Chapter 2

Mule Deer (*Odocoileus hemionus*)

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I. <u>INTRODUCTION</u> – The Rocky Mountain mule deer (*Odocoileus hemionus hemionus*) occupies nearly all habitats throughout Wyoming, including sagebrush, grasslands, riparian corridors, mountain shrublands and forests, subalpine forests, croplands, and urban interface.

A. <u>History in Wyoming</u> – Historical accounts suggest mule deer were not abundant during the 19th century (Julander and Low 1976, Connolly 1981). The population increased after the turn of the century, reaching its maximum densities in the 1950's and early 1960's. The population declined in the late 1960's and has fluctuated since. In more recent years, comparatively higher abundance was documented in the early 1980's and 1990's. However, the population apices are believed to be lower with each subsequent cycle. Possible factors include declining habitat quality and quantity, competition with elk, drought, and predation.

B. <u>Current Status</u> – Mule deer are segregated into 39 herd units in Wyoming, each consisting of one or more hunt areas. A herd unit represents a distinct population of deer that interchanges minimally with adjacent populations. Each herd is managed to maintain numbers within 10% of a postseason population objective. The objective represents a compromise between the biological carrying capacity and competing social desires. The statewide population objective is about 565,000 mule deer. In 2003, the estimated population was 487,000 deer or 14% below this objective (Schilowsky 2004).

C. <u>Natural History Information</u> –

1. <u>Range of Productivity</u> – Statewide, the average productivity has ranged from 55 fawns:100 does (1993 data) to 82 fawns:100 does (1987 data) based on postseason classifications (Ayres 1999). Productivity generally declined from 1978-98, but has varied substantially amoung herd units. Productivity of individual herds ranged from just 47 fawns:100 does in the Chain Lakes Herd Unit (1987-98 data) to 84 fawns:100 does in the Lance Creek Herd Unit (1987-98 data).

   From research in Utah, Colorado, California, Washington, and Arizona, managers have estimated 86 percent of does more than one year of age become pregnant. The average fetal rate is 1.50 fawns per doe, based on examination of reproductive tracts (Robinette 1956). The potential increase from the post-winter population to late summer (prior to hunting season) is 50 percent annually. However, under favorable habitat conditions an increase of 20–30% is more realistic (Zwank 1976).

2. Range of Natural Mortality – Natural mortality rates used to model deer populations in Wyoming are:
   – fawns (age class 1): pre-season, 30-50%; post-season, 30-55%;
   – yearlings (age class 2) and prime adults (age class 3 - 5): pre-season, 2-5%; post-season, 5-10%.

   Mortality rates increase incrementally after age class 5, based on a step-up process. In these older age classes, differentially higher mortality rages are applied to males than to females. Models should support 12-15 age classes.

   Unsworth, et. al. (1999) examined survival rates of mule deer radio-collared in Colorado, Idaho, and Montana. Overwinter fawn survival rates did not differ among states, but varied between years. The mean overwinter survival rate for fawns was 44% (56% mortality). The mean annual survival rate for adult females was 85% (15% mortality). Assuming survival of radio-collared deer is a valid approximation of natural survival rates, researchers predicted a December fawn:doe ratio of 66:100 is needed to maintain population levels**.** However, Mackie (1976) documented population increases associated with ratios of 55-66 fawns per 100 does and declines with ratios below 40 fawns per 100 does.

II. CENSUS – Accurate, cost-effective techniques are not available to census mule deer at the herd unit level. Techniques such as pellet group transects may be useful for small areas, but are impractical for estimating populations.

A computer-based model (POP-II) has been used to estimate mule deer populations in Wyoming since the early 1980's. The following field data are required to model populations: post-season age and sex classifications, harvest composition from field checks, mortality estimates, and total harvest estimates. Information from field studies and the literature are also used to establish model parameters for number of age classes in the population, harvest effort values, mortality estimators, wounding loss, and sex ratio at birth.

A. Preseason Herd Classification – This type of survey is not done in Wyoming. Herd classifications should not be attempted prior to the hunting season because mule deer are dispersed and difficult to observe in early fall.

B. Postseason Herd Classification –

   1. Rationale – Herd classification ratios approximate the proportions of fawns, does, and bucks in the population . Age and sex ratios can be determined more accurately from postseason classifications because all segments of the population become more visible at that time of year. Bucks accompany does and fawns during the breeding season, and deer are beginning to concentrate on winter ranges. The data are used to analyze population dynamics. Annual fawn:doe ratios from successive years can indicate trends in reproductive success and survival of fawns to early

winter. They can also be compared against historic data to document population-level effects of habitat succession and land use changes. However, these data sets are used primarily to align population model simulations.

Classifications in inaccessible areas are conducted from helicopters. Elsewhere, they are done by ground surveys conducted from vehicles.

2. Application – The optimum time to conduct postseason classifications is 10 November through 10 January. In areas lacking distinct migrations to traditional winter ranges, classifications can be begin on 1 November. In areas with distinct winter ranges, classifications are most effectively accomplished when deer concentrate on winter ranges. Classifications within any herd unit should be completed within a two-week period.

   Design classification surveys to achieve a classification sample that is representative of the population being surveyed. The Job Completion Report (JCR) program is used to calculate an adequate sample size based upon the postseason population estimate and the anticipated buck:doe and fawn:doe ratios. Sample sizes are based on an 80% confidence interval (C.I.) of $\pm$ 5 animals per 100 does. Refer to Appendix XII (Classification Sample Sizes) for a detailed discussion of adequate sample sizes. Survey routes should cover all occupied deer habitats throughout the herd unit. The number of deer classified in any given area should be somewhat proportional to number of deer thought to be in the area.

