999*	*2000*
Count:	*435*	*482*	*363*	*606*

The fawn recruitment ratio as measured during spring surveys has been well above the objective of 25 fawns per 100 adults.

These criteria, as stated in the Mule Deer Management Plan, trigger the recommended standard hunting season to allow the sale of antlerless B licenses targeted first to areas where game damage is occurring. This change is consistent with the management objective.

Survey Methods and Timing

There are three primary modes of travel when surveying animals: fixed wing aircraft (i.e. Supercubs: two-seaters), helicopters, and trucks. The preferable type of fixed wing aircraft is one that will go "slow and low." Helicopters are necessary for some species and terrain. Fixed wing aircraft are also used in some regions because of reduced cost and increased availability. Antelope surveys are typically conducted using a fixed wing aircraft.

FWP has three helicopters, two in Helena and one in Billings. The department also has two fixed wing aircraft: one in Billings and one in Great Falls. FWP employees pilot the aircraft. The department contracts with private firms for most aircraft services. The hourly cost for contracted helicopters is approximately $550 per hour and fixed wing about $125 per hour. The hourly cost for state helicopter time is about $310 per hour and $54 per hour for fixed wing. There are no replacement costs factored into the state's rate. Total aircraft rental costs for FY 2002 were about $345,000. Private contractors

accounted for over $227,000 of the annual total. The following chart provides information on the annual regional costs for using department and private aircraft (by region) for survey and inventory.

Table 1

Survey Aircraft Costs for Fiscal Year 2002 by Provider and Region

	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
	Kalispell	Missoula	Bozeman	Grt Falls	Billings	Glasgow	Miles City
Aircraft							
Department	$32,128	$7,161	$23,816	$26,773	$22,036	$4,829	$0
Private	$1,847	$59,670	$54,170	$27,295	$11,239	$44,738	$28,765
Total	$33,975	$66,831	$77,986	$54,068	$33,275	$49,567	$28,765

Source: Fish, Wildlife and Parks SABHRS records.

Ground surveys conducted by truck or on foot are more prevalent in examining white-tailed deer populations and are used to supplement aerial survey data for other species. For example, Region 7 uses some ground counts for antelope in March. Some Region 4 biologists do ground counts of deer in January/February. One Region 4 biologist does ground counts of sheep after the hunting season.

The type of ungulate dictates when and why it will be counted. Deer (primarily mule) and elk are aerial surveyed for classification and population trends. Deer, elk and moose surveys are most commonly conducted following big game hunting seasons (December/January) and/or during the late winter or early spring. Since classifying requires distinguishing bucks/bulls from does/cows, the flights are conducted before the antlers are dropped in late spring. Mule deer are generally classified in late December, early January. Elk are counted anywhere from December to March and even into May if needed. Biologists will count both species in a flight if it is convenient (winter grounds for each are typically close to each other). Flights to obtain total counts are generally flown March to May. Antelope are counted in July in Regions 2 through 7.

Bighorn sheep aerial surveys are flown during the April "green-up" period to determine totals and sex/age ratios. Hunting permits are recommended based upon the percentage of sub-adults and adult rams observed during helicopter surveys. The number of yearling rams annually recruited into the sub-adult age class is used to establish the number of permits. This approach provides mature rams for breeding purposes and legal rams for hunters.

Generally, all mountain goat surveys are done by helicopter and fixed wing aircraft when the snow has melted and adult/young distinctions can be made.

The following chart summarizes the survey activity of two biologists for the purpose of example. The chart illustrates the timing, purpose, species, and method of survey. Terrain, aircraft availability, and need for consistent survey techniques are factors that influence the type of aircraft used.

Table 2

Example of Annual Survey Activity for Two Biologists

Time of Year	Species	Purpose	Biologist 1 Ground or Type Of Aircraft	Biologist 2 Ground or Type Of Aircraft
January	Mule Deer	Classification	Rotary	Rotary
	Elk	Class. & Pop. Trend		Rotary
February	White-tailed Deer	Classification		Ground
March	Elk	Class. & Pop. Trend	Fixed Wing	Rotary/Fixed
	Mule Deer	Class. & Pop. Trend	Fixed Wing	Rotary
	Mountain Goat	Class. & Pop. Trend	Fixed Wing	
	Bighorn Sheep	Class. & Pop. Trend	Rotary/Ground	Rotary/Fixed
	Whitetail Deer	Classification	Ground	
April	Elk	Class. & Pop. Trend	Fixed Wing	Rotary/Fixed
	Mule Deer	Class. & Pop. Trend	Fixed Wing	Ground
	Mountain Goat	Class. & Pop. Trend	Fixed Wing	Rotary/Fixed
	Bighorn Sheep	Class. & Pop. Trend	Fixed/Ground	Rotary/Fixed
	White-tailed Deer	Class. & Pop. Trend	Ground	Rotary/Fixed
May				
June				
July	Bighorn Sheep	Classification	Ground	Fixed Wing
	White-tailed Deer	Classification	Ground	Ground
	Elk	Classification	Fixed Wing	Fixed Wing
	Mountain Goat	Class. & Pop. Trend		Rotary/Fixed
	Antelope	Class. & Pop. Trend		Fixed Wing
August	Elk	Classification	Fixed Wing	
September	Elk	Classification	Fixed Wing	Fixed Wing
October	Elk	Classification	Fixed Wing	
November				
December	Mule Deer	Classification	Rotary	Rotary
	White-tailed Deer	Classification	Rotary	
	Bighorn Sheep	Class. & Pop. Trend	Fixed Wing	Ground

Source: Fish, Wildlife and Parks Biologists and Survey Reports

Aerial Surveys Do Not Always Occur

Weather is a big factor in counting game. If it is windy, foggy, cloudy, snowing heavily, etc., survey counts do not happen, or do not occur in the established timeframe. There are some years when

herds do not get counted because the weather was bad when the biologist had access to the plane or helicopter. If it is cloudy, they cannot see the animals as well. If it is a mild winter, the animals may not be on the traditional winter-feeding grounds until after "antler drop" so they do not get a classification. If the snow is old and preexisting tracks are not covered, they sometimes cannot track the animals. If it is the wrong time of day (middle of the day instead of morning or evening), they might not see the animals. If it is windy, the animals will not be in the open; they will be "holed up" under the trees.

The other significant factors in counting game are resources available and the availability of aircraft and pilots. If the weather is bad during a scheduled flight period, the survey cannot be flown. Because of the high demand for pilots and aircraft during these time periods the aircraft or pilot are probably not going to be available shortly afterwards. Not only do biologists compete with each other for resources, but they also compete with damage control flights for shooting coyotes, spraying weeds, and other states (i.e. Idaho). Biologists will also not fly with just any pilot. Flying is dangerous and they want someone experienced in surveys, someone they are comfortable with, and someone who knows the terrain.

Funding is not available to survey every species or hunting district every year or all of the area in a hunting district. Flight and survey plans may include alternate year or every three years as timetables. Some surveys may not occur for periods longer than three years.

Information and Data

Age and sex ratios provide supplementary data that is used to interpret population trends. A ratio of fawns to does for example provides an index of recruitment. These ratios do not reflect the number of young produced, but those that survived through the end of the hunting season or through the first year of life. Sex ratios are used to determine the effect of harvests on adult males. The count information in conjunction with the statewide harvest survey of hunters provides an estimate of the number of animals harvested

statewide by region and hunting district. The age and sex data can also be used to evaluate age distribution.

