



# **Protocol for Monitoring Caribou Populations in Wrangell- St. Elias National Park and Preserve, Central Alaska Monitoring Network**

*Standard Operating Procedures – Version 1.0*



## **ON THE COVER**

Photograph of a radiocollared cow from the Mentasta caribou herd.

Photograph courtesy of the National Park Service

# **Protocol for Monitoring Caribou Populations in Wrangell- St. Elias National Park and Preserve, Central Alaska Monitoring Network**

*Standard Operating Procedures – Version 1.0*

Natural Resource Report NPS/CAKN/NRR—201X/XXX

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## List of Acronyms

|       |                                                               |
|-------|---------------------------------------------------------------|
| ACETA | Animal Capture, Eradication, and Tagging of Animals           |
| ADF&G | Alaska Department of Fish and Game                            |
| AFF   | Automated Flight Following                                    |
| AQD   | Acquisition Services Directorate                              |
| ARCC  | Alaska Region Communication Center                            |
| CAKN  | Central Alaska Network, Inventory and Monitoring Program, NPS |
| DENA  | Denali National Park & Preserve                               |
| DOI   | Department of Interior                                        |
| FBMS  | Financial and Business Management System                      |
| GOC   | Gulkana Operations Center                                     |
| IACUC | Institutional Animal Care and Use Committee                   |
| IAT   | Interagency Aviation Training                                 |
| IBC   | Interior Business Center                                      |
| NEPA  | National Environmental Protection Act                         |
| NPS   | National Park Service                                         |
| OAS   | Office of Aviation Services, U.S. Department of the Interior  |
| PAM   | Park Aviation Manager                                         |
| PASP  | Project Aviation Safety Plan                                  |
| PEPC  | Planning, Environment & Public Comment                        |
| PI    | Principal Investigator                                        |
| PPE   | Personal Protective Equipment                                 |
| RPRS  | Research Permitting and Reporting System                      |
| SOP   | Standard Operating Procedure                                  |
| TNWR  | Tetlin National Wildlife Refuge                               |
| YDE   | Yukon Department of Environment                               |

|      |                                             |
|------|---------------------------------------------|
| YUCH | Yukon-Charley National Preserve             |
| WRST | Wrangell-St. Elias National Park & Preserve |

# Standard Operating Procedure (SOP) # 1 Preparation and Training Requirements for the Field Season

Version 1.0 (October 2017)

## Revision History Log:

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This SOP describes how to prepare for the various field components except where specific tasks are covered by other SOPs

## Obtaining Permits

A National Park Service (NPS) research permit should be obtained for the monitoring efforts. Applications can be submitted through the NPS Planning, Environment & Public Comment (PEPC) at <https://pepc.nps.gov> or the Research Permitting and Reporting System (RPRS) at <https://irma.nps.gov/rprs/Home>. Applications for permits should be made well in advance of the field season. Monitoring staff must perform internal and inter-agency scoping to assure that the project meets the criteria for a categorical exclusion under the National Environmental Policy Act. A categorical exclusion has been issued for these monitoring efforts, effective 2017 to 2020. The NPS Institutional Animal Care and Use Committee (IACUC) must be contacted at [npsiacuc@nps.gov](mailto:npsiacuc@nps.gov) for review and approval.

While not required, acquiring a scientific permit from the Alaska Department of Fish and Game (ADF&G), Division of Wildlife Conservation is recommended. Requirements for scientific permits are found at: [http://www.adfg.alaska.gov/static/license/otherlicense/pdfs/scientific\\_policy\\_11\\_21\\_2008.pdf](http://www.adfg.alaska.gov/static/license/otherlicense/pdfs/scientific_policy_11_21_2008.pdf). The permit application can be downloaded from [http://www.adfg.alaska.gov/static/license/otherlicense/docs/sci\\_app.doc](http://www.adfg.alaska.gov/static/license/otherlicense/docs/sci_app.doc).

## Use of Pharmaceuticals

This protocol currently suggests caribou be captured through the use of pharmaceuticals. NPS Directors Order #77-4 and the accompanying Reference Manual 77-4 outline the operational policies and requirements for the use of pharmaceuticals for wildlife and must be reviewed. Nearly all pharmaceuticals used for wildlife are restricted to use by or on the order of a licensed veterinarian under a valid veterinarian-patient-client relationship. The key steps for the use of pharmaceuticals as an NPS employee are to:

- Establish a veterinarian-patient-client relationship with the NPS veterinarian (Biological Resources Division's Service-wide Wildlife Veterinarian). Develop an approved protocol for the species (caribou) in consultation with the veterinarian of record.
- Establish a park practitioner (usually the biologist conducting the captures). Park practitioners may obtain controlled substances under a prescription from an individual holding an appropriate DEA license (veterinarian of record) or may register directly with the DEA.
- Have approved security and storage requirements for controlled substances.
- Receive training and qualify with each type of firearm or other remote delivery system used.
- Obtain certification in the use of pharmaceuticals in accordance with requirements described in RM 77-4.
- If controlled substances are fired from an aircraft, obtain Aerial Capture, Eradication and Tagging (ACETA) certification (see below).

## **Aviation**

Caribou capture, radio-tracking, sex and age composition counts, and surveys to estimate herd size are each accomplished through the use of aircraft. Rather than repeating information in each SOP, general aviation operating procedures are presented here.

