

## APPENDIX III

### Harvest Survey Program

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#### I. INTRODUCTION –

Each year, the Wyoming Game and Fish Department conducts several harvest surveys to obtain biological and social data needed for management. Information from these surveys is used primarily to monitor status and trends of game populations, assess effectiveness of hunting seasons, determine future license quotas, and provide data for economic reporting. In addition, harvest summaries are published in several reports available to the public upon request and via the Internet.

Based on data from these surveys, we estimate harvest and hunter activity (participation rates, effort) with respect to the following species groups: big game (deer, elk, pronghorn, moose, bighorn sheep, and mountain goat), small and upland game, migratory game birds, wild turkey, and furbearing animals. Harvest statistics for big and trophy game and wild turkey are reported at several levels of aggregation including hunt areas, herd units, and statewide. Data are also reported according to license type (fee type) and residency status. Harvest statistics for small and upland game, migratory game birds, and furbearers are reported based on species management areas and at the statewide level. Harvest statistics for bison and falconry seasons are obtained from mandatory reporting records rather than formal surveys. Harvest statistics for black bear, mountain lion, and bobcat are obtained from a combination of mandatory harvest checks and surveys to estimate effort and success rates.

An external contractor performs the deer, elk and pronghorn survey, and the hunter effort portion of the black bear and mountain lion survey, collectively called the Big and Trophy Game Harvest Survey. The University of Wyoming Survey Research Center conducted the survey from the 1970s through 1995. Since that time, the survey has been outsourced based on a competitive bid process. PA Government Services of Madison, Wisconsin was awarded the contract in 1999 and remains the survey provider as of this publication (2007). Biological Services performs other species surveys “in-house.” At one time, we also estimated archery harvest through a separate survey, however archery data have been captured in the regular big and trophy game harvest survey since 2006.

Sample frames for all harvest surveys are developed from the Department’s license sales databases. As the automated “point-of-sale” system comes on line in 2008, license records from vendors will be loaded into the system in “real time,” and should be more complete, accurate and consistent in format. Errors from manually keying in sales and personal information will be greatly reduced.

The harvest surveys are kept very basic. We try to limit the number of questions to reduce the burden and avoid respondent “burnout.” The basic questions are: Did you hunt and if so, how many days?; what species, sex, age (adult/juvenile), and numbers of animals did you

harvest?; and what type of weapon did you use? We also provide the opportunity for hunters to submit their written comments. These comments tend to convey individual perspectives (both positive and negative) about the hunter's experience, and opinions and recommendations regarding various aspects of the Department's management programs. The survey format and questions vary among species. As information needs and research goals change, the questions we ask may also change.

## II. BIG GAME HARVEST SURVEY –

The major purpose of the big game harvest survey is to estimate the harvest of each species in each hunt area and herd unit throughout the State. Harvest is estimated according to sex and age class (adult/yearling/juvenile) as applicable. Additional information derived from the survey includes numbers of active hunters, effort values (days per harvest), and hunter success rates. Biologists summarize and analyze these data in job completion reports (JCRs) prepared annually for each big game herd and trophy game management unit. Age- and sex-specific harvests are key data applied in models to estimate population size. Effort and success data are frequently consulted to verify population status and trends. Harvest statistics are also used to support season recommendations, environmental impact analyses, agency planning, and economic analyses. Hunters, researchers, consultants and other government agencies frequently consult the Department's harvest data.

A. Moose, Bighorn Sheep and Rocky Mountain Goat – The Biological Services Section conducts the moose, bighorn sheep, and mountain goat harvest surveys “in-house.” All license holders are included in the survey. Although the response rate is high, there are always some hunters who do not respond. Up to 3 attempts are made to obtain information from non-respondents through follow-up surveys and/or telephone calls. Data from survey respondents are extrapolated based on the numbers of licenses sold in each sampling stratum. In the case of bighorn sheep and mountain goats, harvest is determined from mandatory registrations. However, sheep hunter effort is estimated through a follow-up mail survey that captures data from both successful and unsuccessful hunters.