   Fawns are distinguished from adults based upon the short rostrum, fuzzy head characteristics, and smaller body size. Yearling bucks typically have unbranched spikes or small antlers with a single fork. Buck:doe ratios derived from post-season classifications are somewhat conservative. Even though bucks associate with does and fawns during this period, many bucks tend to select denser cover, subordinate bucks may be displaced from territories occupied by dominant bucks, and some bucks wander as individuals. In addition, yearling bucks can be misclassified as does because their small antlers are more difficult to see.

   a. Aerial Surveys – Helicopters are used to conduct aerial classifications of deer. Survey operations must follow protocol outlined in the Aircraft Operation Procedures and Safety Policy of the Wyoming Game and Fish Department (WGFD) Policy Manual (WGFD 1999).

      Fly aerial classifications during favorable weather and good light conditions. Snow cover is preferred, but not essential. Surveys can be flown any time of day, because the helicopter will disturb and move bedded deer so they can be seen. Use a Global Positioning System (GPS) to record locations of all deer encountered. Identify and classify adult bucks, yearling bucks, does and fawns. Deer should be observed from distances that enable the observer to distinguish fawns and yearling bucks from adult does. It can be helpful to view animals in profile, by maneuvering the helicopter as necessary . A second observer can assist with identifying yearling bucks and other deer standing away from the main group. Record classificatons by hand or with a tape recorder.

Fly surveys along creeks, draws, and other occupied habitats. Accurately record the type of helicopter used and the number of hours flown, including ferry time and fuel truck mileage. Coordinate surveys with adjacent biologists to limit ferry time since helicopter rental costs are high.

b. Ground Surveys – Deer are most often classified from the ground. Observations are made from a vehicle driven methodically through areas where deer concentrate. Conduct classifications during the early morning and late afternoon hours. In cold weather, deer often feed earlier in the afternoon, and this provides more time to classify. Select days with good light conditions. Use binoculars and a spotting scope to classify deer as adult bucks, yearling bucks, does, or fawns. .Record observations only when age and sex are positively identified. Also use a GPS receiver to determine locations of all deer encountered. Record classification data by hand or with a tape recorder. A siren or deer or predator call can be used to raise bedded deer or make feeding deer lift their heads.

   Travel slowly and deliberately along routes to obtain an adequate sample. If routes have not been established, plan classifications in a sequence that avoids duplication. If an area is classified a second time, only one set of data can be retained. Never combine the results of both classifications.

   When deer cannot be classified accurately due to exessive distances or poor light conditions, record the group sizes and specify "unclassified." It is important to identify all animals in the group to assure the classification is accurate

3. Analysis of Data – Data from post-season herd classifications are used to estimate herd composition including total bucks, yearling bucks, and fawns per 100 does. Herd ratios are useful to evaluate herd productivity, fawn survival to early winter, and fawn recruitment to the second year, as well as postseason buck ratios. Herd ratios are considered accurate when an adequate sample of classification data is obtained based on a statistically valid sampling plan. However, yearling bucks may be underrepresented because their smaller antlers can be difficult to detect.

4. Disposition of Data – Refer to Chapter 1, Section II.A.1.d (Pronghorn – Aerial Classifications).

C. Spring Herd Classification –

1. Rationale – The objective of classificatons done in March and April is to estimate overwinter survival of fawns. However, correctly classifying larger fawns can be difficult at this time of year.

   Spring classifications are done in some regions of Wyoming. However, post-season classifications are considered sufficient for management in areas where fawn survival through winter is not extremely variable.

2. Application – Spring classifications utilize the same procedures as post-season, ground classifications, except the sex of adults is not identified because bucks have shed their antlers.

   Spring classifications are done between 1 March and 30 April, before deer leave the winter range but after most winter mortality has occurred. Surveys are conducted the first three hours after daylight and the last two hours before dark, and are completed within a two-week period.

   To apply this technique, managers must assume: 1) the samples are randomly distributed throughout the known, occupied habitat; 2) biases associated with the post-season (pre-winter) and post-winter classifications are the same (ideally, the composition ratios are considered unbiased estimates of the true herd composition); 3) Overwinter mortality of adults is minimal; 4) fawns can be accurately classified in the spring; and 5) the probability of observing bucks is the same during both sampling periods (composition data are expressed as fawns:100 adults, including bucks and does).

3. Analysis of Data – Overwinter mortality of fawns can be estimated based on the difference between fawn/adult ratios observed during post-season and spring classifications. However, bucks may be more visible on winter ranges and fawns can be misclassified as adults during spring classifications. These biases would tend to depress the spring ratio of fawns:adults, resulting in an inflated estimate of overwinter fawn mortality. On the other hand, if adult mortality is significant, the spring ratio of fawns:adults would underrepresent fawn mortality, producing the opposite effect to some degree. These potential biases should be taken into account when spring classificaiton data are analyzed. Managers must also recognize deer distribution does change following the rut

4. Disposition of Data – Refer to Chapter 1, Section II.A.1.d (Pronghorn – Aerial Classifications).

III. HARVEST DATA – Harvest data are obtained from hunter field checks, game check stations, and an annual harvest survey conducted by mail each year.

A. Harvest Survey – The harvest survey is done annually by a consultant, under contract with the WGFD. Harvests of each sex and age (adult/juvenile) class are estimated for each license type, hunt area and herd unit. Licenses sold, number of active hunters, hunter success, and harvest effort values are also reported.

Refer to Chapter 1, Section III.A. (Pronghorn – Harvest Survey) and Appendix III (Harvest Survey) for detailed discussions of the harvest survey.