### **Requirements**

All aviation operations will comply with the Federal Aviation Regulations, DOI policy, DO 60, RM 60, and Regional Aviation policy in that order. All persons utilizing aircraft resources in WRST should review the current WRST Aviation Management Plan. All flights under this protocol are considered 'Special Use', defined as any flight operation other than point to point and occurring below 500 ft. An approved pilot and aircraft list, with special qualifications listed, can be found at <http://oas.doi.gov/>. Prior to any flight the project PI or aviation manager must ensure that both the pilot and aircraft have been approved to conduct flight operations for DOI work by reviewing the pilot's USDOI Pilot Qualifications Card and that he/she is approved for the mission being performed. An Interagency Data Card indicates specific uses for the aircraft.

### **Procurement**

Each aircraft and pilot should be scheduled several months in advance. Pilot and aircraft resources are available through either the DOI fleet or vendor operations. A DOI fleet aircraft and pilot, if well qualified, should be considered first to reduce costs. The use of DOI fleet aircraft and pilot are requested at the park level. For vendor aircraft, the Interior Business Center (IBC), Acquisition Services Directorate (AQD) provides centralized contracting for aircraft and related services for all Department of the Interior agencies. To procure a vendor aircraft for a specific project, an AQD-91 form must be completed and provided to administrative personnel at the park or network level. Administrative personnel will use this information to create a purchase request which is entered into

the Financial and Business Management System (FBMS). When the flight(s) is approved, a Task Order will be sent back to the person requesting the flight. The flight request form (AQD-91) should be entered into the system at least 10 working days prior to the flight. The AQD-91 form can be obtained from <https://www.doi.gov/aviation/library/forms#aqdforms>.

### ***Oversight and Training Requirements***

Interagency Aviation Training (IAT) requirements and courses can be found at <https://www.iat.gov/>. Refer to the IAT Aviation Use and Management Qualifications Guide at [https://www.iat.gov/docs/IAT\\_Guide\\_2017\\_10.pdf](https://www.iat.gov/docs/IAT_Guide_2017_10.pdf). The PI for this project must complete training as a Project Aviation Manager, which is required for DOI employees who plan, organize, or manage the aviation operations for a project utilizing aircraft. All persons working in and around aircraft that are essential to ensure the safety and successful outcome of the mission are considered Aircrew Members and must complete A-100 Basic Aviation Safety. All NPS fixed wing flights must have an assigned fixed-wing flight manager. For special use flights the flight manager should be on the entire flight. Helicopter operations under this protocol require a Resource Helicopter Manager who has completed courses S-271 (resource helicopter crewmember) and S-372 (helicopter manager) and supervised training assignments. All helicopter crew members must complete S-271.

The capture of caribou using darting or netgunning techniques from a helicopter is considered an Aerial Capture, Eradication and Tagging (ACETA) mission. An ACETA gunner must obtain certification by completing an initial ACETA course with a net or dart gunning module and live mock-ups and attend an ACETA refresher every 3 years. ACETA animal handlers must attend the initial ACETA course and subsequent refreshers. Additional required certifications for ACETA gunners are S-271(resource helicopter crewmember), A-110 (Interagency Aviation Transportation of Hazardous Material), A-200 (Aviation Mishaps Review), certification for STEP, firearm/capture devices qualification training, training in the use of pharmaceuticals for wildlife per DO-77-4, and first aid and CPR. Crew members on ACETA missions must read and adhere to the 2017 National Park Service Operations Plan for Aerial Capture, Eradication, and Tagging of Animals, or its most current version.

### ***Safety and Communications***

All ‘Special Use’ flights require a Project Aviation Safety Plan (PASP). The PASP must be prepared by the PI and submitted to the WRST Park Aviation Manager (PAM) for approval. The PASP should include the project objectives, dates, location, aircraft and pilot, passengers, flight following details, emergency procedures, and hazard analysis and mitigation measures. PASP templates are available on the WRST Intranet under Documents and Forms, Aviation and Backcountry. The PASP must be provided to dispatch operations prior to the survey.

The pilot and observer(s) must wear required personal protective equipment (PPE) during all special use flights. PPE includes fire-retardant clothing (NOMEX), gloves made completely of NOMEX or leather, an approved aviation helmet, survival vest, and leather boots that extend above the ankles. Cotton or wool (non-synthetic fabric) clothing should be worn under NOMEX outerwear. An exception for winter flying has been arranged between NPS and OAS, that allows warm clothing and

footwear that would not otherwise meet PPE standards to be worn on special-use flights because of their survival value in cold weather.

Flight following for survey aircraft is required by Operational Procedures Memorandum (OPM) Number 06-02 (<http://amd.nbc.gov/library/opm/06-02.pdf>). The NPS-Alaska Region requires all aircraft used in park operations to be equipped with an Automated Flight Following (AFF) system. Flight following can be accomplished through the Gulkana Operations Center (GOC) in WRST or the Alaska Region Communication Center (ARCC) in DENA. Flight following requirements are described in the 2017 WRST Aviation Management Plan and in the ARCC Standard Operating Guidelines. A daily flight plan must be submitted and approved prior to any flight. Forms, SOP's and Field Resources can be obtained from the ARCC Homepage (<https://sites.google.com/a/nps.gov/arcc-region/home>).

DOI fleet aircraft generally communicate with ARCC and GOC through a VHF radio repeater system in WRST or through an onboard satellite phone that is wired into the aircraft. Radio equipment carried in vendor (non DOI) aircraft is not usually able to communicate on park radio systems. For verbal communications with dispatch, a satellite phone is carried on non-DOI aircraft. A Kennedy® cell set is used to connect the satellite phone to the intercom system on the flight helmet to facilitate making calls from the aircraft. Handheld radios, both on aircraft and NPS frequencies, should be carried by personnel on the ground so that they can communicate with aircraft and with dispatch operations. Radio frequencies for coordination between aircraft are arranged at the beginning of the operation.