In the past, we also surveyed mountain goat hunters by mail, but no longer do so. Since harvest success is close to 100%, the information we need is generally available from the goat registration cards. Missing data are retrieved by phoning the comparatively few hunters who did not register a harvested goat.

The Department also collects additional biological information from harvested moose, sheep, and goats for management purposes and to refine harvest estimates. These additional measures are briefly described below.

Moose – Teeth from harvested moose are submitted to the Department's lab in Laramie for aging. Prior to the hunting season, Biological Services mails each licensed moose hunter a “tooth box.” Successful hunters are requested to extract the 2 lower incisors from the moose they harvested and return them to the lab. We achieve a very high level of cooperation in part, because hunters are interested in finding out the age of their

animal. When the lab finishes processing the moose teeth collection each year, a completed age database is sent to Biological Services. In prior years we compared the database of hunters who submitted teeth against the mail survey responses and identified additional harvests in the tooth data that were not reported in the mail survey. However, the tooth database reflects only successful hunters whereas the mail survey, in theory, represents a random cross-section of moose hunters. Thus, augmenting the harvest reported in the mail survey with additional harvests from the tooth sample would have skewed data toward successful hunters and biased any extrapolations. As of hunt year 2005, the tooth data are no longer used as proof of additional harvests, but the data are forwarded to regional wildlife biologists for their use.

Bighorn Sheep – Biological Services maintains a cumulative database of bighorn sheep registrations. Each successful sheep hunter, anyone acquiring the skull and horns from a dead sheep (called a “pick-up head”), and anyone possessing the head of a bighorn sheep in Wyoming is required to register the sheep. Registration records include the sheep hunter’s (or owner’s) name and address, days hunted, whether an outfitter or guide was used, the hunt area and specific location where the sheep was harvested or found, the estimated age, and several horn measurements. Biological Services cross-references this information against the mail survey data to verify every harvest reported by hunters.

Mountain Goat – Harvested mountain goats and “pick-up heads” must also be registered with the Department. The WGFD issues only about 16 to 20 mountain goat licenses annually. As with sheep, the mountain goat harvest database is a cumulative record.

Virtually all moose, sheep and mountain goat licenses are issued in the computer license draw. The single license draw (SLD) database is the source of the hunter information for the mail survey and follow-up contacts. The Department’s license carryover process also has a particular bearing on the harvest surveys for these species due to the small numbers of licenses issued in each hunt area. Wyoming Statute provides that a hunter with legitimate medical or other reasons may be granted permission to carry his unused license over to the subsequent hunting season. These inactive licenses must be tracked and accounted for in the sheep, moose, and mountain goat harvest survey.

Governor’s licenses can also impact the harvest survey results when they are exercised in hunt areas with small quotas. We obtain a list indicating the hunt areas where Governor’s licenses will be exercised each year from the Wildlife Heritage Foundation. The information from these licenses must be manually added to the survey databases. The finalized lists are sent to the wildlife biologists and wildlife management coordinators for their reference. In the ideal, commissioners’ and Governor’s licenses for deer, elk, and antelope would be added to the “over-the-counter” (OTC) license databases or other big game license datasets. In the past, they have not been added due to the small number of licenses in proportion to the overall pool of deer, elk, and antelope licenses. Moose and sheep licenses on the other hand, are often very limited so a governor’s license can significantly increase harvest (on a percentage basis) within a particular area.

1. Survey Process for Bighorn Sheep, Moose, and Mountain Goat Harvest Reporting – After all the drawings are completed, license and hunter data are downloaded from the network and copied to the appropriate ACCESS database maintained by the Harvest Survey Coordinator. Hunter and license information are extracted from the license draw database and included in an annual table created within each species' database. Tables are also added or maintained each year to update the carryover licenses, hunt areas, herd units, and hunt area/license type quotas in each database. An additional field in the survey database uniquely identifies each survey (by number) to track printing, mailing, and data entry.
2. Harvest Estimates – Extrapolations to estimate harvest and hunter activity parameters are based on the proportions of total license sales the useable survey responses comprise for each hunt area and license fee type. We assume the information reported by survey respondents is representative of all hunters. For example, if 1% of the respondents reported they did not hunt, we assume 1% of the non-respondents also did not hunt. We make similar assumptions with regard to the average number of days hunted, age and sex of animals harvested, harvest success, and so forth.