B. Age Determination –

1. Field Aging Techniques –

a. Rationale – The age structure of the harvest, especially the female segment, can indicate the age structure of the population when sample sizes are adequate. However, data obtained from harvested animals should be interpreted cautiously. Hunters tend to select larger bucks, but mature bucks are more difficult to locate and harvest. The degree to which this selectivity may bias the harvest sample is uncertain. Nontheless, the proportions of yearling and adult bucks in the harvest can provide important insights regarding year class recruitment. Age structures derived from harvested deer and from documented, nonhunting mortalities are commonly used to align deer population models.

b. Application – Field techniques for aging mule deer are described in the Wildlife Forensic Field Manual (Adrian 1992). Dentition patterns based on deciduous and permenent incisors and moliform teeth are used to distinguish fawns, yearlings (1.3 years), and adults 2.3 years or older. Deer older than 2.3 years can be aged based on tooth wear patterns, however the technique is not as accurate.

Fawns have a fully erupted set of deciduous teeth and a partially erupted fourth molariform tooth. The deciduous third molariform is 3-cusped and all teeth are new looking with little wear or staining. At 1.3 years of age, yearling deer typically have two or more pairs of permanent incisors and the deciduous, third molariform (3 cusps) is retained, but shows some wear. The permanent, fourth and fifth molariform teeth are in place, and the anterior cusp of the sixth molariform tooth may be erupting. Adult deer at 2.3 years of age have a full set of teeth with little wear or staining. The permanent third molariform tooth is 2-cusped with no wear or staining. At 3.3 years of age, all permanent teeth are in place with some staining and visible wear.

When specific ages of older deer are required, aging should be based on laboratory analysis of cementum annuli. Refer to Appendix V (Aging Techniques) and Section III.B.2 of this chapter.

c. Analysis of Data – Refer to Chapter 1, Section III.B.1.c (Pronghorn – Tooth Replacement).

d. Disposition of Data – Forward summaries of hunter field checks, including age information, to the Wildlife Management Coordinator (WMC) after the hunting season. The WMC's is responsible for distributing harvest data summaries to appropriate field personnel. These data should also be summarized annually in the applicable Job Completion Reports (JCRs).

2. Tooth Cross-sectioning

a. Rationale – Tooth Cross-sectioning (the cementum annuli technique) is the most accurate method of aging harvested animals. When an adequate sample can be obtained, the age structure of harvested adult females (>1.3 year old) is commonly assumed to represent the structure and number of age classes within the adult female segment of the population. However, hunters select older males with larger antlers, so managers generally presume the age structure of harvested adult males is biased. Tooth cross-sectioning is an expensive, laboratory technique that should only be used when the composition of ages greater than 2 years must be accurately determined for management purposes.

b. Application – Prior to the hunting season, Biological Services will coordinate with the regions to determine the number of teeth that will be processed, and then notify the laboratory. Field supplies needed for tooth collection include big game field check forms, knife, pliers, and tooth envelopes. To extract teeth, first split the gum deeply on both sides of the central pair of incisors. Use the pliers to twist, pry, and pull these teeth until they are loosened and can be removed with roots intact. Record the follwing information on a tooth envelope: species, sex, hunt area, date of harvest, collector's name, and WGFD Region of harvest. Do not collect teeth from fawns or yearlings, because these age classes can be reliably determined in the field. Use hunter field check forms to record information from fawns and yearlings.

Another method for obtaining large samples of teeth is to issue hunters tooth envelopes and instructions at the time licenses for specific hunt areas are mailed or issued over the counter. Hunters extract the teeth and return them in postage-prepaid boxes.

For a more thorough discussion of this technique, refer to Appendix V (Aging Techniques).

c. Analysis of Data – Refer to Chapter 1, Section III.B.1.c (Pronghorn – Tooth Replacement).

d. Disposition of Data – Refer to Section III.B.1.d. (Field Aging Techniques) of this Chapter.

C. Field Checks and Check Stations – Sex and age data be collected from harvested animals during hunter contacts in the field, and at check stations, game processing plants, hunter camps, and motels. Hunter contacts also enable biologists to get the hunters perspective on game populations, herd quality, access, and other issues. For a detailed discussion of field checks and check stations refer to Chapter 1, Section III.C. (Pronghorn – Field Checks and Check Stations). The Department's Guidelines for Establishment and Operation of Wildlife Check Stations are provided in Chapter 1, Attachment 2.

IV. MORTALITY ESTIMATION (non-hunting) – Significant mortality events should be taken into account when population models are updated and when hunting seasons are set. Localized mortiality events should also be documented to identify and correct human-created problems. Major sources of non-hunting mortality can include highway and railroad accidents, fence entanglements, starvation, disease, and predation. Other causes include illegal take and take authorized by kill permits. Significant die-offs can also result from severe winters, drought, or the combined effects of both. The following methods are used to document non-hunting mortality and to estimate the extent of mortality following weather extremes.

A. Incidental Observations – Refer to Chapter 1, Section IV.A. (Pronghorn – Incidental Observations).

B. Body Condition Evaluation –

1. Rationale – The ability of deer to survive winter conditions is determined in part by their physiological condition entering the winter period. Managers can assess the potential level of winter mortality by evaluating a body condition index in conjunction with winter severity indices. Body condition is also an indication of the general quality of spring/summer/fall habitats.

2. Application – The body condition index is a composite score based upon musculature and fat deposition in a sample of harvested animals (Lutz et al. 1997). Body condition scores are obtained from harvested animals examined during field checks, at check stations, or at locker plants.