Most survey aircraft burn 8 or 9 gallons per hour so using 10 gallons per hour as an average is safe. Plan on each survey aircraft flying eight hours per day even though it will probably be less. Fuel is available at WRST Gulkana flight operations hangar. Ensure that adequate fuel is available at the Chisana airstrip for Chisana Herd captures. Drums of fuel, in proper containment, can be placed at the Chistochina airstrip for Mentasta Caribou Herd captures.

## **Equipment**

Caribou monitoring efforts that serve as the basis of this protocol are currently being conducted in WRST, so basic equipment for animal darting and radiotelemetry are available (Appendix A). Items on the equipment list that have already been purchased for monitoring efforts at WRST are indicated by a 'Y' under the WRST Inventory column. Much of the equipment can be purchased through the companies listed in Appendix B.



# Standard Operating Procedure (SOP) # 2 Techniques for Capturing and Radiocollaring Caribou

Version 1.0 (October 2017)

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This Standard Operating Procedure (SOP) explains the procedures for the capture, handling, and placement of radiocollars on individual female caribou. Radiocollars provide the means to locate caribou periodically throughout the year to assess herd distribution and adult female survival, and to conduct annual herd size estimates and fall sex and age composition surveys. This SOP also describes the measurements and specimens that are collected from captured caribou, and the disposition of specimens.

## Preparation

### *Timing of Capture Work*

Captures generally occur during early September for the Mentasta herd and early to mid-October for the Chisana herd. Captures for the Mentasta herd should begin prior to arrival of the migrating Nelchina Caribou Herd. About 2-3 days of captures are required for the approximately 15 captures per year per herd needed to meet the goals of this monitoring protocol.

### *Aviation*

Captures will require a helicopter for darting (or netgunning) animals and a fixed-wing aircraft that works with the helicopter to locate caribou for capture, monitors the darted caribou during drug induction, and checks on caribou 2-3 days after capture. Commonly used helicopters for capture work include the Hughes 500 and Robinson R-44. A small tandem fixed-wing aircraft such as the Piper PA-18 Supercub is preferred to assist with captures. The helicopter and pilot should be scheduled at least 6 months in advance of the capture operation. The fixed wing aircraft and pilot should be scheduled 3 months prior to the operation. Refer to SOP 1 for further aviation requirements.

### *Equipment*

Minimum equipment should include radiocollars and associated visibility covers, at least one telemetry receiver, antennae, cables, wing strut brackets, and switchbox for aerial telemetry, a dart rifle or pistol, darts, internal and external dart charges and drugs, and a well-stocked capture kit. A

recommended equipment list for caribou monitoring, including capture equipment, is provided in Appendix A. Radiocollars specifications for female caribou are listed in Appendix C.

Caribou are anesthetized by darting using either a Palmer Cap-Chur® Extra Long Range or Short Range Projector (Palmer Chemical and Equipment Company, Douglasville, GA). The Extra Long Range Projector propels the dart with a 22 caliber blank charge inserted into an adapter that is loaded into the breech of the gun behind the dart. Only very low velocity, brown power loads should be used. Darts are propelled from the Short Range Projector using a CO2 gas pack. Aluminum, 32 gauge, 3 ml Palmer darts are used and equipped with 3/4-inch barbed needles and cloth tails. Internally, they contain a lubricated rubber plunger, a space for the drug in front of the plunger, and an internal explosive charge.

### ***Radio Frequencies and Radiocollars***

When purchasing radiocollars, radio frequencies must be provided to the manufacturer. Radio frequencies for telemetry are managed nationally through the National Wildlife Telemetry Frequency Management Database ([radio@fws.gov](mailto:radio@fws.gov)) and be approved by the National Park Service's Radio Coordinator. A Radio Frequency Assignment Request Form must be obtained from, completed, and returned to [radio@fws.gov](mailto:radio@fws.gov). Frequencies assigned to federal agencies are in the 164 to 168 megahertz range. Approved frequencies will be spaced at least 10 kilohertz apart. An adequate number of frequencies for the life of the project should be requested. This initial process can take several weeks and should be factored into the time needed for radiocollar purchase.

Previous monitoring activities have employed the standard conventional VHF radiocollar (Telonics® MOD-600). Eight GPS/Argos radiocollars were purchased and deployed in 2012 with funds from outside the CAKN monitoring program. Deployment of GPS Satellite radiocollars will replace conventional VHF radiocollars that have ceased to function or were retrieved from caribou mortalities. Additional funding outside of the CAKN monitoring program has been secured to accomplish this goal. Specifications for VHF and GPS collars currently being used are given in Appendix C. GPS/ARGOS collars determine an animal's location using the GPS satellite system, and upload the data through the ARGOS satellite system to the user. Radiocollars have multiple programming options and these will determine the lifespan of the collars. The current schedule for GPS/ARGOS collars to collect 4-5 GPS locations per day with an approximate 3-4 year lifespan. Each GPS collar carries a duty cycled conventional VHS transmitter so that it may also be tracked from aircraft. For GPS/ARGOS collars, several forms must be obtained from [www.argos-system.org](http://www.argos-system.org) in order to subscribe to Argos services. A System Use Agreement must be completed in order to apply for an Argos program. The Platform ID Number Request Form is completed to request Platform (transmitter) ID numbers and the ArgosDirect form is completed to determine how and when data will be delivered to the user.