The following is one example of a post-season mule deer classification survey for two hunting districts. This survey is used because it has been conducted every year since 1989. As noted, there may be years when surveys are not conducted for specific species or in certain hunting districts.

Table 3

Survey Data of Post-Season Mule Deer Classification (Two Districts)

Year	Yearling Bucks	Adult Bucks	Total Bucks	Does	Fawns	Total Deer	Bucks/ 100 Does	Fawns/ 100 Does
1989	34	9	43	548	263	854	8	48
1990	67	17	84	1320	533	1937	7	40
1991	90	32	122	1557	896	2575	8	58
1992	55	18	73	1616	840	2568	5	52
1993	119	57	176	1845	1177	3201	10	64
1994	97	65	162	1395	994	2551	12	71
1995	77	24	101	1345	1028	2483	8	76
1996	123	98	221	1512	1145	2878	15	76
1997	94	52	146	2096	1547	3789	7	74
1998	158	87	245	1428	1210	2896	17	85
1999	136	120	256	1401	1035	2692	18	74
2000	175	204	379	1488	787	2656	25	53

Source: Fish, Wildlife and Parks Biologists Survey Reports

Biologists try to count a specific herd at the same time of day, year after year, to get consistent congregations of animals. For the most part biologists are interested in trend data.

Mountain Lion and Black Bear

The information base for mountain lions and black bears is limited almost entirely to harvest information. Regions 1 and 5 are the only areas where bears are surveyed. Two biologists in Region 1 count bears in late August from a helicopter when the bears are on open mountainsides eating berries. One biologist in Region 5 surveys bears in the spring to obtain a count of sows and cubs. Again the

bears are on open mountainsides. Lions are not inventoried due to low visibility of the animals from air and ground.

Research is being conducted for both species. Statewide mountain lion research began in the Garnet mountain range of West Central Montana in 1998. The purpose of the research was to evaluate the accuracy of track (footprints) surveys and other techniques to determine trends in lion abundance. Lion hunting was suspended in this area for three years starting with the 2000-2001 season to allow the researchers to capture and radio-collar lions in the study area and to allow the lion population to increase. Population indicators will be trends in the number of lion tracks on 11 established survey routes; lion observations by deer hunters; houndsmen opinions of lion trends; prior lion hunting statistics; deer and elk surveys; and lion DNA sampling. By monitoring the population increase and decrease, researchers are hoping to determine which population indicators are most sensitive to changes in lion abundance. Results of this research will then be applied statewide to help monitor lion population trends. The department is expecting to update its Lion Management Plan with the results of the study in 2007.

The black bear study is the result of the 1994 Black Bear Environmental Impact Study Record of Decision. It is an 8 to 10 year project initiated in 2000. The objectives of the study are to provide biologists with better information on black bear abundance and habits and population management tools. The department is expecting to update its Bear Management Plan with the results of the study in 2009. A biologist in Region 1 is using collared animals in conjunction with telemetry flights to record bear movement, and the biologist is also collecting and recording DNA from the hair trapped on barbed wire, which is used to surround areas where black bears come for feeding. One goal is to get population estimates. Early indications are the population of black bears is probably higher then the estimated number calculated using the current population reconstruction model.

Adaptive Harvest Management (AHM)

Since 1997 the department has been incorporating concepts of an adaptive harvest management plan (AHM) into its process of setting harvest regulations for mule deer hunting in Montana. This process includes a more focused, statistical, model-based, rigorous system of monitoring population status. The monitoring strategy includes repetitive aerial surveys to census deer in defined units that are representative of the population management units. Surveys immediately after the hunting season include total count and classification in each census unit to primarily determine their composition. Early spring censuses also included one total count and classification survey in each census unit followed by two replicate surveys to obtain only a total count.

The AHM process also involves a computer model that predicts future population trends. There are three main modules: reproduction, hunting, and natural mortality. The model utilizes available data from field studies on mule deer population dynamics derived from long-term research efforts. There are two versions of the model: one for mountains and one for prairies. The model uses fawn to doe and buck to doe ratios as well as the total number of deer counted and the fawn to adult ratio from spring surveys. These data are used to predict mule deer population size and composition during the following spring, given a variety of harvest regulations and environmental conditions.

Predator Counts/Control

Major non-federally regulated predators of ungulates are black bears, lions and coyotes. FWP manages black bears and lions as big game through harvest. The department sells licenses to hunt bears and lions. Coyotes prey on young animals and can be killed at any time without a license. The Predator Control Program (operated by the Brands-Enforcement Division, Department of Livestock), through helicopter hunting and contracts, controls certain types of predators (mainly coyotes) that kill or injure domestic livestock. FWP provides some funding to the federal Wildlife Service for wildlife management purposes and coordinates with the Montana Department of Livestock for this program. The Department of Livestock also contracts with the Wildlife Service to destroy coyotes in specific

areas. There is no specific survey or inventory done of coyotes. FWP conducted a study in the Roundup area to determine the effect of predation of coyotes on mule deer and antelope. The study concluded that, over the long run, it is unlikely coyotes controlled the populations, but may cause temporary declines and maintain populations at a lower level for longer than desired periods.

Wolf Conservation and Management Plan

Wolves are a federally regulated predator. FWP does not currently manage wolves. The department is working on a wolf management plan to implement after/when the wolf is de-listed (no longer federally regulated). The plan is scheduled for completion in 2003. The department is developing alternatives that reflect consideration of some 4,000 public comments and concerns related to a state-run wolf management program. The comments were collected early in 2002 during the initial phase of the project.

Chapter III - Inventory Techniques and Processes

Introduction

One of the major objectives of the performance audit was to determine how Department of Fish, Wildlife and Parks' biologists conduct game counts. Once we determined how these surveys were conducted we compared the observed techniques to those that are considered accepted practice.

To establish the basis of this comparison we contacted other states and gathered information from studies that were completed on survey methodology by wildlife organizations and wildlife biologists. We contacted individuals in Montana not associated with the department who specialize in game management techniques to get their views on survey and inventory techniques. Using this information as a foundation, we observed the biologists conducting air and ground counts for various species. We compared the department's techniques to the survey and inventory methodologies we identified from these other sources.

Other States' Survey and Inventory Techniques

None of the comparative states used only one survey method exclusively for a given species. The information suggests states use a variety of methods, depending upon the species and area surveyed, the biologists conducting a particular survey, and the specific survey needs.

We created an overview of survey components by comparative state (see Table 4). The categories were chosen because they relate to major techniques used and data collection. If a species is not listed under a category either the technique is not used or data is not available. For example: data availability applies to white-tailed deer. In general white-tailed deer are managed similar to or incidental to mule deer; however, the quality of the data and the quantity are not as good. According to biologists the nature of this species and its habitat use make data collection more difficult and management is less exacting. Biologists have stated that to date, state wildlife departments have generally not been able to develop reliable models and population estimates for white-tailed deer.

The categories listed in the following table represent:

1) Use of aerial surveys.

2) Use of ground surveys.

3) Observed animal counts are adjusted using a visibility bias correction factor.

4) Use of statistical random sampling in the design of the survey.

5) Samples selected using purposive sampling because they are representative or typical of the entire study group.

6) Techniques are used to estimate population sizes rather than observed counts.

7) Computer models are used to input variables and project future populations of the species.

8) Estimates such as bull-to-cow, buck-to-doe, young-to-adult, young-to-female ratios are used to gather information on herd composition, survival and recruitment.