Body condition scores are calculated in 5-point increments, ranging from 0 to 20. The portion of the score based on musculature is 5 points if the body has a full appearance and good overall mass, or 0 points if the body appears boney. Fat deposition patterns comprise up to 15 additional points. In deer, fat depostion takes place along the back beginning in the posterior region and progressiong to the anterior region. Body fat measurements are taken at three points along the spine: 1) base of tail; 2) anterior to the hind quarters, and 3) above the shoulder (immediately posterior from the point of the shoulder). A knife blade is inserted through the hide, into the tissue at the base of tail. If fat is present, the blade is inserted at the second point, then at the foremost point. Scores are assigned as follow: 0 if no fat is present; 5 if fat is present at the first point only; 10 if fat is present at the first and second points; and 15 if fat is present at all 3 points.

The body condition score is the sum of the musculature score and the fat deposit score. The score is interpreted in the following manner: 0 or 5 points = poor condition; 10 points = fair condition; 15 points = good condition; and 20 points = excellent condition. Record the body condition score and the following additional information on field check forms: hunt area, sex, and age class. The following numerical codes can be used to indicate sex and age clas: 1 = yearling doe; 2 = yearling buck; 3 = adult doe; and 4 = adult buck. Fawns need not be checked. When determinable, note lactation by adult does as this will influence fat deposition and thus fat scores.

It's worthwhile for inexperienced personnel to visit a game processing plant and view skinned carcasses to observe how deer deposit fat. Connective tissue also has a white appearance that can be incorrectly identified as fat.

3. Analysis of Data – Calculate average condition scores of each sex and age class (yearling/adult) within each hunt area and herd unit. This information can be analyzed in conjunction with winter severity indices and habitat conditions, to estimate winter mortality rates. Lower body condition scores predispose animals to winter mortality, even in mild winters.

4. Disposition of Data – Body condition data are forwareded to the responsible biologist, and evaluated in the annual JCR for the applicable herd units. The data can be used to estimate postseason mortality severity indices (MSIs) for use in population models. However, post-season MSIs may also be adjusted to align other data points, such as ratios of yearling bucks to does, which reflect composit mortality for the herd. The body condition and weather severity indices become corroborating data in these cases.

C. Winter Mortality Transects – Mortality surveys have been used to estimate winter mortality in the Baggs area (Reeve and Lindzey 1991) and the Wyoming Range (Fralick 1995). Mortality transects are suitable for winter ranges with high deer densities when high mortality is suspected. Refer to Chapter 1, Section IV.B. (Pronghorn – Mortality Transects).

D. Weather Severity Indices – Weather severity indices, based on temperature and precipitation data, are used to evaluate climatic effects on deer populations. Weather

Severity Indicies provide a means to estimate mortality severity indices used in population models. Refer to Chapter 1, Section IV.C. (Pronghorn – Weather Severity Indices).

E. Diseases and Parasites – Mule deer in Wyoming are susceptible to several endemic diseases described by Thorne et al. (1982).

1. Potential Diseases – Two similar diseases, bluetongue and epizootic hemorrhagic disease (EHD), commonly afflict mule deer. The viral agents responsible for these diseases are carried by biting gnats called no-see-ums. Outbreaks occur when gnat populations are highest in late summer and early fall, and end with the onset of freezing temperatures.

   Chronic Wasting Disease (CWD) has been documented in free-ranging mule deer and white-tailed deer in the Bighorn Basin and the eastern half of Wyoming. In some hunt areas, over 25% of the deer are infected. The disease has also been documented among elk herds in southeast Wyoming. CWD is present in free-ranging and/or captive deer and elk populations in most bordering states, including Montana, South Dakota, Nebraska, Colorado and Utah. The disease slowly atrophies the brain stem of infected animals, producing the following symptoms: excessive salivation, lethargy, emaciation, and eventual death.

2. Management/Public Safety – When disease outbreaks are detected, regardless whether one or many animals are involved, it is important to document the event including location, number of mortalities, cause, and other relevant circumstances. Obtaining an accurate diagnosis of the cause usually requires submission of the entire animal or samples to the Wyoming State Veterinary Lab. When significant mortality is documented, managers may consider adjusting the herd population estimate and subsequent hunting seasons.

   The Department routinely advises hunters to avoid harvesting an animal that is behaving abnormally, because this could indicate the animal is sick. Humans are not succeptible to bluetongue or EHD, and outbreaks generally end before the firearm hunting season begins. No cases of CWD being transmitted to a human have been documented. As a precaution, hunters are advised to wear gloves while field dressing animals within CWD-endemic areas, and to avoid handling the brain or spinal cord.

   The Department's Chronic Wasting Disease Plan provides a flexible and adaptive framework for managing the disease in Wyoming. Distribution and prevalence of the disease are monitored through targeted surveillance of animals exhibiting symptoms, and by testing samples collected from harvested animals at check stations, locker plants, and during field checks throughout the state. In areas of high CWD prevalence, managers should take disease-related mortality into account when estimating populations and recommending hunting season frameworks. Field personnel should familiarize themselves with Commission regulations governing carcass transport from the endemic area to control the potential spread of the disease.

3. Identification – It is possible to diagnose several diseases in the field, based on visible symptoms and knowledge of the disease history of the area. However, to support a definitive diagnosis, animals displaying symptoms must be necropsied and the vector isolated at the Wyoming State Veterinary Laboratory.