The most cost effective way to collar additional caribou is to retrieve radiocollars from caribou mortalities in the field. This is usually done in the fall when the helicopter is available for captures or a composition survey. Radiocollars can be sent back to the manufacturer and refurbished for about one third the cost of a new collar. Radio frequencies are also recycled when collars are refurbished. Because radiocollars must be obtained on the desired frequencies, there can be a time

lag of several months or more in the construction of collars. Purchase or refurbishment of radiocollars should be done at least 4 months in advance.

### ***Purchase and Use of Immobilization Drugs***

This protocol currently suggests caribou be captured through the use of immobilization drugs. NPS Directors Order #77-4 and the accompanying Reference Manual 77-4 outline the operational policies and requirements for the use of pharmaceuticals for wildlife. Establish a veterinarian-patient-client relationship with the NPS veterinarian (Biological Resources Division's Service-wide Wildlife Veterinarian). In consultation with the veterinarian, develop an approved protocol for caribou anesthesia.

Most drugs used for wildlife anesthesia are tightly regulated by the Drug Enforcement Agency (DEA). Under the Controlled Substances Act, only a person with a DEA registration number may purchase controlled substances. DEA requires secure storage and exact accounting of all use of Schedule II narcotics. Currently, capture drugs can only be purchased through one company (Appendix B) and requires a prescription from a veterinarian for purchase. For the purchase and administration of capture drugs, refer to the National Park Service- Alaska Region Policy on the Use of Pharmaceuticals for Wildlife.

Darts are assembled and loaded with immobilization drugs before departure. A test-tube rack provides a convenient platform for dart assembly and loading. Considering misses and other dart losses, one must prepare three darts for each caribou intended for capture. During capture operations, loaded darts are stored in an ammunition can, with a hand-warmer if necessary, to keep them secure and safe from freezing. A cleaning rod or a set of shorter push rods must be kept available for removing unfired darts from the projector barrel. It is useful to have several blank adapters for the dart rifle on hand, pre-loaded with powder charges, so that fired blank charges need not be removed and replaced in flight.

### ***Capture Operations Plan***

A WRST Capture Operations Plan must be submitted to the WRST Park Aviation Manager and chief of Resources for approval. In addition to key personnel, their roles, and aircraft management, the plan should also include caribou capture methods, animal welfare, drug handling and security, drug pharmacology and dosage, human safety and protocol for accidental human exposure to capture drugs. Handheld programmable radios should be carried by personnel on the ground so that they can communicate with aircraft and with park dispatch. Daily "Go/No Go" determinations are made for each flight immediately before the flight commences.

## **Conducting the Captures**

### ***Darting Procedures***

Typically, the fixed-wing aircraft begins searching for caribou prior to arrival of the helicopter. Radio-collars should be distributed throughout the range of the population at the time of the capture operation. Care must be taken in selecting the area where caribou are darted. Steep terrain and open water present hazards for the animal and for handling personnel, and availability of helicopter landing areas can determine the distance that handling personnel must travel to the immobilized

animal. Careful monitoring of caribou by the fixed-wing aircraft, along with monitoring and judicious herding by the helicopter, can create or maintain safe conditions for the caribou and capture personnel and increase the efficiency of the operation. When caribou have been located and identified for capture, the helicopter is summoned. The fixed-wing aircraft ascends to a higher altitude to direct the helicopter and monitor the caribou. If additional handling personnel are present on board the capture helicopter, they are usually set off, along with excess baggage as needed, to lighten the aircraft and increase maneuverability during darting. During capture operations, the gunner's door is removed and the gunner is situated immediately behind the pilot. An alternative is the use of a shooting door, with a window that opens to allow darting without removal of the door. The gunner is held in the helicopter by a shooting harness while he/she leans out the door to fire the dart gun. Communication between pilot and gunner requires a 'voice activated' microphone. The pilot maneuvers the helicopter to match the speed of the fleeing caribou, usually within 15 meters of the animal and the shooter attempts to fire a dart into the muscle of the caribou's hindquarters. The relatively small size, speed and maneuverability of caribou make them difficult targets, and pilot and shooter experience are necessary for successful and safe capture.

Caribou should be darted in the large muscle mass of the hind leg or shoulder. When a caribou has been successfully darted, the helicopter crew makes sure the fixed-wing aircraft can visually monitor the animal and then lands at a distance to minimize disturbance. The time of initial darting, the dose of drug in the dart, the position of the dart hit on the animal, and the number of darts fired (including missed shots) are recorded on the capture form (Appendix D). If a caribou has been successfully darted with a deep intramuscular injection, the effects of the drug (staggering, head-bobbing, collapse) are usually seen within the reported induction time of the drug. Occasionally caribou are not adequately immobilized with the first dart. In these cases, the caribou is darted again if it shows no noticeable drug effects within the reported induction time. Occasionally a darted animal is approachable but not adequately immobilized for processing. In these cases, the caribou can be physically restrained and given a sedative such as 10-30 mg xylazine hydrochloride IM, depending on age and body size, resulting in adequate anesthesia within 1-2 minutes.