Table 4

Comparison of Various States Game Survey and Inventory Techniques

	Arizona	Colorado	Idaho	Oregon	Wyoming	Montana
1) Aerial Survey	Mule Deer	Mule Deer	Mule Deer	Mule Deer	Mule Deer	Mule Deer
*incidental to other	White-tailed	White-tailed	White-tailed*	White-tailed*	White-tailed*	White-tailed
flights	Bighorn	Bighorn	Bighorn	Bighorn	Bighorn	Bighorn
	Elk	Elk	Elk	Elk	Elk	Elk
	Antelope	Antelope	Antelope	Antelope	Antelope	Antelope
		Moose	Moose		Moose	Moose
2) Ground Survey	Mule Deer				Mule Deer	Mule Deer
	White-tailed	White-tailed			White-tailed	White-tailed
	Bighorn	Bighorn				Bighorn
	Elk				Elk	Elk
				Antelope	Antelope	
3) Visibility	Mule Deer		Mule Deer	Mule Deer*		Mule Deer*
Bias	Bighorn*	Bighorn*	Bighorn	Bighorn*		
Adjustment		Elk*	Elk	Elk*		Elk*
*in some areas	Antelope	Antelope			Antelope	
		Moose	Moose		Moose	Moose
4) Random		Mule Deer			Mule Deer	Mule Deer*
Sampling			Bighorn			
*in some areas			Elk		Elk	
		Antelope			Antelope	
5) Purposive	Mule Deer		Mule Deer	Mule Deer		Mule Deer
Sampling	Bighorn	Bighorn		Bighorn	Bighorn	Bighorn
	Elk	Elk		Elk		Elk
	Antelope	Antelope	Antelope	Antelope		Antelope
		Moose	Moose		Moose	Moose
6) Estimate	Mule Deer	Mule Deer	Mule Deer	Mule Deer	Mule Deer	Mule Deer*
Population	Bighorn	Bighorn*	Bighorn	Bighorn	Bighorn	Bighorn*
Size	Elk	Elk	Elk	Elk	Elk	Elk*
*in some areas	Antelope	Antelope	Antelope	Antelope	Antelope	Antelope
		Moose			Moose	
7) Use Population	Mule Deer	Mule Deer		Mule Deer	Mule Deer	Mule Deer*
Model		Bighorn*			Bighorn	
*in some areas	Elk	Elk		Elk	Elk	
		Antelope			Antelope	
		Moose			Moose	
8) Estimate Ratios	Mule Deer	Mule Deer	Mule Deer	Mule Deer	Mule Deer	Mule Deer
(i.e. Herd Composition)	White-tailed	White-tailed	White-tailed	White-tailed	White-tailed	White-tailed
	Bighorn	Bighorn	Bighorn	Bighorn	Bighorn	Bighorn
	Elk	Elk	Elk	Elk	Elk	Elk
	Antelope	Antelope		Antelope	Antelope	Antelope
		Moose	Moose		Moose	Moose

Source: Compiled by the Legislative Audit Division from Other State Contacts and Studies.

Audit Analyses and Conclusions

The following sections summarize our observations and analyses of the survey and inventory process. Each section starts with an overall conclusion on an inventory technique; followed by more specific conclusion(s), which are followed by related observations.

A major conclusion from our audit analysis of survey counts is that survey and inventory techniques are only designed to identify changes in game populations – not the causes of those changes. The biologists must use their experience, knowledge, research and other techniques to get at the causes.

Aerial Survey Techniques

Montana's use of fixed-wing and rotary-wing aircraft to survey big game animals is consistent with other states. The type of animal being surveyed and the terrain usually dictate the type of aircraft used. In almost all cases, the same type of aircraft used the previous year is used again in the current year to provide for consistency. The flights provide the biologists with data necessary to manage the species and other information on habitat and land use. If there are cover and weather limitations that reduce the effectiveness of aerial surveys, the biologists may need to rely upon sex and age ratios obtained from ground surveys, past surveys, adjoining district data, and harvest information.

Conclusions:

- **All biologists used some system to identify survey areas and schedule flights so trend data would be as consistent as possible over the years surveyed.**
- **The method of counting animals and documenting the data, survey routes and methodologies were different among biologists.**
- **Entire hunting districts are not usually surveyed; just historical or trend areas.**
- **There are areas of a FWP region not surveyed every year; these areas may be surveyed on a rotational basis.**

Observation: All biologists maintained a tally of animal numbers and characteristics. Count sheets or reports contained information on time of day, location, weather conditions, hours flown, species,

hunting district, terrain, light conditions, and game animal characteristics. Some biologists use global positioning system (GPS) units to identify the location of animals. The information is downloaded from the GPS units and combined with count data. The biologists use the data to create topographical maps that include identifiers of survey areas for the hunting districts. These maps illustrate how the flights cover particular areas of the hunting districts and not all of the hunting districts. For example one hunting district is 700 square miles, but the trend area for moose is 50-60 square miles. For other biologists, the survey areas were manually marked on topographical maps and the actual counts were recorded on manual counting sheets. One biologist used a tape recorder to record the counts. Other biologists did not use maps, but used their knowledge of different drainages and gulches and recorded the data based on the name of the gulch or drainage. Cameras were used sporadically and for particular species that tend to "bunch" for counting, such as elk. For example: one biologist took a digital picture of elk and would use that (in conjunction with other counts) to help get a total count of the elk. Actual survey routes and methodologies are not specifically documented in the form of written procedures, but can be reconstructed from survey reports.

Conclusions:

- **The pilot is an integral part of the survey process.**
- **Pilots (both department and contracted) are used for their knowledge of the areas and the ability to help count and classify. Knowledgeable pilots add an element of consistency to the survey process.**
- **The competition for and the scheduling of aircraft and pilots is an ongoing issue that has to be addressed each year to attempt to get necessary surveys completed.**

Observation: The pilots used by the department were familiar with flight areas and drainages and knew which patterns to fly in the hunting district. The pilots helped identify adults and young and helped count. The biologists and the pilots count the animals and confer. Most biologists used the pilots as a resource and a check to make sure they saw the same number and characteristic (bucks, does,

yearling, etc.) of animals. Sometimes biologists would adjust numbers slightly based on pilot observations.

Contractors pilot more than half the survey flights. Since surveys are scheduled to be conducted at the same times each year, pilots and equipment need to be available at that time. If weather or equipment problems cause the cancellation of a flight it was not always possible to reschedule since other private and public groups needed the resources of the contracted and state pilots in other areas of the state.

Conclusions:

- **Game counts are not a comprehensive recording of every applicable animal in a survey area. However, biologists attempt to make the data as accurate as possible.**
- **The counts are affected by weather, light conditions, ground cover, animal characteristics (such as size of fawns, antlers still visible, dispersement), observer proficiency and aircraft movement.**
- **If animal characteristics or numbers are in question, the data is not included in the biologists' analysis of the composition of the herds.**

Observation: During flights in some areas it was evident fawns being observed were larger than normal and it was necessary to classify fawns based on nose structure rather than animal size. This made accurate identification less likely. There were also instances where bucks had dropped half their racks. This also made classification more difficult. During a moose survey the antlers had also dropped from an estimated half of the bulls so a good representation of male structure was not possible. The biologist looked for other identifying markings to help gather sex-ratio data. On one flight, light conditions in conjunction with background cover made it difficult to count and classify animals. For some flights dispersion of deer was an issue. In the biologist's flight notes it is stated the deer were scattered from middle to upper elevations and the density of deer indicated not all of the deer had arrived on the winter ranges. There were other noted instances of the effect of light snow pack. The mule deer were not concentrated on winter ranges (survey areas) as should be the case most winters. In two different

flights the passenger saw groups of deer the pilot or the biologist did not see. If there was a question as to whether the animals had been counted previously, biologists were conservative and they did not recount animals. If the biologist could not classify animals for any reason, the animals were recorded as "not classified" and included only in total counts.