4. Collecting and Handling – Specimens submitted for necropsy should be in good condition. Suitable specimens include animals that recently died and have not begun to decompose, or symptomatic animlas that were collected by euthanasia. Ideally, the entire animal should be sent to the State Veterinary Lab. If it is not feasible to transport the whole carcass, preserve samples of the major organs and blood, and ship them by overnight delivery service to the lab. Shipping procedures are described in the Wildlife Forensic Field Manual (Adrian 1992). CWD testing requires collection of the retropharyngeal lymph node. The location where the animal was killed and information about the animal's condition must also be recorded. Instruction on CWD sampling is provided at annual training sessions held prior to hunting seasons.

V. DISTRIBUTION AND MOVEMENT –

A. Incidental Observations –

1. Rationale – The Department has delineated boundaries of mule deer populations generally throughout Wyoming. Acknowledged populations are managed as "herd units." Important seasonal habitats such as migration routes, parturition areas, and crucial winter ranges have also been identified within most herd units. Seasonal habitat delineations are continually refined and updated as additional distribution data are collected. In some cases, herd unit boundaries have been adjusted based on new information. Distribution data can provide essential documentation to support management recommendations and comments regarding impacts of proposed development or land use activities.

2. Application – The distribution data of greatest use to managers are mule deer observations during severe winters, migration periods, and fawning seasons, and observations within areas of proposed subdivisions and energy developments. Always use Wildlife Observation Forms to record mule deer observations (refer to Appendix I). If detailed location data are needed to document migration routes, seasonal habitat use, or potential herd interchange, studies involving radio-collared or marked animals may be justifiable. Seasonal range definitions and guidelines for mapping deer distribution are provided in Appendix VI (Wildlife Distribution and Seasonal Habitat Mapping).

Submit Wildlife Observation Forms containing deer observations to the responsible biologist. After proofing, these forms are forwarded to the applicable regional office for entry into the Wildlife Observation System database. Biologists can sort applicable observations from this database to develop and update seasonal distribution maps.

3. Analysis of Data – Refer to Chapter 1, Section V.B.3. (Pronghorn – Aerial Surveys).

4. Disposition of Data – Refer to Chapter 1, Section V.C.4. (Pronghorn – Incidental Observations).

B. Aerial Surveys –

1. Rationale – Aerial surveys can be an effective method of documenting the distribution of deer over large or remote areas. However the effectiveness of aerial surveys depends on type of aircraft, terrain, and time of year.

2. Application – Helicopters are the most effective aircraft for conducting surveys to document distribution of mule deer. However, the cost is prohibitive except when the distribution surveys are done in conjunction with post-season herd classifications on winter ranges. Fixed-wing aircraft are less expensive, but also effective because observers' abilities to detect deer are reduced. This is due to the greater height above ground level and faster airspeeds at which they must fly. Distribution surveys are more effective if conducted during adequate snow cover or with contrasting green vegetation during the spring green-up period. Plan flight patterns to adequately cover the areas or habitat types in which distribution data are sought. Use a GPS to determine deer locations. Record the locations with a tape recorder or note pad. Typically, it is sufficient to record the total numbers of deer observed in each location. Classifications are not necessary to map distribution, and are not considered reliable if attempted from a fixed-wing aircraft.

3. Analysis of Data – Refer to Chapter 1, Section V.B.3. (Pronghorn – Aerial Surveys).

4. Disposition of Data – Refer to Chapter 1, Section V.B. 4. (Pronghorn – Aerial Surveys).

C. Marked Animals – Refer to Chapter 1, Section V.A. (Pronghorn – Marked Animals).

D. Pellet Group Transects –

1. Rationale – The relative use of specific locations or habitats by mule deer can be estimated based on pellet group transects. The technique has limited application in Wyoming. However, pellet group counts have been employed to evaluate crop

depredation within agricultural regions and, in conjunction with habitat surveys, to estimate seasonal use of winter ranges. The technique is most useful within discrete areas such as crucial winter ranges, or locations where depredation is being investigated.

2. Application – Pellet group transects consist of ten or more 0.01-acre, circular plots (11 ft, 9 in radius) established at 66-foot centers along a straight line. Materials necessary to set up pots include a chain or rope, 11 ft, 9 in long, metal stakes 12 to 16 inches long for plot centers, and a compass. Place the circular plot stakes along a straight line following a compass reading from the starting point. Establish 1 transect per vegetation type.

   Identify and count all pellet groups less than 1 year old within each plot. Plots are delineated by walking the 11 ft, 9 in chain once around each center stake. Mark the start and end points with an object such as a rock, stick, hat, or notebook. Count pellet groups bisected by the plot boundary when more than one-half the group is inside the plot. Count every other group that is evenly bisected (alternatively, count each group as one-half group). If pellets were not cleared from the plot after they were counted the prior year, determine the age of pellet groups to be counted based on fresh versus weathered appearance and herbaceous plant growth around the group. If plots are to be read again, clear all pellet groups or spray them with yellow highway paint. Tally the pellet groups counted in all sample plots and extrapolate the total to estimate the number of pellet groups per acre. The expansion factor is generally 10 (the total area sampled is 0.1 acre). To estimate deer use (expressed as "deer-days" per acre), divide the number of pellet groups per acre by 13, the average, daily defecation rate per deer (Neff 1968).

3. Analysis of Data – Changes in use can be detected by contrasting results from pellet transects among years. However, apparent changes may not be related to a change in population size. Duration of use can also vary among years.

4. Disposition of Data – Results of pellet group surveys should be summarized and discussed in the appropriate annual JCR. There is no standard form for reporting these data.

VI. SEASONAL RANGE CLASSIFICATIONS – Refer to Appendix VI (Wildlife Distributioin and Seasonal Habitat Mapping) for a detailed discussion of seasonal range mapping.