### ***Initial Assessment of the Caribou***

Once the fixed-wing pilot indicates that the caribou is immobilized, the helicopter crew returns to the area, landing approximately 20-30 meters away, and personnel deploy to process the anesthetized caribou through a standard protocol. The most dangerous complication for the caribou is hyperthermia (overheating) caused by the exertion and excitement of capture, coupled with the loss of thermoregulatory ability in anesthesia. Immediately upon arriving at the caribou, capture personnel should position the caribou on its sternum, assess the state of immobilization, determine its' physical well-being, and take the animal's body temperature. A battery-powered, digital thermometer commonly available for human use is adequate for monitoring the body temperature of captured caribou. LCD readouts may become sluggish or inoperative in very cold weather, so spare thermometers, including an older-style analog fever thermometer, should be carried. Temperature is taken rectally, with a thermometer or probe lubricated with K-Y Jelly® and inserted at least two inches to obtain core body temperature. Normal body temperature for caribou is about 101° F (38.3° C). Body temperature is monitored throughout handling to verify that body temperature stays in the

desirable range of 98-104 ° F (36.7-40° C). These are not absolute thresholds, and an animal whose body temperature is approaching the limits of this range should be treated pre-emptively, particularly if serial temperature measurements have shown a trend toward hyperthermia or hypothermia. If the observed temperature is greater than 104° F (40° C), attempts should be made to cool the caribou by packing the groin area with snow or placing the caribou in a sternally recumbent position with its underside exposed to the snow. If body temperature is rapidly approaching or exceeds 41.7° C (107° F), handling other than radiocollaring is eliminated, and antagonist drugs are injected quickly. Capillary refill time, an index of cardiac function, can be measured by pressing on a non-pigmented part of the gum, releasing pressure, and determining the time to restoration of color. A capillary refill time of less than 2 seconds generally implies adequate blood pressure. A slower refill time indicates low blood pressure or other circulatory dysfunction. Breathing frequency and depth are also qualitatively assessed throughout the handling period. All vital signs, along with any booster drugs or other drugs administered, should be recorded along with the time (military or 2400 hour time) on the table provided on the capture sheet (Figure 1).

Handlers should also locate the dart and remove it as soon as possible. Barbed needles are used to prevent the dart from bouncing out of the animal before injection is complete, to help with the verification of a successful dart hit, and to retain the dart for re-use. Removal of the barbed needle can be accomplished by pushing the dart sideways so the barb clears the entrance hole, or if necessary by making a very small incision with a scalpel. Prior to loading dart, a sharpie can be used to draw a line down the length of the dart under the barb, so that the location of the barb is known. Used darts should be stored in a labeled Nalgene bottle or other secure container. Processing kits should also contain a small sharps container for safe storage of disposable hypodermic needles and other hazardous items. Dart wounds are cleaned and treated if necessary. The eyes of drugged caribou should be protected from sunlight, foreign objects, and drying. Antibiotic eye ointment may be applied to each eye, and the eyes covered with a cloth or blindfold.

The general body condition of captured caribou should be briefly described and recorded on the capture data sheet. A caribou in good condition should have a layer of fat over the pelvis, ribs, and spine making them palpable but not sharply so. On a caribou in excellent condition, the pelvis ribs and spine may not be felt beneath a heavy layer of fat. Caribou in fair condition, and poor condition, will show decreasing fat levels and more sharply palpable bones. The presence of calf and whether the cow is currently lactating is determined and recorded. Caribou should be examined for old or new injuries, including broken bones, abrasions, and abnormalities of the skin and fur. Digital photographs should be taken of any injuries or abnormalities. New or old wounds should be treated with the application of an antibiotic ointment or nitrofurazone spray. Injured caribou may be given a long-lasting antibiotic such as Flo-Cillin® or Dual-Cillin®, with a concentration of 150,000 units per ml, at a dose of 1.5 ml per 10 kg of body weight, administered subcutaneously. A total of 10 ml per typically-sized adult female should be sufficient.

### ***Body Measurements***

Caribou should be weighed on an accurate scale with units (pounds or kilograms) recorded as needed. Handlers should use a weighing net and suspend it from the scale at the top of a weigh pole.

The data sheet contains spaces for recording body length (tip of nose to base of tail), neck circumference, jaw, metatarsus and hind foot lengths, and chest girth (distance around the chest immediately behind the front legs). These measurements should be taken in centimeters with a cloth measuring tape or calipers. Although many other measurements may be taken, speed and efficiency of handling argue for maintaining this brief set. The most valuable measurements for long-term evaluation of morphological change are likely to be measurements of the jaw, metatarsus and hind foot lengths. Please see the CircumArctic Rangifer Monitoring & Assessment Network (CARMA) Level 2 Monitoring Protocols for diagrams and photos that depict how to collect these data. These procedures (level2\_Body\_Condition\_SEPT\_2008\_WANfinalMS1e42d.pdf ) can be found at (<https://carma.caff.is/resources/field-protocols>).

### ***Animal Identification and Radiocollar Attachment***

Each captured caribou is assigned a unique number, based on the year and the order in which it was captured. Thus, the first caribou captured in 2009 will be named 0901. Preceding this with the species and herd, as in MCH 0901, should provide a unique identifier even when data or specimens from many areas are combined. Capture date should be recorded in the format month/day/year. A general description of the caribou's capture location (distance from some landmark) is recorded, along with the latitude and longitude of the capture site in degrees, minutes, and decimal minutes (datum WGS84). The sex and age of the caribou are recorded. For adult caribou, an estimated age in years should be recorded.

The standard radiocollar used for monitoring will be the Telonics MOD-600 collar. Before capture efforts begin, each collar should be marked in waterproof pen with the radio frequency, serial number, and agency information including a contact phone number. The frequency and serial number of the collar are recorded on the data sheet. The magnet, taped to the collar to keep it from broadcasting, is removed to start radio transmission. A telemetry receiver is used to verify the operation and frequency of the collar before it is deployed on a caribou. A colored vinyl visibility collar with a black number is placed over the belting of the radiocollar. The radiocollar is then affixed snugly around a caribou's neck, leaving enough room to insert a hand between the collar and the neck. A collar should be tight enough that it does not flop around excessively when the animal moves. Collars placed on yearling or young caribou should be left an inch or two looser to allow for growth. Belting material that extends beyond the collar attachment should be trimmed off but care must be taken not to cut the antenna off when the belting is trimmed away. A nut driver for tightening nuts and a sheet metal shears for cutting collar material are needed.