Conclusion: Count numbers from tally sheets matched flight report numbers.

Observation: For those flights where we accompanied biologists we checked our recorded numbers against the numbers submitted on the flight reports. The number of animals and characteristics matched those we recorded.

Ground Survey Techniques

Like other states, Montana uses ground surveys to supplement data gathered during aerial surveys and to gather information on animals not surveyed using aircraft. Montana uses ground surveys more extensively than most other states. Most white-tailed deer data is gathered through ground survey because of the nature of the species. The following is the conclusion on Montana's use of ground survey techniques and the related observations.

Conclusions:

- **Ground survey techniques are not as rigorous, but the surveys are completed in similar areas from year to year and provide data about herd composition and are used in monitoring trends in game populations.**
- **There is an inherent bias in ground surveys conducted from roads (white-tailed deer) since it is difficult to extend the results of road-based surveys to non-road areas.**
- **Ground survey locations have been established for white-tailed deer, elk, and bighorn sheep based upon the variation in habitat features, hunter access, habitat security, hunter densities, and the influence of private land on hunter access.**

Observation: White-tailed deer ground surveys are usually done from established roads through a predetermined area. Due to density of vegetation, population parameters are primarily determined using ground surveys. One biologist noted he tried to get total counts of white-tailed deer, but has found the numbers unreliable. He tried to extrapolate the number of animals seen to the population and the numbers did not track from one year to the next. Some white-tailed deer population counts are done incidental to mule deer surveys. During mule deer aerial surveys biologists did track numbers of white-tailed deer. Ground survey techniques include driving to designated areas, waiting for the right time of day, and using binoculars or scopes to observe game. Classifications and counts are recorded on census sheets. The fawn-to-adult ratios are used in combination with harvest statistics to estimate total population trends. Landowner contacts and input were other activities that occurred during ground surveys.

Visibility Bias Adjustment

Visibility bias, the error associated with the failure to observe all animals during a specific survey, occurs in all studies that attempt to count the numbers of animals in the field. How detectable or visible animals are depends on many factors, including animal behavior and dispersion, observers, weather, habitat type, equipment, and methodology. Established sightability models attempt to correct for this by standardizing observation factors under the control of the observers (flight speed, number of observers, etc.) and providing a measure of visibility bias for environmental factors not under the control of the observers (group size, obscuring vegetation cover, snow cover, animal behavior, etc.). The measure of visibility bias can then be used to adjust raw counts of animals observed to an unbiased estimate of group size and structure. Montana's experience with visibility bias is summarized below.

Conclusions:

- **Biologists use visibility bias adjustments on a limited basis in Montana. Some states have more extensive programs that use visibility bias adjustments and sightability models to modify raw counts of animals.**
- **Most states, including Montana, use the adjustments in selected areas.**
- **The use of adjustments appears to be dependent on overall game management objectives and the related goals of the survey.**

Observation: During aerial surveys biologists do not expect to see all big game animals being surveyed. For example, there is research that indicates in aerial surveying biologists can only see 40 to 60 percent of the deer and elk in certain terrain during the survey. The percentages change for other species, terrains, time of year, and habitat conditions. Montana biologists have estimates of observability, the proportion of a group actually sighted, for elk, mule deer, and moose. Based on reports and documents their use seems to be infrequent and inconsistent. Reports and survey documents tend to concentrate more on trends of observed animals. Some reports include both numbers - adjusted for visibility bias and observed counts. This varies among biologists and hunting districts. The department's Montana Elk Plan evaluation includes both observed and adjusted numbers when comparing surveyed animals to plan objectives. Charts compiled by biologists to illustrate trends tend to be observed numbers. When adjustments are made Montana does not use sightability modeling, but uses percentage adjustments based on research results on radio-collared animals observed in certain census areas. Some examples:

- One hunting district survey reported adjusted mule deer total numbers by using a 62 percent factor. Five hundred sixty (560) deer were observed. This translated to 560/.62 or approximately 900 deer. The 900 estimate was presented as additional information. The deer management objectives outlined in the Adaptive Harvest Management Plan is based on the number of deer counted.

- For the lower Clark Fork Valley to get an estimate of the area's population size for elk, the biologist divides the observed count by 40 percent.
- In Valley County, elk observability ranges between 60 and 80 percent.
- In areas of Region 1 total moose counts are adjusted by a 52 percent factor to estimate populations in observed areas.

Sampling

Sampling is the process of selecting units (e.g., animals, land areas) from a population of interest so by studying the sample one may fairly generalize the results back to the population from which they were chosen. Samples must be representative of the populations they are drawn from and they must be able to be quantifiably evaluated. Random statistical sampling, in which each item has an equal chance of being selected and items are selected randomly, satisfies both of these conditions. The laws of chance allow biologists to state precise conclusions for statistically chosen samples. Statistical sampling however requires much more time upfront to plan and administer than non-statistical sampling. Non-statistical (purposive) samples are usually drawn using the biologist's knowledge of the area and species and professional judgment (judgmental sampling). Non-statistical methods do not allow the biologist to scientifically extrapolate sample results to the population. However, judgmental sampling does provide for the development of an understanding of the characteristics, compositions, and trends of the population being studied. Randomized sampling methods are more easily developed for aerial surveys.

Conclusions:

- **In the comparative states and Montana non-random sampling was more common than random sampling.**
- **Random sampling was more prevalent in research studies rather than in ongoing survey techniques.**
- **Some statistical sampling methods are being employed for mule deer surveying in Montana.**

Observation: Non-statistical (purposive) sampling is the norm for biologists' surveying for big game in Montana and other states.

Sample areas are selected that are thought to be representative or typical of the entire survey frame. In some cases samples are selected for convenience because they are easy to access, such as road surveys for white-tailed deer. Biologists only report what they see when they count and the majority of the time they do not extrapolate to a population. They only count specific herds of various species, knowing full well there are other animals in the area. The herds they observe, in most cases, are the herds that have been counted for a number of years, thus there is a lot of historical and trend data available to make game management decisions. For example: antelope in one FWP region are surveyed using fixed-wing aircraft flying transects in census areas biologists have studied and believe most accurately reflect the entire hunting district population characteristics. Overall, all game surveys are conducted to determine the general population health based on numbers, sex, and age. They are also done to obtain trend information. Specific sample sizes are required under the department's Adaptive Harvest Management Plan for mule deer, so estimates of herd composition are statistically valid. For bighorn sheep, biologists try to get complete counts rather than sample the herds.

Population Size and Modeling

The ability to estimate the population size of a species for a given area depends on the quality of the data and the capability to accurately define the geographical boundaries of the groups surveyed. Data quality can differ due to distribution of animals during different seasons, environment and topography, and survey resources. Due to these factors biologists have to decide on the use of the data collected. Most states, in one way or another and using different techniques, try to estimate game population sizes where game managers believe it is useful information. There is always a need to balance survey precision with resources. Recent research in the area suggests population size estimates should be derived from actually counting animals within a specific area and not be based entirely on herd composition data. Survey methods to directly estimate population size are:

- Quadrat Sampling: Small, manageable areas of known dimensions are designated as the sample unit. Usually, everything of interest within the quadrat is counted.