In reality, characteristics of respondents and non-respondents differ somewhat. The Department commissioned 3 studies of non-response bias in the deer, elk, and antelope harvest surveys over past 3 decades. Generally speaking, the non-respondent is less likely to have hunted and less likely to have harvested an animal. If the non-respondent did harvest an animal, it was less likely to be an adult male. However, the biases detected were generally minor and inconsequential to harvest management decisions. In addition, bias factors were not consistent and often not statistically significant. Accordingly, we assume that characteristics of respondents and non-respondents are similar enough that we do not need to correct for non-response bias in our harvest surveys. (Data from bighorn sheep and mountain goat harvest registrations are not extrapolated because 100% of harvested animals are registered).

3. Precision standards – The goal for moose and bighorn sheep surveys is a response rate of 100%. If the response rate is less than 80% for any hunt area or license type, a second survey is mailed and/or follow-up telephone calls to non-respondents are made by either Biological Services or field personnel. When follow-up calls are necessary, they are usually associated with the moose harvest survey. Calls should be made after the preliminary harvest report is completed, but before the final report deadline.
4. Assumptions –

Bighorn Sheep. Hunters place such a high value on the opportunity to hunt bighorn sheep that license recipients very seldom decline to hunt. Given historic participation rates, we assume all license recipients hunted unless they state otherwise on the sheep harvest survey or unless the license has been carried over due to medical or other reasons. This assumption affects our calculation of the total number of active

hunters, since we no longer extrapolate from the harvest survey responses to estimate overall participation rates. We also no longer extrapolate to estimate the total sheep harvest because this is derived from the mandatory harvest registrations. The only statistic we extrapolate from the harvest survey is the total number of days hunted. In this way, the effort of hunters who did not kill or register a sheep can be factored into the overall estimate of days hunted per sheep harvested. We assume the effort of non-respondents is the same as that of respondents. The total number of hunter days is calculated by multiplying the average number of days per sheep harvested by the total number of hunters. In 2006, we modified the sheep harvest survey instrument to collect information on the type of archery weapon (crossbow, longbow) archers used to hunt and harvest a bighorn sheep.

Moose. As previously discussed, we no longer use tooth submissions as proof of a harvest in order to adjust the estimates of total moose harvest, hunter participation, and effort. Tooth data represent only successful hunters, whereas the harvest survey is a random sample of all hunters. Therefore, combining these data can skew the accuracy of extrapolations. Beginning in hunt year 2006, moose harvest estimates will be extrapolated from just the survey data. Information from the tooth-aging database will be sent to field biologists. They can address any potential discrepancies they believe exist and explain their rationale in the JCRs. In 2006, we modified the moose harvest survey instrument to collect information on the type of archery weapon (crossbow, longbow) archers used to hunt and harvest a moose.

5. Disposition of Data – Harvest estimates and related information are compiled into the Annual Big & Trophy Game Harvest Report. Biologists consult these reports to prepare recommendations for license quotas, bag limits, season dates and so forth. The reports are sent to the Wyoming State Library, environmental consulting firms, conservation organizations, and government agencies. We also post harvest reports on the Department's public web site. The survey information is analyzed in the herd unit job completion reports (JCRs) prepared by each region, and total harvests and hunter participation are summarized in the Department's Annual Report.

A preliminary harvest report is prepared after most of the surveys have been returned and preliminary harvest estimates are generated. Preliminary harvest reports are sent electronically to field biologists and wildlife management coordinators for use during the Department's season setting process, which occurs fairly early in the calendar year. The biologists and coordinators also review the reports for potential errors and inconsistent data. After field personnel have reviewed the preliminary estimates and any additional survey data we receive have been entered, final estimates are generated and incorporated into the final harvest report. The final estimates are also sent electronically to the field for use in drafting the JCRs each year. We generate separate harvest reports for each species. The reports summarize harvest and related statistics with respect to herd units, hunt areas, license types, and residency status. Statistics reported include numbers of licenses sold, numbers of licenses exercised (hunters in the field), effort (days expended per animal harvested), harvest success rates, and numbers of each age/sex harvested.