### ***Specimen Collection***

A 25-30ml blood sample is drawn from the cephalic (foreleg) vein, using either a large (35 ml) syringe with an 18 gauge needle, or a Vac-U-Tainer® system (Becton, Dickinson Inc). For disease antibody screening, whole blood is placed in two serum separation tubes (red and gray stopper) for subsequent centrifugation, freezing and analysis. Tubes containing EDTA anticoagulant (purple stoppers) are used to store blood for hematology and genetic analysis. All blood tubes should be gently upended several times to mix the contents. In cold weather, blood samples must be kept from freezing, which causes cell destruction. Tubes should be labeled with the animal number and stored

in a protected location (e.g. a cooler with a hot water bottle or hand warmer in it to prevent freezing) until returning from the field.

In addition to collecting blood, we may collect other specimens for genetic analysis. These will include buccal swabs (cotton swab rubbed on the lining of the mouth), and a tuft of hairs with roots attached. These samples will be placed in small manila envelopes for storage. Fecal pellets for dietary analysis will also be collected. These will be stored in plastic whirl packs. Care must be taken to label all specimens with the animal number, because multiple caribou are typically captured in a day. A tooth may be extracted using a tooth elevator for cementum aging. Lydacaine or similar anesthetic may be used to numb the gum.

It is convenient to prepare specimen collection packs in zip lock bags, with the supplies needed for one caribou. These might include one 35 ml syringe for blood drawing, two 6ml or 10 ml syringes for penicillin dispersion, several 18 gauge (green) needles 1.5 inch in length, two 10 ml serum separation tubes, two 10 ml blood tube ("red top") containing Longmire's Solution, two 3 ml EDTA (purple top) tubes, and several small manila envelopes for tissue specimens.

### ***Drug Reversal***

Once processing is complete, the effects of the immobilizing drugs may need to be reversed (antagonized), depending on the drug(s) in use. Drug reversal agents, amount, and route of administration will be indicated in the protocol for anesthesia that was developed with the veterinarian of record. Reversal agents may need to be given for each dart hit and bounce or glance, and this should be indicated in the anesthesia protocol as well as the efficacy time. Monitor caribou closely to ensure they are able to stand, walk or run within the efficacy time after receiving the antagonist(s). Each captured caribou will be located within 1-3 days post-capture to determine that it has survived the capture process.

### **Recording the Data**

Record all data from the capture on the caribou capture data sheet (Figure 1) should be printed on Rite-in the Rain® paper. Graphite pencils should be used to record data. The data sheet should be examined before leaving a recovering animal, to check for measurements or observations that may have been missed. If enough personnel are present, designating one person to record data can facilitate the consistency and accuracy of the process. This is especially true when more than one caribou is being processed together. The capture location should be way pointed with a GPS unit, and the coordinates or waypoint number recorded on the data sheet as soon as practical. Fields on the data sheet allow the recording of the names of the capture crew, a record of photographs taken, and other comments. The comments section can be used to record any injuries or abnormalities not noted elsewhere on the data sheet, unusual coat color or physical conformation, identity and activity of other caribou during the capture operation, other caribou captured at the same time, significant weather conditions, the condition of the caribou on release, and any other observations that may be useful in interpreting laboratory results or the subsequent behavior of the caribou.

Date: \_\_\_\_\_ Shooter/Crew: \_\_\_\_\_ Animal No.: \_\_\_\_\_  
Frequency: \_\_\_\_\_ Vis Collar: \_\_\_\_\_ Old Freq/Vis: \_\_\_\_\_ Serial No.: \_\_\_\_\_  
GPS Location: \_\_\_\_\_ General Location: \_\_\_\_\_

| Time                                   | Dart Location                                                                     |                                    |
|----------------------------------------|-----------------------------------------------------------------------------------|------------------------------------|
| Start Chase: _____                     |  | Dose: _____                        |
| 1 <sup>st</sup> Hit/Bounce/Miss: _____ |                                                                                   | # Hits: _____ # Misses: _____      |
| 2 <sup>nd</sup> Hit/Bounce/Miss: _____ |                                                                                   | Drug Effect: Light 2 3 4 Heavy     |
| 3 <sup>rd</sup> Hit/Bounce/Miss: _____ |                                                                                   | Init Body Temp: _____ Time: _____  |
| Visible Effect: _____                  |                                                                                   | Final Body Temp: _____ Time: _____ |
| Animal Down: _____                     |                                                                                   | Additional Drugs: _____            |

Sex: \_\_\_\_\_ Age: \_\_\_\_\_ With Calf? \_\_\_\_\_ Lactating? \_\_\_\_\_ Body Condition: Fat Good Poor Emaciated  
Body Weight: \_\_\_\_\_ lbs/kg Tare: \_\_\_\_\_ lbs/kg

Measurements (cm): Body length: \_\_\_\_\_ Neck circumference: \_\_\_\_\_ Jaw: \_\_\_\_\_  
Metatarsus length: \_\_\_\_\_ Hindfoot length: \_\_\_\_\_ Chest girth: \_\_\_\_\_

Samples: Blood Red: \_\_\_\_\_ Purple: \_\_\_\_\_ Green: \_\_\_\_\_

Reversal:

| Drug /Dose/ Route | Time  |
|-------------------|-------|
| _____             | _____ |
| _____             | _____ |

Standing: \_\_\_\_\_  
Mobile: \_\_\_\_\_

Comments:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Figure 1. Caribou capture data sheet.