- Sightability Methods: Adjusting counts based on visibility factors; and

- Distance sampling: Distance sampling extends quadrat-based methods by relaxing the assumption all objects within the circle or strips are counted. By measuring distances to the objects, the probability of observing an object within the circle or strip can be estimated. Flat terrain is essential for this technique.

As a tool to help in estimating population sizes and determining and projecting population trends computer models have been developed. The quality of the models is dependent on the quality of the data. Models have been constructed to include a number of variables including: counts, animal characteristics (age, sex, ratios), harvest numbers, natural mortality, weather, habitat condition, terrain, etc. Simulations can then be run using the models to replicate various conditions and estimate the effect on populations.

Conclusions:

- **Until recently Montana has not used statistically estimated population sizes or simulation models.**
- **The major focus is on trend analyses and herd composition of observed animals.**
- **The current Adaptive Harvest Management (AHM) Plan for mule deer incorporates simulation modeling. Mule deer are the only species in Montana managed with the help of simulation models.**

Observation: FWP game management objectives are tied to observed animals. Survey techniques focus on using the number of observed animals in consistently surveyed areas. Conclusions on population sizes were based on trends in observed animal numbers. If observed numbers stay relatively consistent over a number of years, then it is concluded the population is also relatively stable in size. If anomalies (relatively big jumps or drops in numbers) in one or two year periods were noted, the biologists often explained the difference in terms of animal movement or weather conditions

during survey periods. These explanations occurred mostly for deer, elk and antelope surveys. Anomalies in sheep and goat counts were often reevaluated (resurveyed) because of the species smaller populations and susceptibility to disease. Biologists base their estimates on what the population will do from the observed numbers year to year. As mentioned previously, the Elk Plan evaluation combines observed and projected numbers. An overall estimate of elk population size in the report is a combination of both types and is less important than individual numbers presented for each Elk Management Unit (a geographic area designated for elk herd management).

The AHM model for mule deer uses fawn-to-doe and buck-to-doe ratios as well as the total number of deer counted and the fawn-to-adult ratio from spring surveys. These data are used to predict mule deer population size and composition given a variety of harvest regulations and environmental conditions. The information base for the model includes not only animal counts, but weather data, unclassified numbers, size of the survey area, survey conditions, and natural mortality. The natural mortality rate used in the model is developed from the results of 1,800 collared mule deer fawns over 16 years in three states. Over 900 adult does were also radio collared, and the number of collared bucks were in the 100s. The mortality rate formula includes all mortality except hunting. Harvest data is collected for the hunting portion. Predation is included in the natural mortality rate.

Use of Herd Composition (Ratios)

Herd composition factors are commonly used to develop ratios of males (bucks, rams, bulls, etc.), females (does, cows, ewes, etc.) and young (fawns, lambs, calves, etc.) in the population. In addition, the ratio of adult females to adult males and young to adult females are also key population relationships often used to implement and evaluate management and harvest strategies. An estimate of the percent of adult males, adult females, and young in the total population must be known before harvest rates can be accurately formulated. Size and age characteristics of adult males are often collected. Group size and number of adult females are factors that

need to be collected. These ratios and factors are used to estimate adult female and young survival rates and recruitment levels.

Conclusions:

- **The herd composition factors and ratios used by Montana are consistent with those of other states and are related to the management objectives of the various species surveyed.**
- **The information is used during discussions of herd health and structure. The ratios and counts are used to help evaluate the success of harvest plans for hunting districts throughout the state.**
- **The factors are an integral part of the discussion and decisions leading up to recommendations.**

Observation: Inventories of big game animals are designed to estimate population trends, taking into account measures of reproduction and mortality rates. Measures we found being discussed in meetings and recorded on justification documents and surveys included:

- bull-to-cow ratios for elk;
- calf-to-cow ratios for elk;
- fawn-to-adult ratios for deer;
- yearling buck numbers observed for deer;
- the number of older buck deer
- lamb-to-ewe ratios for bighorn sheep;
- number of cubs;
- number of yearling bears;
- the number of rams, ewes, and lambs; and
- the curl structure of observed rams.

The composition information was used in conjunction with harvest data, hunter access and congestion information, and game damage information to establish harvest and hunting levels by hunting district.

Conclusion

The Western states we contacted conduct similar wildlife habitat management activities. States use survey and inventory and harvest

survey information to gather information about wildlife populations, population trends, and population characteristics, such as sex distribution and age structure.

All Western states use population objectives and/or management plans for managing wildlife, although states do not necessarily have management plans for each species. The season setting process in the Western states relies a great deal on survey and inventory information.

Montana's FWP department employs game management methods that compare to accepted standards. The development of the Adaptive Harvest Management Plan and associated survey techniques has refined the department's approach for one species, mule deer.

Our contacts with other states and the results of studies of survey methodologies in these states indicate these departments were evaluating the use of different game surveying techniques and models (some developed by neighboring states), as well as continuing to refine and pursue methods to assess size and trend of game populations, including mountain lion and black bear.

Even though Montana's FWP is comparable to other states in terms of survey methodology and use, it still can improve its process. The following chapter compares Montana's process to accepted and desired management practices for big game survey and inventory.

Chapter IV - Improving the Survey Process

Introduction

In today's public environment, there is more interest in natural resource management. This creates an atmosphere of changing public attitudes, new legislation, special interest groups, interagency involvement, etc. According to the Record of Decision for the Wildlife Programmatic EIS (April 1999), the need for the programmatic review included the following:

- The public is demanding increased involvement in resource decisions and increased FWP accountability.
- FWP faces expanded responsibilities and a need to define, coordinate, and defend management decisions.

Planning provides a structured approach to help clearly define the department's intentions for wildlife management. The department established objectives for some wildlife species. Justification forms, which reference objectives, are required to support recommendations for changes in hunting seasons and quotas. The FWP Commission, at public meetings, makes decisions on final hunting seasons and quotas. These actions indicate the department's intention for "management by objectives." Documentation is critical to this process.

Lack of consistent data and documentation lessens the department's accountability. Without documentation, individuals involved with or interested in wildlife management will not have a clear idea and understanding of department plans, actions, and decisions. This can create a situation of doubt and even distrust.

Accountability Through Objectivity and Understanding

Harvest management for big game has been defined as the art of melding the objectivity of wildlife science and the subjectivity of public wants for the attainment of the management goal. Harvest management strategies should be based on objectives established as part of a comprehensive planned management program. The objective setting process must be based on a thorough analysis of inventory information that includes sociological (i.e. impact on land and people) as well as biological data.

As discussed in the previous chapter, inventories of game animals are designed to estimate population trends and composition, taking into account measures of reproductive and mortality rates. The inventories occur in established management units (hunting districts, or areas within hunting districts).

According to other states' biologists and studies of game management, the most powerful negotiating tool a game manager has is the ability to provide the public with thorough and objective analysis of data about wildlife populations. Generally the techniques these agencies used to assess population status have evolved from compromise among management needs for precision, budget restrictions, and personnel availability.