- B. Big and Trophy Game Harvest Survey. The deer, elk, pronghorn, black bear and mountain lion survey is contracted to an outside provider. As of this publication, the survey is being done by PA Government Services of Madison, Wisconsin. State purchasing guidelines require large contracts (>\$1,500) must be bid no less than every 3 years. A formal request for proposal (RFP) is completed to initiate the bid process. The contract can be renewed with the successful bidder up to 2 successive years pending satisfactory performance. Cost increases for items like postage may not exceed 10% per year and are subject to negotiation. The special provisions and performance stipulations in the harvest survey RFP are extensive and cover the metrics to be estimated, precision standards, report formats, timelines, penalties, and other specifications.

The Department provides the contractor with information from the big and trophy game license databases and other necessary details such as license types and limitations. The contractor selects a random sample of license holders to survey from each hunt area, as outlined in the RFP special provisions and data standards. The numbers of useable survey returns that must be obtained is a calculated percentage of the total number of licenses sold in each area, or the number needed to realize a 90% confidence interval that is  $\pm 10\%$  of the male harvest estimate at the herd unit level. The required sample percentage is smaller in areas with greater numbers of licenses issued. For example, the number of useable returns from a hunt area with 700 licenses available may be 25% of the licenses issued, whereas all hunters would be receive a harvest survey in areas with less than 50 licenses issued, given the expectation of realizing at least a 40% response rate.

The contractor conducts separate surveys of pronghorn antelope, deer, elk, black bear license holders, and beginning in 2007, mountain lion hunters. Selected license holders are notified by postcard and requested to complete the survey form on a website hosted by the survey contractor. A mail survey is sent as a backup if the license holder does not respond to the Internet survey by a predetermined date. Specifications for the harvest reports and other deliverables are included in the RFP, and close coordination with the contractor is necessary throughout the year. We work with the survey contractor on the design of the survey instrument, process improvement, data transfer, and occasionally on supplemental surveys. The deliverables to WGFD field personnel include data tables used in the job completion reports, spreadsheets summarizing harvest information in various ways (herd units, hunt areas and statewide totals), results of hunter satisfaction questions, hunter comments received via the Internet, and written comment letters returned with the mail surveys. The contractor also provides us an annual report including thorough documentation of the methodology used and a summary of the year's survey processes and results.

1. Survey Contract & Special Provisions – The Department has segregated big game populations throughout the State into “herd units” for management purposes. A herd unit is (theoretically) a discrete population of animals having less than 10% interchange with adjoining herds. We estimate the size as well as the age and sex composition of each herd based on classification surveys, harvest field checks, mortality surveys, the harvest survey, and population modeling. The harvest survey

is an essential part of the Department’s annual management program. Data from the harvest survey are used not only to establish harvest quotas, but also to estimate population size based on change-of-ratio modeling.

Herd units are subdivided into one or more hunt areas to manage the distribution of hunters and harvest. One to several license types may be issued in each hunt area. Some license types may be valid for more than one hunt area within one or more herd units. License types provide managers additional means of controlling the age and sex composition of the harvest, managing hunter densities or distribution through time, and directing harvest to specific portions of a hunt area.

The Department regulates black bear and mountain lion harvest through a quota system. Harvest status is updated in all hunt areas throughout the season. Bear and lion hunters are required to call a toll-free telephone “hotline” and listen to the most current recording to determine if the area they plan to hunt remains open each day. Successful hunters must register their harvested black bear or mountain lion within 72 hours. The biologist or warden who checks a harvested animal promptly reports the harvest to the Biological Services Section in Cheyenne and the hotline is updated.

The numbers of herd units and hunt areas included in the 2007 harvest survey are listed in Table 1.