### ***Post capture responsibilities***

When capture personnel return to the laboratory, serum separation tubes are centrifuged for 15 minutes, and the serum poured into screw-topped plastic CryoTubes® (Nalge Nunc International) and frozen. The original blood collection tube is discarded, but the plug of cellular material in it (blood clot) is kept as a genetic sample. Whole blood in Longmire buffer collected for genetic analyses is

subdivided into several CryoTubes and frozen. Hair and buccal swab specimens, also collected for genetic analysis, are stored in manila envelopes at room temperature. Both blood and tissue samples are collected to ensure quality DNA extraction. EDTA (purple-topped) tubes are stored in a refrigerator, not frozen, if they will be used for hematology analysis (e.g., a caribou with an apparent infection). This will be done periodically (3-5 years). Otherwise, blood from EDTA tubes can be transferred to unbreakable CryoTubes and frozen for a genetic specimen. The final containers for all specimens are labeled in permanent marker, both on the caps and sides of each tube, with the species, herd, park unit, animal number, capture date, sex, , and tissue type (whole blood, blood clot, serum, hair, or tissue, etc.).

None of the specimens collected require rapid handling or express shipping. Genetic specimens may be sent to the USGS Alaska Science Center Molecular Ecology Laboratory in Anchorage. Samples will be sub-sampled by NPS and deposited at various agencies. Redundancy of specimens will allow long- term storage by USGS, ADFG, and the University of Alaska Museum Frozen Tissue Collection, so that archival specimens are available for future analyses. Frozen serum specimens will be sent to the ADFG for disease analysis. In cases where a systemic infection or other blood abnormality is suspected, hematology analysis of whole blood preserved in EDTA will be performed by a veterinary laboratory.

At the end of the day, processing kits should be cleaned out and dried, refuse disposed of and contents replenished. Capture guns are cleaned and any darts unused at the end of the day must be unloaded to prevent corrosion. Data sheets are checked for completeness, photocopied (if possible) and stored securely.

Caribou capture data will be entered and stored in the designated Caribou Monitoring Database and Application as described in SOP#6.

# Standard Operating Procedure (SOP) # 3 Conducting the Herd Size Estimate

Version 1.0 (December 2004)

## Revision History Log:

| Previous Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
|--------------------|---------------|--------|--------------|-------------------|---------------|
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This Standard Operating Procedure explains how to determine the survey area, conduct the aerial survey, and place observed caribou into sex and age categories.

*Herd census:* For the Chisana Caribou Herd, censuses are conducted in early October, in association with captures and fall composition surveys. Conducting a Chisana Caribou Herd census will require 2-3 days of fieldwork and will require a minimum of 3-4 personnel, including a helicopter pilot, a fixed-wing pilot, and 1-2 biologist-observers. Mentasta Caribou Herd censuses are conducted on 1 day in late June and utilize 3 pilot-observer teams in fixed-wing aircraft. Fall sex and age composition surveys are combined with the June Mentasta Caribou Herd census to provide a herd size estimate.

## Preparation

### *Timing*

*Mentasta Caribou Herd:* The summer portion of the herd size estimate is conducted in late June, at the traditional time for conducting post-calving counts for caribou, and can be completed in one day. At this time of year caribou tend to be grouped well and in open, high-elevation habitats. The June survey is combined with a sex and age composition count conducted during the first two weeks of September (See SOP # 3). The September composition count can be accomplished in one day and is usually conducted in conjunction with caribou captures. *Chisana Caribou Herd:* The herd size estimate for the Chisana Caribou Herd is conducted in early to mid-October and can be accomplished in 2-3 days. Snow provides a contrasting background against which caribou are more visible from the air, therefore it is preferable to conduct the census with adequate snow cover.

### *Aircraft and Personnel*

*Mentasta Caribou Herd:* The June segment of the Mentasta Caribou Herd size estimate will require 3 fixed-wing aircraft, each having a pilot-observer team. The September sex and age composition survey requires a helicopter to collect the sex and age data and a fixed-wing aircraft to assist with

locating caribou. *Chisana Caribou Herd*: The Chisana Caribou Herd size estimate requires a helicopter and 1-2 fixed-wing aircraft. Appropriate fixed-wing aircraft include slow flying, tandem seated aircraft such as the Piper Super Cub and Aviat Husky. Commonly used helicopters for composition work include the Robinson R-44 and Hughes 500 aircraft. The fixed-wing pilot and aircraft should be scheduled 3 months in advance of the operation. The helicopter and pilot should be scheduled at least 6 months in advance of the operation.

Caribou herd estimates involve mountain flying and low-level operations. Selection of capable, experienced pilots is perhaps the most important safety consideration in caribou survey work. Biologists should have experience conducting caribou or large mammal surveys from fixed-wing and rotary aircraft. Biologists should be skilled in caribou sex and age classification.

## **Conducting the Herd Size Estimate**

### ***Chisana Caribou Herd***

A day or 2 prior to the census, radio collared caribou should be located using fixed-wing aircraft to delineate a survey area that encompasses the region inhabited by nearly all the radioed caribou with a reasonable buffer and bounded by obvious geographic features and treeline. The Yukon Department of the Environment assumes responsibility for completing the census in the Yukon while the responsible agencies in Alaska complete the census in Alaska. A coordinated effort is made to complete the census on the same day, if weather permits. Optimal survey conditions include clear skies or high cloud overcast and a complete snow cover on the ground. Generally there is snow cover present during mid-October and incomplete or patchy snow conditions make sighting caribou difficult.