A. Rationale – To support sound management decisions, it is extremely important to identify key seasonal habitats including crucial winter ranges, parturition habitats, and migration cooridors. Seasonal habitats are classified and mapped according to definitions developed by the Wyoming Chapter of the Wildlife Society (1990). The maps are kept on file to assist with planning habitat projects and to provide documentation for commenting on proposed developments and land management actions.

B. Application – Seasonal ranges are identified based upon relevant distribution data obtained from field observations. The data are sorted depending upon the criteria used to define a specific type of seasonal range (e.g., time of year; prevailing weather conditions), and retrieved from the Department's Wildlife Observation System database. Seasonal habitats are mapped using Geographic Information System (GIS) technology, or they are hand-plotted on overlays fitting BLM 1:100,000 scale base maps.

C. Analysis of Data – Overlays of seasonal habitats are essential documentation for analysing the impacts of developments and land management decisions. In addition, this information is often requested by consultants, companies, and other federal, state, and local agencies.

D. Disposition of Data – Each regional biologist keeps copies of seasonal range overlays covering the herd units in his district. The Department's Biological Services Section also maintains a statewide set of overlays at the Cheyenne headquarters office.

VII. TRAPPING, MARKING AND TRANSPLANTING

A. Trapping Adults –

1. Rationale – The most common reasons for trapping mule deer are to conduct studies in which animals must be marked to document distribution and movement, habitat selection, or mortality. In very rare circumstances, mule deer may be captured for transplanting to vacant habitats, however this is seldom justified.

2. Application –

a. Aerial Net-gunning – Net-gunning from a helicopter has become the preferred method to capture mule deer in recent years (Barrett et al. 1982, van Reenen 1982). Net-gunning is an efficient, cost effective, and highly mobile means of capture. The Department contracts private companies that specialize in use of net-gun equipment to capture big game. The net-gun is either hand-held or mounted on helicopter skids. "Muggers" restrain captured animals as they are processed and marked.

b. Clover Trap – The Clover trap (Clover 1956) is also commonly used to capture mule deer. Deer are lured with bait, into the trap. Alfalfa from second cuttings has been used successfully for this purpose. Two men can normally handle deer inside a Clover trap. A modification to the trap (Rickens 1967) enables one man to handle the trapping, but this is not recommended. The trapping period is normally from mid December to March. Trapping operations are most successful during periods of snow cover. A modified "Clover Trap" constructed of metal pipe and nylon mesh panels is commercially available.

c. Helicopter/Drive Net – Both mule deer and pronghorn have been captured in Wyoming by using a helicopter to drive them into nets (Easterly et al. 1991). Beasom (1980) describes this technique in detail.

d. Box Trap – The “Stephenson” box trap (Day, et al. 1980) and variations are also effective for trapping deer. Box traps designed to trap deer are constructed of wood or metal with the following dimensions: 1.2 m high, 1.2 m wide, and 3.7 m long. The trap is set with both ends open, so deer can see through it. Bait is used to lure deer inside. Gates at each end are released simultaneously by a tripping device.

e. Cannon-net Trap – Cannon nets have been used to trap white-tailed deer (Hawkins et al. 1968) and can be adapted for trapping mule deer.

f. Drop-net Trap – The drop-net trap has been used successfully in Wyoming to capture bighorn sheep and white-tailed deer. The method should also work well for capturing mule deer. Trapping should be done during periods of total snow cover, between 1 December and 15 February, when deer respond well to bait. However, trapping may be accomplished with lesser degrees of success when conditions are not ideal.

3. Analysis of Data – Refer to Chapter 1, Section VI.A.1.c. (Pronghorn -- Corral Traps).

4. Disposition of Data – Refer to Chapter 1, Section VI.A.1.d. (Pronghorn -- Corral Traps).

B. Trapping Juveniles –

1. Rationale – Juveniles are sometimes trapped and marked for specific research purposes such as documenting mortality. However, mortality data from such studies should be interpreted cautiously, because capture, handling and marking can increase stress and susceptibility to predation. Some researchers have attempted to control potential biases, for example, by not including marked animals in the sample unless they survive for a period of time after the initial capture operation. Nevertheless, the presence of a radio transmitter or other visible marker undoubtedly has some influence that should be considered. A potential control is to compare the proportion of marked fawns that survive to fall with the overall fawn:doe ratio in the herd or study area. The surviving proportion of marked fawns is essentially the ratio of fawns to does that gave birth. The overal fawn:doe ratio should be somewhat lower because it includes yearling does and adult does that were not pregnant or did not carry fetuses to term. If the proportion of marked

fawns that survives is similar to, or lower than the overall fawn:doe rato, this may indicate a bias exists. Several of the methods used to trap adults are effective for capturing fawns.

2. Application –

   a. Aerial Net-gunning – Net-guns fired from helicopters were used to capture both fawns and adult mule deer in Colorado (Unsworth et al. 1999) and Idaho (Idaho Dept. Fish & Game 1999). Refer to the technique described in this chapter for trapping adult deer (Section VIII.A.2.a.).

   b. Helicopter drive net – This technique (Beasom et al. 1980) was used to capture fawn mule deer in Idaho (Idaho Dept. of Fish & Game 1999) and Colorado (Unsworth, et. al. 1999).

   c. Vaginal implant transmitters – Vaginal implant transmitters have been used to locate parturition sites and newborn fawns of white-tailed deer (Bowman and Jacobson 1998). The technique should work equally well with mule deer. Pregnant does must be captured and fitted with vaginal implant transmitters prior to parturition

3. Analysis of Data – Refer to Chapter 1, Section VI.A.1.c. (Pronghorn – Corral Traps).

4. Disposition of Data – Refer to Chapter 1, Section VI.A.1.d. (Pronghorn – Corral Traps).

C. Chemical Immobilization –

1. Rationale – Chemical immobilization is an effective method to capture small numbers of mule deer in specific locations. The technique is commonly used to deal with injured or problem animals in urban settings.