Table 1. Herd units and hunt areas in 2007. \*

SPECIES	# OF HERD UNITS	# OF HUNT AREAS
Elk	35	114
Mule Deer	39	151
White-tailed Deer	5	151
Pronghorn	44	110
Black Bear	N/A	31

\* Herd units and hunt areas may be adjusted through time (sometimes they are combined or boundaries are modified). Not all hunt areas are necessarily open every season. The annual hunting regulations specify open hunt areas and limitations including quotas for each species.

Big and trophy game hunt areas and herd units are delimited independently for each species, except hunt areas for mule deer and white-tailed deer coincide. We have adopted this approach because the features that comprise barriers to interchange (i.e., boundaries of herd units), habitat preferences, and the species distribution differ.

Stratifying the sample of hunters to achieve target precision levels is a very complex undertaking. In addition, duplication caused by a hunters’ ability to hunt in more than one hunt area or herd unit must be reconciled when hunt area totals are “summed” to estimate herd unit totals, and again when herd unit totals are “summed” to estimate statewide totals. The ability in some cases to hold multiple licenses for a single

species also adds to the complexity. License sales for 2006 are summarized in Table 2.

Table 2. Licenses sold in 2006 (pre-audit).

LICENSE TYPE		GENERAL	LIMITED QUOTA	TOTAL SOLD
Antelope	Quota	N/A	65410	
	# Sold	N/A	58138	58138
Deer	Quota	Unlimited	22270	
	# Sold	71545	19424	90969
Elk	Quota	Unlimited	30495	
	# Sold	28475	28993	57468
Black Bear	Quota	Unlimited	N/A	
	# Sold	2967	N/A	2967

### III. SMALL AND UPLAND GAME HARVEST SURVEY –

Since 2002, the Biological Services Section has conducted the small and upland game (SMUG) harvest survey “in-house.” Historically this survey was done by the University of Wyoming Survey Research Center and then by an independent private contractor. Harvest data for 12 species of small game and upland game birds are reported from 37 small and upland game management areas. In addition, harvest data for 6 species groups of migratory game birds are reported from 19 migratory bird management areas.

A. Small Game, Upland Game, and Migratory Game Bird Survey – This is our largest and most complex in-house harvest survey. It involves 2 different sets of management areas and 3 sets of species or species groups. The migratory bird species are ducks, geese, coots, rail, mourning doves, and snipe. The small game species are cottontail rabbit, snowshoe hare, and tree squirrels (red, gray, and fox squirrels). The upland game species are gray partridge, chukar partridge, pheasant, blue grouse, ruffed grouse, sharp-tailed grouse, and sage grouse. In 2006, 11 different license fee types were available to hunt these species. The fee types include resident lifetime licenses, resident and nonresident annual licenses, and resident and nonresident daily licenses in various combinations of license privileges (i.e., bird only, small game only, and bird and small game in combination). As new fee types and license privileges are added or discontinued, the structure of the survey and reporting requirements must be adjusted accordingly.

Sampling is stratified according to fee type. The types with smaller total sales are surveyed at 100%. The types with larger total sales are sampled at 25% to 50%. Virtually all licenses to hunt small and upland game, and migratory game birds are sold over the counter. The over the counter (OTC) license database is the main source of the hunter contact information for surveying harvests of these species. Lifetime license information is extracted from the lifetime license database.



1. Survey Process for Small and Upland Game and Migratory Game Bird Harvest Reporting – Once sufficient data from license sales have been entered to attain the target sample sizes, Biological Services creates an annual table in the SMUG database by running queries to extract the hunter and license information from the OTC and lifetime license data sets. Tables are also added or maintained each year to record survey response data based on hunt areas and license types. An additional field in the survey database uniquely identifies each survey (by number) to track printing, mailing, and data entry.
2. Data Extrapolation – Extrapolations to estimate harvest and hunter activity parameters are based on the proportions of total sales of each license fee type represented by the useable survey responses. We assume the information reported by survey respondents is representative of all hunters. For example, if 1% of the respondents reported they did not hunt, we assume 1% of the non-respondents also did not hunt. We make similar assumptions with respect to the areas hunted, number of days hunted, species harvested, and so forth.