To provide thorough and objective analyses, the studies of survey techniques strongly recommend inventories should be designed to sample the entire reproductive segment of the population with a standard, repeatable methodology. Thus, the need for comparative data makes surveying consistency extremely important. Survey accuracy, itself, is enhanced through repetition. A game management process based on good repetitive monitoring provides decision makers with information to measure results in trying to meet the goals and thresholds that have been established through objectives. Experts in game management also emphasize the monitoring system include procedures that result in an easy transfer of the exact methodologies used in the collection of data.

Refine Survey Techniques for All Species

The department can improve its game inventory system by refining current survey techniques. In recent years the department has recognized this need. A department review of its own survey program stated Montana's Adaptive Harvest Management plan for mule deer has the benefits of including "a well-focused, rigorous system of monitoring to determine population status relative to population objectives and improved understanding of relationships between population dynamics of mule deer and harvest regulations."

The review also notes aerial and ground surveys often lack design, rigor, and discipline to provide statistically reliable estimates. In addition, there also is some uncertainty with regard to observability of game and how this might be affected by the physical environment, weather conditions, timing of surveys, and variation in ability among various observers and pilots. This has confounded efforts to measure, with statistical reliability, any change ongoing within the game populations. Replicates of surveys (several surveys over the same area) can address variation in survey efficiency over short periods and also provide a reliable estimate of variance.

In another department proposal for future work on a potential wildlife program, the proposal calls for improvement in wildlife population monitoring techniques. In order to successfully meet wildlife population management objectives and develop decision-making processes that support those actions the proposal requires, in part, an accurate assessment of trends in those wildlife populations. It further states the state must refine visibility indices and confidence limits for seasonal deer and elk surveys within the different eco-types and develop and/or validate population-monitoring techniques.

Our audit observations reflect the same issues identified in these department documents. We identified the following:

- The method of counting animals and recording data, survey routes and procedures were different among biologists and regions. In most cases actual survey routes and procedures are not specifically documented in the form of written procedures, but can be reconstructed from survey reports and maps. The use of GPS units and the associated mapping capabilities have provided much better documentation for some biologists.

- Within the same region elk survey techniques and efforts have not been consistent.

- The individual biologist conducting the survey influences survey techniques significantly. In order to maintain "comparative trend data" biologists are reluctant to change their procedures. Thus they continue to use different survey documentation and approaches. In addition, in situations where new biologists have

replaced departing biologists they have changed survey techniques and incorporated trend data into new analyses.

- The competition for and the scheduling of aircraft and pilots is an issue that has to be addressed each year to attempt to get necessary surveys completed during the same time periods.

- Biologists use visibility bias adjustments on a limited basis in Montana. The use of adjustments appears to be dependent on overall game management objectives and the related goals of the survey. More recently the department is being asked, "how many animals are there", as well as for trend analysis.

- Specific sample sizes are required only under the department's Adaptive Harvest Management Plan for mule deer, so estimates of mule deer herd composition in some areas are statistically valid.

- As a tool to help in estimating mule deer population sizes and determining and projecting population trends computer models have been developed and are in the initial stages of use. There is no modeling for other species.

- Twenty percent of the personnel in the Wildlife Division are within five years of retirement eligibility. The historical knowledge of biologists and pilots is essential to the current process. The loss of these individuals would impact the repetitiveness and transfer of the data. In addition, the need to contract for pilots brings in another element of inconsistency, if new contractors are used.

- The department's Montana Elk Plan evaluation includes both observed and adjusted numbers when comparing surveyed animals to plan objectives. Biologists have referred to both observed and adjusted numbers as "population totals."

Other states' wildlife agencies indicate Montana has a very good start on a more exacting and understandable management system that could be used for other species, even though it is in its early stages. The Adaptive Harvest Management (AHM) Plan for mule deer provides for a more rigorous and repeatable approach to game management. Many of the concepts used in the AHM plan are the ones needed for other species if the survey process is to be refined.

A survey program designed to do repetitive surveys of a representative sample of the same key representative game management areas, and not doing other areas or doing other areas less frequently is desirable. Game management studies have concluded it is impractical and prohibitively expensive to conduct statewide surveys for widely distributed wildlife species. Frequent surveys conducted under less than rigorous conditions dilute finite survey dollars, stretch needed aircraft/pilot resources, and result in diminished accuracy. Rather than conducting less accurate surveys in many management areas, more accurate estimates through repetitive surveys in fewer units yield better information using the same resources. Resource decisions would need to be made. And, fewer hunting districts may be surveyed regularly leading to questions from the hunting public as to why surveys are not being conducted in those areas. The questions arise because these public groups have different expectations of survey results. Some are interested in what was seen; others want to know why there are not more animals in an area; others want to know what areas were flown. However, such an approach would give the biologists a better idea of the variability of their observations.

Repeating actual procedures used is also important. Game management practice has shown the more standardized a survey route is the better the surveyor can replicate inventory procedures. Replication helps remove some variability bias inherent in the survey process. Standardized protocol is important because it removes subjective type judgments and leads to more rigorous surveying. Biologists do have experience and knowledge that give credibility to subjective decisions, but in gathering data the surveyor wants to remove as much variability as possible. This is why it is important to document how surveys are conducted so they become repeatable and transferable. Even though the flight routes and results could be reconstructed from information maintained by biologists, there is room for improvement in documenting how surveys are conducted.

Public Demands and Understanding

As mentioned previously, the techniques used have evolved from compromise among management needs for precision, budget

restrictions, and personnel availability. Now, FWP faces expanded responsibility and a need to define, coordinate, and defend management decisions, as the public is demanding increased involvement and increased FWP accountability. Lack of consistency and the perception of subjectivity lessens the department's accountability.

In refining survey procedures it is now equally important the hunting and general public understand why decisions were made and how the information that was used in making a decision was gathered and compiled. Any refinements to the documentation of the decision-making process should include materials that help in the understanding of count procedures and herd composition analysis. The use of GPS units, cameras, and mapping (besides helping insure consistent procedures) helps with data presentation.

With the increased use of justification forms by biologists to recommend changes in seasons and quotas, the data used is now more available for review and scrutiny. Results of the surveys need to be directly related to management objectives, as they are in the AHM plan for mule deer. The triggering of specific actions (recommending changing quotas, etc.) can then be tied directly to the survey results. This increases the public's understanding of why a recommended change was made or not made and adds a level of objectivity to the process.

The type of implementation process used by the department to develop and use the AHM for mule deer will be necessary to bring about refinement of other survey techniques. Because of the regional structure of Montana's game management process, along with the independent nature and operation of individual biologists, it will be necessary for the department to demonstrate the benefits. The costs associated with repetitive surveys and development of new management objectives, along with the availability of aircraft and personnel are factors that will need to be addressed. However, to provide the type of information necessary to increase the public's understanding and department accountability, a refinement of survey

and inventory techniques is a major step. This step is a long-term process because of the many factors involved.

Recommendation #1

We recommend the department refine its survey and inventory techniques for all species to better incorporate the concepts of:

A. Repetitive surveys of representative management areas;

B. Standardized and documented protocol that is easily transferable;

C. Use of visibility bias adjustments and required sample sizes;

D. Tying survey results directly to management objectives and subsequent recommendations; and

E. Understandable and concise presentation to the public based on objective analysis.

Is Predation Considered as a Factor in Season and Quota Recommendations?