2. Application – Various drugs and dosage rates are discussed in Appendix VIII (Immobilization). Additional information is available in the *Handbook of Wildlife Chemical Immobilization* (Kreeger 1997).

3. Analyisis of Data – When a mule deer is immobilized, the event should be documented by recording pertinent data on a Wildlife Observation Form and a Department Immobilization Data Form.

4. Disposition of Data – Submit the Wildlife Observation Form for entry into the Wildlife Observation System database and forward the Immobilization Data Form to the Veterinary Services Section.

D. Marking Protocol – Refer to Appendix VII (Marking Techniques).

VIII. MODELING – The Wyoming Game and Fish Department uses a simulation model (POP-II, Windows Version 1.2.5 by Fossil Creek Software) to estimate mule deer populations. Each year, the model is updated and aligned based on annual classifications, harvest estimates, and mortality severity indices. Body condition indices and weather severity indices are also considered in determining appropriate mortality severity indices. Consult Appendix IX (Population Modeling) for additional detail about the modeling process.

IX. DEPREDATION – Methods for evaluating and managing wildlife depredation are comprehensively described in the *The Handbook of Wildlife Depredation Techniques* (Buhler et al. 1999) and *Prevention and Control of Wlidlife Damage* (Hygnstrom et al. 1994). In addition, the Internet Center for Wildlife Damage Managment (http://wildlifedamage.unl.edu) provides various resources to assist persons dealing with wildlife damage management, as well as symposia proceedings and links to other related websites. The site is maintained by the University of Nebraska-Lincoln, School of Natural Resource Science.

A. Depredation Issues – At times, mule deer damage stored or growing hay, ornamental trees and shrubs, shelterbelts, and gardens. Damage can include forage consumed, waste excretion on stored crops, and physical damage to trees and shrubs.

B. Depredation Management – Widespread depredation is ordinarily addressed by controlling deer populations through liberal hunting seasons and increased doe/fawn harvest. In areas of localized damage, depredation seasons, kill permits, or damage compensation may be necessary. The Department generally supplies exclusion fence to stop or prevent damage to stored crops. When deer damage gardens, ornamental trees and shrubs, the homeowner or landowner is responsible for fencing or otherwise protecting his property.

X. SUPPLEMENTAL FEEDING – The Department does not support the practice of feeding deer. Elk feedgrounds are maintained to deal with otherwise irreconcilable circumstances in which access to native winter ranges has been lost or when depredation to private lands is excessive. However, supplementally feeding deer is generally ineffective and can lead to more serious, disease transmission problems. In addition, any inference that feeding deer could be a viable solution for loss of habitat will undermine the case for maintaining native winter ranges intact. Developers have recommended feeding to justify further loss of habitat. State-supported feeding would also contradict the Department's educational messages regarding the importance of habitat to sustain populations of wildlife.

During severe winters, when deer begin to show signs of malnutrition, the public may pressure the Department to feed. One of the problems is anticipating when to start feeding and how long severe weather will continue. Once deer have reached a state of diminished health, feeding often leads to death because the microflora in the deer's rumen cannot adjust to the change in diet. Deer that were fed have often been found dead with full rumens. Therefore, by the time the public becomes concerned, it is often too late to begin a feeding operation.

If feeding is unavoidable, alfalfa is the best supplement because it is readily available and can be spread on the snow. During winter, deer consume approximately two pounds of browse per 100 pounds of body weight daily (Dean 1975). Therefore, fawns would require approximately 2 lbs of forage per day, yearlings about 3 lbs and adults about 4 lbs per day.

Alfalfa hay should be spread in a long line so all deer can access the supplemental feed. Otherwise, fawns and weaker adults will be driven from the hay by larger, stronger deer. The feed line can be moved incrementally to entice deer into exposed natural food and sheltered locations.

XI. JOB COMPLETION REPORTS – Refer to Chapter 1, Section X (Pronghorn – Job Completion Reports).

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XIII. OTHER REFERENCES – Attachement 1 is a list of literature containing information relavent to managing mule deer populations and habitat in Wyoming. These reference materials are available at the WGFD Mule Deer Working Group library in the Casper Regional Office.

ATTACHMENT 1

Mule Deer Working Group Library – Casper, Wyoming (July 2004)

AUTHOR	DATE	TITLE	PUBLICATION NUMBER
THOMAS E. KUCERA	1999	A SPORTSMAN'S GUIDE TO IMPROVING DEER HABITAT IN CALIFORNIA	1
RICHARD MACKIE, DAVID PAC, KENNETH HAMLIN, GARY DUSEK	1998	ECOLOGY AND MANAGEMENT OF MULE DEER AND WHITE-TAILED DEER IN MONTANA	2
LARRY E. BENNETT	1999	CURRENT SHRUB MANAGEMENT ISSUES IN WYOMING	3
HALL SAWYER, FRED LINDZEY	1999	SUBLETTE MULE DEER STUDY	4
THOMAS EASTERLY, ALAN WOOD, THOMAS LITCHFIELD		RESPONSES OF PRONGHORN AND MULE DEER TO PETROLEUM DEVELOPMENT ON CRUCIAL WINTER RANGE IN THE RATTLESNAKE HILLS	5
ARCHIE F. REEVE, FRED G. LINDZEY	1991	EVALUATION OF MULE DEER WINTER MORTALITY IN SOUTH-CENTRAL WYOMING	6
	1998	MANAGEMENT OF INDIGENOUS NORTH AMERICAN DEER AT THE END OF THE 20TH CENTURY IN RELATION TO LARGE PREDATORS AND PRIMARY PRODUCTION	7
STEVE TESSMANN	1999	LITERATURE RELEVANT TO THE CONDITION, TREND, AND ECOLOGY OF WYOMING SHRUBLANDS (2 BIBLIOGRAPHIES PERTAINING TO SUBJECT)	8