The SMUG extrapolation is complicated by the large number of sampling strata – 11 different fee types are each valid for a unique residency and hunting privilege combination. Survey responses are tallied in the appropriate fee type groups and then 11 weights (extrapolation factors) are calculated based on the total sales of each fee type divided by the number of usable responses. Harvest statistics for each fee type, such as total harvest and hunter days, are estimated by multiplying the survey response tallies by the applicable weighting factor.

3. Precision standards – Due to the complexity of the SMUG survey, the number of fee types with limited sales, and the number of management areas for which harvest is reported, no precision standard is applied. The goal is to achieve target sample sizes specified for each fee type.

In addition, any attempt to determine confidence intervals is complicated by the fact we do not sell small and upland game licenses valid for individual species. Hunters have the ability to exercise their licenses for various combinations of species to the exclusion of other species, depending on the individual hunter's preference. Consequently, we have no way of relating the sample of hunters who say they hunted doves or blue grouse, for example, to the actual numbers of dove or blue grouse hunters in the state in order to calculate a confidence interval by conventional means. More sophisticated methods of estimating confidence intervals have been suggested by the Wyoming Survey and Analysis Center (WYSAC), but would require substantial reprogramming and may render the survey too costly and complex to conduct "in house."

Lacking a straightforward way to estimate precision, we cushion our sample by selecting a very high proportion of license holders. The 2 fee types representing the largest numbers of licenses sold are resident annual game bird and resident annual

combination game bird/small game licenses. These are sampled at 30% of the total numbers issued. The 2 fee types representing mid-level sales are lifetime combination game bird/conservation stamp and non-resident daily game bird/small game. They are sampled at 50%; and the remaining 7 minor fee types are sampled at 100%. Grandjean et al. (2006) provide a detailed description of the statistical procedures they recommend to estimate variance within the complex sampling framework of the Department's small and upland game licensing system.

The response rate for the SMUG survey has varied from 15% to 40% depending on fee type. In an effort to improve response (and precision), we have mailed the initial survey earlier to improve hunter recall, conducted follow-up surveys, improved the design of the survey instrument, and provided the option of entering survey data on the Internet. Although we presume these measures have helped to increase the response rate, due to budget and time constraints, we are unable to measure the extent to which they have.

Since small and upland game licenses are valid statewide, survey samples of licenses exercised for some species and management area combinations can be quite small and variable. We presume the statewide estimates of harvest, effort, and hunter participation are reliable, however estimates for finer stratifications based on management area and fee type can become very imprecise and unreliable.

4. Assumptions – We assume the survey selection is a random sample of license holders; the information reported by survey respondents is representative of all hunters including non-respondents; and we are obtaining a representative sample of licenses exercised for each potential species/management area/license fee type combination (fee type can define residency status, as well as length of time and species group(s) for which the license is valid). We also assume respondents do not report information for more than one license fee type. These assumptions may not be rigorously met in all cases, but we feel they are reasonably defensible. Field personnel and managers can account for possible biases in formulating and justifying their management recommendations. Some aspects of hunter behavior differ among daily, annual, and lifetime license holders as well as residency status. To account for these possible differences, we stratify our sample based on fee types and we develop separate estimates by extrapolating from the data reported for each fee type. Management area and statewide harvest statistics are estimated by adding the fee type estimates together.
  5. Reporting – Results of the SMUG survey are published in the Annual Report of Small and Upland Game Harvest. Estimates of hunter numbers (participation), harvest, and effort are provided for each species/species group and management area.
- B. Wild Turkey Harvest Survey – The wild turkey harvest survey is conducted twice per year, once following the spring hunting season and again after the fall season. Although the surveys are done separately, results are combined to estimate the total harvest published in the Annual Small and Upland Game Harvest Report. Turkey licenses are

sold both through the Department's license draw system and over the counter. Limited quota and general licenses are issued depending on the hunt area. In an average year, at least twice as many turkey licenses are exercised during the spring season, making the harvest survey for that season a much larger effort compared to the fall season survey.

As turkey populations and their distribution expanded in Wyoming, additional hunt areas were converted from limited quota to general hunting seasons. This trend has complicated the harvest survey because the entire population of general license holders must be surveyed to obtain samples of hunters who exercised their licenses in specific hunt areas. Obtaining an adequate sample from some of the less popular, general hunt areas can be quite difficult.