Predation is not included specifically in any game population size decisions that would be used in making season and quota recommendations. Natural mortality is only considered formally as a factor in estimating game populations for mule deer. Natural mortality for other species has been taken into account at times through observable effects of disease and weather, and in some cases where predators have preyed on smaller herds.

Predation on mule deer is included in the mule deer model's natural mortality rate. The natural mortality rate was developed from the results of a research study of collared animals. The natural mortality rate formula includes all mortality except hunting. Hunter harvest data is collected from the hunter survey portion of the game management process. Human caused mortality (hunting, road kills) is usually measured more easily than natural mortality (weather, disease, predators). Legal harvest of the game is perhaps the most available mortality data and the easiest to collect.

There is a difference between surveying methods used for research and surveying methods used for ongoing game management. The resources available and the study objectives are different. Research projects have the benefit of concentrating on a specific objective within a controlled area. For example, the current mountain lion study in the Garnets is designed to provide some information on the interaction between lion and other game populations. The study area has a long history of deer and elk survey information. The lion research may be able to determine the degree to which trends in deer and elk populations correlate with trends in lion densities.

Another example is a research study of elk calf mortality caused by grizzly bears, black bears, coyotes, cougars and wolves in Grand Teton National Park. Approximately 60 elk calves will be captured and fitted with radio collars. Sixteen grizzlies, twenty black bears and two mountain lions are already wearing collars. These animals will be monitored during the study.

A Montana-related example is a research project to monitor the impacts and dynamics of wolf packs and predation rates on elk distribution and demographics across a range of environments in the Greater Yellowstone Area (GYA), using three study sites. The broad approach is intended to allow comparisons to be made among the demographics of elk herds subjected to wolf predation, but no hunting, and herds impacted by both wolves and hunting. By working at three sites in the GYA that differ in critical variables such as elk density, herd size, intensity of use by wolves, snow depth and human harvest, the study will make comparisons among sites to identify factors that have the strongest impacts on wolf-elk dynamics. Because historical data on elk numbers and demography are available for all three sites, extending back as far as the 1920's, the study will make pre- and post-wolf comparisons within each site, effectively using wolf reintroduction as a natural experiment with three replicates.

Conclusions:

- Normal game management survey techniques are not designed to estimate the rate of predation on game populations.
- An analysis of trends in total observed counts and herd composition gives the biologist an indication of changes in the herds, but the causes of the changes have to be deduced using other information.
- Research provided the factors necessary to estimate the natural mortality rate for mule deer. Similar research would be necessary to analyze the effects of predation.

Chapter V - Information Used by Commission/Biologists

Introduction

One of our objectives was to determine the usefulness of data collected during surveys and the extent to which the Fish, Wildlife and Parks Commission uses the biologists' information when setting quotas and seasons. We were also interested in the use of game damage as a factor. We reviewed the processes for the 1999 through 2001 hunting seasons. We attended wildlife managers' meetings and attended Commission meetings concerning the 2002 hunting season. This chapter concludes on the use of survey and biologists' information and discusses the whole season/quota setting process to provide a framework as to how the information gets to and through the Commission.

Seasons and Quotas

A season change consists of changing the types of permits/tags (i.e., antlered to antlerless, either sex to bucks, spike bulls to branch antlered bulls, etc.), increasing or decreasing the length of the season (adding or deleting an early or late season hunting period), closing a hunting district, opening a new district, selling licenses over-the-counter, etc. Quota changes consist of increasing or decreasing the number of permits/tags that will be offered in the general Big Game drawings.

If a biologist is aware of the need for a major change in quotas, those recommendations can be presented to the Commission in December along with season changes. These quotas will not be finalized until June or August, depending on the species. By identifying quota changes during the season setting process, sportsmen are aware of the change when applying for any permit/tag through the Big Game Drawing.

Information Used in Justifications

The use of justification forms by biologists has increased over the three years of information we reviewed. Information and data used to make recommendations is now more readily accessible to other decision makers and the public.

Conclusion:

- **Survey data is discussed and is a major component of the decision-making process for managing ungulates.**
- **Survey data is just one component biologists use to determine what, if any, changes need to be made to a season or quota.**

The following lists the types of information used by the biologists when making their decisions:

a. Survey numbers (counts and classification).
b. Management plan objectives.
c. Game damage – potential and actual.
d. Access – public and private – limited or unlimited, outfitting.
e. Landowner tolerance for animals.
f. Harvest survey information.
g. Weather – winters mild/hard, summers dry/wet.
h. Check station information.
i. Hunter effort – how many days it takes to harvest an animal.
j. Hunter success – whether or not they filled their tag.
k. Public safety – urban animals, and animal/vehicle collisions.
l. Public input (landowners, hunters) regarding hunter opportunity, number of animals they have seen, how long it takes to see/harvest an animal.
m. Game warden comments about public safety, game damage, and number of animals they are seeing.
n. Habitat condition.
o. Recommendations of private groups such as outfitters (initiate a sheep quota), and numerous sports persons' associations.

Items a.. through g. were the most prevalent pieces of information used in formulating initial recommendations. Most of these items were mentioned in all justifications.

Discussions relied on survey data for numbers, game animal migration patterns, public comment, hunter access, and landowner and biologists comments. Hunter effort and hunter success were discussed in those hunting districts or for those species where there was no current survey data. Effort and success were prevalent in the

moose, sheep, and goat justifications. Information from the harvesting of bears, goats, sheep and lions provided by the successful hunters was used to age the animal, determine the sex and health, and identify location of the harvest.

All the deer and elk changes in the last two years discussed management plan objectives. Some species do not have a specific management plan, but the region might have established management objectives. These were mentioned. If a hunting district was not part of a particular survey area (for example, if the mule deer numbers in a district were not part of a trend or census area), the trend in the closest survey area was discussed.

Game Damage

Survey numbers and objectives were discussed in previous chapters. Using game damage as a factor in the decision making process was addressed in a number of ways by the biologists, department and Commission.

Conclusion: Discussions and documentation on season and quota setting included information on game damage.

The documentation and discussions confirmed the department's current game damage program emphasizes public hunting during the general hunting season as the primary method of accomplishing solutions to game problems. Discussion for the quotas for most hunting districts included an examination of game damage complaints and if those areas being damaged allowed for public hunting or were next to areas that did not allow public access. Special hunts were also used to reduce the effects of game damage to crops and property. For example: in Region 2, there have been 28 special elk damage hunts since 1992. In Region 3 there were 53 elk damage hunts since 1992. These hunts were conducted through a combination of special hunts and extending the time period for receiving special elk licenses in those hunting districts. Region 4's recent information on game damage hunts included summaries of the decision making process for issuing supplemental game damage licenses, which were authorized by the 2001 Legislature. The

justification information included effective dates, elk population status, estimate of damage, total permits allowed, extent of public hunting allowed, harvest opportunity, and suggestions for improving the process, including a need to address the problem through the regular season setting process. Region 5 tracks game damage complaints on a spreadsheet by landowner and location to help establish a pattern of damage and frequency.

The department's "Game Depredation Report" listed estimates of the number of animals causing the damage. The actions taken or recommended include: special seasons, repellants, herding, live traps and transplanting, direct control by killing, tranquilizing, scare-away gun, etc. The department expended over $476,000 on game damage in 2001. The prior two years' expenditures averaged about $400,000 each.

Justifications Written and Reviewed for Tentative Seasons/Quotas

Prior to sending the justifications to the central office in Helena, regional personnel will have a meeting of biologists and wardens to discuss the changes to see if there is any trouble or problem with the change, or if there are changes that are needed the biologist did not see. After the meeting and any changes, the wildlife manager and/or supervisor will sign off on the justifications and send them to Helena.