F.G. LINDZEY, W.G HEPWORTH, T.A. MATTSON, A.F. REESE	1999	POTENTIAL FOR COMPETITIVE INTERACTIONS BETWEEN MULE DEER AND ELK IN WESTERN US AND CANANDA	9
GAR W. WORKMAN, JESSOP B. LOW	1976	MULE DEER DECLINE IN THE WEST A SYMPOSIUM	10
STEVE TESSMANN	1999	LARRY BENNETT'S WHITE PAPER ON SHRUB MANAGEMENT ISSUES IN WYOMING	11
JAMES C. DEVOS, JR.	1997	PROCEEDINGS OF THE 1997 DEER/ELK WORKSHOP RIO RICO, ARIZONA	12
JAMES HEFFELFINGER, SAMUEL BEASOM, CHARLES DEYOUNG	1987-1989	THE EFFECTS OF INTESIVE COYOTE CONTROL ON POST-RUT MORALITY O FMALE WHITE-TAILED DEER	13
M. DUDA, K.YOUNG, S.JACOBS, A. LANIER, W. TESTERMAN, S. BISSELL	1998	DEER HUNTER SURVEY: LICENSED DEER HUNTERS' OPINIONS AND ATTITUDES TOWARD DEER MANAGEMENT IN WYOMING (RESPONSIVE MANAGEMENT)	14
LARRY BENNETT		(DRAFT) THE QUALITITY AND QUANTITATIVE ASPECTS OF WYOMINGS WILDLAND SHRUB COMMUNITIES AND RELATIONSHIP TO WILDLIFE POPULATIONS	15
CHARLES MEYERS (DENVER POST)	1998	OUTDOORS IN THE WEST: ENVIRONMENT EXACTING A DEER TOLL	16
BILLINGS GUZETTE	1999	SUPRISING THINGS ABOUT EASTERN MONTANA MULE DEER	17
CHARLIE D.CLEMENTS, JAMES A. YOUNG	1997	A VIEWPOINT: RANGELAND HEALTH AND MULE DEER HABITAT	18
JIM HEFFELFINGER	1997	AGE CRITERIA FOR ARIZONA GAME SPECIES	19

		REPORT)	
THOMAS COMPTON	1975	MULE DEER-ELK RELATIONSHIPS IN THE WESTERN SIERRA MADRE AREA OF SOUTHCENTRAL WYOMING	32
RITCH NELSON, GLENN STOUT, LINDA MYERS, RICK STRAW	1994	BAGGS MULE DEER CRUCIAL WINTER RANGE ANALYSIS	33
JIM HEFFELFINGER (DEER BIOLOGY)	1997	DARK TAILS: THE FACTS ABOT HYBRID DEER	34
JIM HEFFELFINGER	1996	QUALITY DEER MANAGEMENT: DOES THE WEST NEED OR WANT IT?	35
NEAL BLAIR	1967	MANAGEMENT PROBLEMS OF A MULE DEER HERD: THE WYOMING RANGE MULE DEER HERD COKEVILLE AREA WINTER RANGES	36
D.STICKLAND, L. MCDONALD, G. JOHNSON, W. ERICKSON, D. YOUNG, J. KERN	1994	AN EVAULUATION OF MULE DEER CLASSIFICATIONS FROM HELICOPTER AND GROUND SURVEYS (FINAL REPORT)	37
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RICH OLSON	1989	A STUDY TO DETERMINE THE POTENTIAL FOR INCREASING CURLLEAF MOUNTAIN MAHOGANY PRODUCTION ON CRUCIAL DEER WINTER RANGE THRU MECHANICAL TREATMENT	42
GREGORY S. HIATT, DAVID BAKER	1981	EFFECTS OF OIL/GAS DRILLING ON ELK AND MULE DEER WINTER DISTIBUTIONS ON CROOKS MOUNTAIN, WYOMING	43
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ARCHIE F. REEVE	1989	VEHICLE-RELATED MORTALITY OF MULE DEER IN NUGGET CANYON, WYO.	45
DALE STRICKLAND	1975	MULE DEER IN THE MEDICINE BOW MOUNTAINS ECOLOGY STUDY (GAME AND FISH LABORATORY RESEARCH)	46
THOMAS RYDER, JOHN EMMERICH, STANLEY ANDERSON	1985	WINTER ECOLOGY AND SEASONAL MOVEMENTS OF MULE DEER IN THE HALL CREEK HERD UNIT	47
ARCHIE REEVE, FREDERICK LINDZEY	1991	EVALUATION OF MULE DEER WINTER MORTALITY IN SOUTH-CENTRAL WYOMING	48
ARCHIE REEVE	1996	MULE DEER RESPONSE TO OIL AND GAS WELL RECOMPLETIONS AND WINTER HABITAT USE ON THE BIRCH CREEK UNIT, BIG PINEY-LABARGE WINTER RANGE	49
TOM CHRISTIANSEN	1987	AN ANALYSIS OF ELK AND MULE DEER HARVEST STRATEGIES AND THEIR EFFECT ON HUNTER PARICIPATION AND HARVEST IN WYOMING	50