The turkey survey has been modified for the 2007-08 season to include questions regarding the number of general areas hunted and the weapon type used to harvest a turkey. The Department is also considering a 2-turkey bag limit on a trial basis in 2008 and 2010, and this may require another license fee type in the general hunt areas.

1. Survey Process – We attempt to survey 100% of license holders, but are constrained to some degree by the timing of OTC license data entry. Over the past several years increasing numbers of general license receipts have been received from license selling agents later than would be optimal for the survey. Consequently, somewhat less than 100% of license holders are being surveyed. Hunter identification and license type information are downloaded from both the single license draw (SLD) and the OTC license databases. An additional field in the survey database uniquely identifies each survey (by number) to track printing, mailing, and data entry.
2. Data Extrapolation – Data obtained from general license holders are treated differently than data from limited quota licenses because not all general license hunters report the hunt area(s) in which they exercised their license. Limited quota licenses are only valid in a specified area, whereas general licenses can potentially be exercised in several areas. All data reported by limited quota license holders are used to estimate harvest statistics in the hunt area where the license is valid. Harvest statistics for general hunt areas can only be derived from the survey respondents who reported where they hunted. However, statewide harvest statistics are extrapolated from all general license data, including data from the respondents who did not identify their hunt area. The extrapolation factor for each limited quota area is the number of licenses issued for the area divided by the number of respondents. The extrapolation factor for general hunt areas is the statewide total of general licenses sold divided by the total number of respondents who indicated the area in which they hunted. The extrapolation factor for the statewide estimate of general license harvest is the statewide total of general licenses sold divided by the number of respondents who hunted with a general license.
3. Precision Standards – Estimating confidence intervals is rendered difficult for several of the reasons discussed in the SMUG survey methodology, i.e. the ability to exercise a license in more than one hunt area coupled with resident and nonresident fee types

(refer to Section III.A.3.). We assure estimates are as precise as can reasonably be achieved by surveying all license holders and implementing practices to improve response rates. In addition, we provide an Internet option to facilitate responding, which also reduces survey costs. As with the SMUG survey, we presume the statewide estimates of harvest, effort, and hunter participation are reliable, however estimates for finer stratifications based on hunt areas and resident/nonresident fee types can be very imprecise.

4. Assumptions – We assume the survey selection is a random sample of license holders; the information reported by survey respondents is representative of all hunters including non-respondents; and we are obtaining a representative sample of licenses exercised for each potential hunt area/license fee type combination. These assumptions may not be rigorously met in all cases, but we feel they are reasonably defensible. Field personnel and managers can account for possible biases in formulating and justifying their management recommendations. Some aspects of hunter behavior differ between resident and nonresident license holders. To account for these differences, we stratify our sample based on residency fee types and we develop separate estimates by extrapolating from the data reported for each fee type.
5. Reporting – Turkey harvest estimates are published in the Annual Report of Small and Upland Game Harvest. The Harvest Survey Coordinator prepares 3 separate reports each year: one summarizing spring harvest statistics, one summarizing fall harvest statistics, and the combined annual harvest statistics. Harvest statistics are reported for each hunt area and also according to residency status. The statewide harvest statistics are published in the Department’s Annual Report.

- C. Furbearer Survey – Historically, the furbearer survey required trappers to recall detailed information about numbers of traps, days traps were set, and harvest totals for a large array of species. The information was primarily needed to monitor bobcat harvest in order to fulfill reporting requirements of the Convention on International Trade in Endangered Species (CITES). However, we also compiled survey data to monitor trends of other furbearing species and assure the Department has sufficient data to justify trapping seasons. The furbearer survey was discontinued in 2002 due to a chronically low response rate ( $\leq 30\%$ ) and was replaced with a mandatory bobcat registration and tagging requirement to comply with CITES. However, this left the Department with insufficient data for the remaining species, and truncated a long-standing data set.