Wildlife Division staff then review the justifications. A memo will be sent to department employees for their input on the season changes. (Comments about the changes were found in the files from wardens to fishery personnel.) The regional wildlife managers, management bureau chief, division administrator, law enforcement division administrator, and big game drawing staff will then meet to discuss the proposed season changes. Errors, corrections, and justifications for the changes are discussed.

There is generally not a meeting for quota changes, nor are the quota changes sent to a large number of department staff for comment.

Commission Presented With Tentative Quotas/Seasons

Information from the previously noted meetings is compiled and sent to the Commission. The Commission discusses the information at a public meeting. Members of the public are invited to make any comments about the proposed season/quota. If the Commission does not make any changes to any hunting district in a region, they will approve the region's "tentatives". If there is a change to a tentative season/quota in a particular district the Commissioners will make a motion to amend. After all the districts are discussed in a region, there will be a motion to accept the region's tentative changes as amended.

Public Hearings Conducted

After the season and quota tentatives are approved by the Commission, the information is compiled and distributed for public comment. The regions are provided all the materials to distribute to the public. The region will conduct public hearings in various sites in the region. The wildlife manager and appropriate biologists attend the meeting along with the Commissioner for that area.

Final Justifications Written and Reviewed

After the public comment period, the biologists complete justification forms for any needed changes to the tentatives. These forms are reviewed in the same manner and by the same parties as the tentatives. The wildlife managers, division staff, law enforcement personnel and game drawing staff meet to discuss the new season changes. Administrative staff from the regions might also attend the meeting to discuss season changes to general regulations, typos, etc.

Commission Presented Quotas/Seasons for Finalization

The changes to the tentatives are compiled and sent to the Commission for review. The Commission holds a public meeting to discuss the changes. Public comment may or may not be taken. Again, the Commission can make changes, approve the amendments, or approve the tentatives as final.

Commission Changes

Are the commissioners using the information and data presented by biologists? Is there a level of subjectivity? These questions were answered by evaluating what sort of changes the Commission made to the biologists' recommendations.

The Commission will change a proposed season – either sex to antlerless, does to bucks, etc. It will change quotas: 100 to 200, 300 to 150. In 1999, there was limited documentation and support to determine why changes were made. Following our performance audit of the Wildlife Division the use of justification forms increased and the documentation improved in 2000, and even more in 2001.

From the available information we determined that the commissioners do make new recommendations and modify department recommended changes. This occurred (over four years):

- 31 times (21 new) out of 253 season tentative proposals;
- 26 times (9 new) out of 105 season finals;
- 12 times (7 new) out of 169 for quota tentative proposals;
- 19 times (7 new) out of 124 for quota finals.

For deer and elk particularly, the majority of the changes to the tentative seasons and quotas are based on comments from the general public, landowners, sportspersons and organizations received during the public comment period. Proposed changes to tentative antelope quotas are based primarily on information gathered during the July survey flights. The flights are conducted so close to the commission meeting to set finals, there is little time for public comment

Deer and elk are the major species with changes. From documentation reviewed during the last two years, the department (based on biologist input) did not contest many of the changes. In some cases the Commission would discuss a change and the department would interject its preference and the Commission would use the department's recommendation. The changes were made after discussion of the data available, but as mentioned previously, the survey data was only one part of the information base used to make a decision, even at the Commission level.

Conclusion

The process used by the department and the Commission follows the established accepted steps of a harvest management program. Biologists' survey data and other ecological information is used to

inventory or determine population abundance; population and recreational goals and objectives are established at the state or regional level; and the harvest management regulations are directed at meeting those two types of goals and objectives. The regulations recommended by biologists are based upon data they have available – taking into account social factors such as landowner tolerance of game and hunter numbers.

Commissioners do recommend and make changes. These recommended changes come from information at public hearings and from individual private citizens the commissioners represent. The discussions often revolve around the impact regulations are having on hunter opportunity and bringing about the desired outcomes. These discussions involve both the department's and public's views on game population health and size. The Commission uses the process as it has been structured. Information sources and input from areas within and outside the department are solicited and used.

Overall, the commissioners and the biologists use the survey information gathered and provided when setting seasons and quotas. In the absence of objective and scientific data the decision makers relied upon judgment, personal knowledge, and public opinion. This added a level of subjectivity to the process.

Department Response

Montana Fish, Wildlife & Parks

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Ref: DO0803-02
November 1,2002

Mr. Jim Pellegrini
Deputy Legislative Auditor
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POB 201705
Helena, MT 59620-1705

Dear Jim:

The final audit report on the Big Game Inventory and Survey Process was complete and you and the staff are to be complemented on a thorough job. An audit of a counting exercise would, on the surface, seem quite simple but as your report notes there are numerous nuisances to this program which add to the complexity.

Fish, Wildlife & Parks' (FWP) response to the single recommendation is as follows:

Recommendation #1

We recommend the department refine it survey and inventory techniques for all species to better incorporate the concepts of:

A. *Repetitive surveys of representative management areas;*
B. *Standardized and documented protocol that is easily transferable;*
C. *Use of visibility bias adjustments and required sample sizes;*
D. *Tying survey results directly to management objectives and subsequent recommendations; and*
E. *Understandable and concise presentation to the public based on objective analysis.*

FWP concurs with the recommendation.

Our concurrence is made with the understanding that full implementation of the recommendation is a long-term commitment. Implementing repetitive surveys to increase survey accuracy is costly and will require prioritization with other activities. If the Mule Deer AHM process is used for other species it will require three repetitions to meet the standard. It is unlikely that it can be or should be accomplished for all species. As an example, selecting representative areas similar to those used in the deer example are likely to work for species such as elk and antelope but less applicable for species which are occupying isolated habitat types such as bighorn sheep or mountain goats.

FWP has undertaken a more formal standardized approach to data management. The expected turnover in personnel in the near future has necessitated the ability for future biologists to replicate or at least evaluate past efforts. The affordability of handheld GPS units has enhanced this effort. Training sessions have been offered to regional biologists on the use of GPS and data storage for use in mapping. A GIS programmer has been devoted half time to developing web based data entry for a number of species in the wildlife program. FWP recently implemented a data edit entry program for the mule deer survey information and plan to implement similar programs for other big game species in the future as plans are revised or drafted.

The use of bias adjustments and sample sizes are tied directly to the development of management plans and objectives. The level of precision, etc., is dependent on the management objectives and what criteria are measured that result in changes or decisions. FWP is in the process of updating the elk management plan, drafting an upland bird management plan, and will reevaluate management plans for black bear and mountain lions once the research efforts on these species are completed. The FWP Commission has expressed a desire to see more management plans, which follow a format similar to the mule deer plan. Progress will depend on availability of personnel and funding.

The use of computer databases will enhance the opportunities for better presentation of the survey information to the public. A level of standardization to the presentations will likewise be of benefit to the public and its understanding of the information presented.

The greatest challenge which FWP will face in implementing the recommendation is gaining public acceptance. While most will understand the value of increased precision to arrive at a number, it is unlikely that they will accept the fact that "their" area was not flown as a trade off for increased precision somewhere else.

Thank you for the report and recommendation and FWP will respond to any questions that this response may generate.

Sincerely,

M. Jeff Hagener
Director