The furbearer survey was reinstated in 2006 (covering the 2005-06 trapping season), but was greatly simplified to improve response rates. We are now requesting much less information – basically the number of each species trapped or harvested and identification of the furbearer management area(s) where the trapping took place. Effort data (trap days) for the bobcat harvest are obtained at the time pelts are registered, but are no longer requested on the furbearer survey form.

The furbearer harvest survey covers 11 species including: badger, bobcat, pine marten, weasel (longtail, shorttail, and least), coyote, raccoon, red fox, striped skunk, beaver,

mink and muskrat. Four of the species (fox, coyote, raccoon, and skunk) are legally classified as predatory animals rather than furbearing animals under Wyoming law and we considered dropping them to further simplify the survey. However, we decided to retain all species that are harvested for their fur.

The Department has designated 39 furbearer management areas and 6 bobcat management areas in Wyoming. Although bobcats are included in the furbearer harvest survey, the core statistics used for CITES reporting are obtained from the mandatory pelt tagging and reporting requirement.

Anyone who traps or hunts furbearing animals in Wyoming must obtain a resident or nonresident furbearer trapping license. Trapping licenses are unlimited in number and sold over the counter. License holder information for the furbearer survey is obtained from the OTC database. Although some beaver and pine marten trapping is done under limited quota permits, persons obtaining those permits must also have a furbearer trapping license and are surveyed as part of the statewide pool of trappers. Thus, beaver and marten harvests in limited quota areas are incorporated in the harvest figures for the applicable management area, but are not reported for the limited quota trapping areas.

1. Survey Process – We survey 100% of the trapping license holders due to the comparatively limited numbers of licenses sold each year and historically low response rates. The 2005-06 survey was conducted at the statewide level and data were reported for resident and nonresident trappers. Harvest estimates from future surveys will be reported from each furbearer management area, as was done historically. Estimates of firearm and trapping harvest will also be reported separately.
2. Data Extrapolation – Extrapolations to estimate harvest and trapper activity are based on the proportions of total license sales represented by the useable survey responses. We assume the information reported by survey respondents is representative of all trappers. For example, if 1% of the trappers reported they did not trap, we assume 1% of the non-respondents also did not trap. We make similar assumptions with respect to the areas trapped, species harvested, and so forth. To address actual and potential differences in behavior, separate extrapolations are done to estimate trapping statistics for resident and non-resident license holders. (See assumptions below)
3. Precision Standards – Response rates were exceedingly low during the last several years the furbearer trapping survey was conducted. Less than 30% of licensed trappers were responding to the survey at the time it was discontinued in 2002. Response improved modestly (32% overall) when a simplified survey was resurrected in 2006. Because of the sheer number of sample strata associated with 11 species, 39 management areas, and resident/nonresident license fee types, estimates for many strata (species/management area combinations) are highly imprecise (refer to the SMUG survey discussion in Section III.A.3.). The problem is compounded by the poor response rate and small sample size. We plan to explore strategies for

improving response rates through survey redesign, public outreach, and other means if time and budget allow.

4. Assumptions – We assume the survey selection is a random sample of license holders; the information reported by survey respondents is representative of all furbearer trappers including non-respondents; and we are obtaining a representative sample of licenses exercised for each potential management area and license fee type combination. These assumptions may not be rigorously met in all cases, but we feel deviations and resulting biases are minimal. Field personnel and managers can account for possible biases when formulating and justifying their management recommendations. Some aspects of trapper behavior differ between resident and nonresident license holders. To account for these differences, we stratify our sample based on residency fee types and develop separate estimates by extrapolating from the data reported for each fee type.
5. Reporting – The furbearer harvest survey is published each year in the Annual Report of Small and Upland Game Harvest. In 2006, results will be reported from within each management area, statewide, and according to residency status. Statewide harvest statistics are also reported in the Department’s Annual Report.

#### IV. REFERENCES

Grandjean, B., T. Fergeson, and K. Gerow. A project for the Wyoming Game & Fish Department for improving the small and upland game harvest survey. Wyoming Survey and Technical Analysis Center Tech. Rep. No. SRC-613. University of Wyoming, Laramie. 21pp.