Starting at one end of the survey area, the helicopter, with 1-2 observers in addition to the pilot, systematically searches for caribou groups ( $\geq 1$  caribou) within the survey area without the aid of radiotelemetry. Simultaneously, a fixed-wing aircraft locates radiocollared caribou to determine their locations and group sizes. Caribou groups encountered by the helicopter are classified as cows, calves, or bulls and bulls are further classified as small, medium, and large (see SOP 4, Fall Sex and Age Composition Counts). Classifications are recorded into a handheld tape recorder or tally counter and results are recorded on a datasheet by the second observer. Observers then use radiotelemetry to determine whether the group contains any radiocollared caribou. The telemetry receiver is turned on and placed in scan mode, with the volume turned down very low. To minimize the chance of picking up radiocollars in other groups, only one antenna is used and the aircraft should circle the group with that antenna pointing at the group. All radio frequencies are scanned and when a signal is heard, the scanner is stopped on that frequency. After making certain the frequency heard is part of the group, the frequency number is recorded on the data sheet. A group may contain more than one radiocollared animal, therefore all radio frequencies must be scanned before continuing to search for new groups. Each radio frequency heard in the group is recorded on the datasheet for that group. Periodically through the survey, the helicopter crew communicates with the fixed-wing aircraft to determine if marked caribou groups were missed by the helicopter, and those groups are then located by the helicopter and classified by sex and age.

Once the survey is completed, the aircraft crews compare results to determine if any other radiocollared caribou were missed during the survey. Radiocollared caribou that were unaccounted for during the survey are located using radiotelemetry by the fixed-wing pilot who then directs the helicopter to the group for sex and age classification.

### ***Mentasta Caribou Herd***

A day or 2 prior to the census, radiocollared caribou should be located to provide an assessment of their distribution. Previous surveys have included the area above 4000 feet between the Cheshnina River on the south to the Upper Copper River/Copper Glacier to the north and east. This area is further divided into 3 survey units, each searched by a different tandem fixed-wing aircraft having a crew of one pilot and one observer. The 3 units to be searched are 1) Cheshnina River to the Sanford River 2) Sanford River to Boulder Creek and 3) Boulder Creek to the Upper Copper River. Optimal weather conditions for the survey include warm temperatures with little wind and minimal fog or cloud cover between 4000 and 6000 feet.

Three pilot-observer teams will conduct the census, covering the entire census area in one day. Each pilot-observer team will thoroughly search their survey unit for caribou, without the aid of telemetry, expending 4-5 hours of survey time. When a caribou group ( $\geq 1$  caribou) is located, the number of caribou in the group is counted and classified as cows, calves, and obvious bulls (small bulls that are indistinguishable from cows fall in the “cow” class). Observers then use radiotelemetry to determine whether the group contains any radiocollared caribou. The telemetry receiver is turned on and placed in scan mode, with the volume turned down very low. To minimize the chance of picking up radiocollars in other groups, only one antenna is used and the aircraft should circle the group with that antenna pointing at the group. All radio frequencies are scanned and when a signal is heard, the scanner is stopped on that frequency. After making certain the frequency heard is part of the group, the frequency number is recorded on the data sheet. A group may contain more than one radiocollared animal, therefore all radio frequencies must be scanned before continuing to search for new groups. Each radio frequency heard in the group is recorded on the datasheet for that group.

Once the survey is completed, the aircraft crews compare results to determine which radiocollared caribou were missed during the survey. Immediately following the survey, radiocollared caribou that were unaccounted for during the survey are located via radio telemetry. When located, the number of caribou in the group are counted and classified by age and sex, and a location is recorded to indicate whether they were in the survey area and missed or outside the survey area and had no chance of being detected. It is essential that all radiocollared caribou are located, either during the survey or during the follow up flight to locate missed radiocollars.

### **Recording the Data**

*Chisana Caribou Herd.* The helicopter pilot-observer team will record data on a paper data sheet (Figure 2). Header data includes the date of the census, type of aircraft/tail number, pilot, observer, time survey begins and ends, total flight time, weather, and assigned search area. Each caribou group is recorded on one line of the datasheet. Groups are numbered consecutively as they are observed, and the number of cows, calves, bulls (small, medium, large), and total caribou are recorded for the

group. If the group contains one or more radiocollared animals, the frequencies of the radiocollars are listed on the same line with the caribou group. For each group, indicate whether the group was seen during the survey as yes (Y) or no (N) and whether it was inside (IN) or outside (OUT) of the survey area. For group location data, the GPS waypoint number is recorded as well as the latitude and longitude. Record any comments appropriate to the observation.

| Chisana Population Estimate Form |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|----------------------------------|-------|-----|------|---------|----------|----------|------------|---------------------------|-----------|-------------------------|-------|----------|-----------|----------|--|
| Date (mm/dd/yyyy) _____          |       |     |      |         |          |          |            | Aircraft _____            |           | Time Depart _____       |       |          |           |          |  |
| Weather _____                    |       |     |      |         |          |          |            | Pilot _____               |           | Time Return _____       |       |          |           |          |  |
| Search Area: Alaska Yukon        |       |     |      |         |          |          |            | Observer(s) _____         |           | Total Flight Time _____ |       |          |           |          |  |
| Grp #                            | Total | Cow | Calf | Sm Bull | Med Bull | Lrg Bull | Total Bull | List Frequencies in Group | Seen? Y/N | IN or OUT               | GPS # | Latitude | Longitude | Comments |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
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|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |
|                                  |       |     |      |         |          |          |            |                           |           |                         |       |          |           |          |  |

Figure 2. Herd size estimate datasheet for the Chisana caribou herd.

Mentasta Caribou Herd. Each pilot-observer team will record data on a paper data entry form (Figure 3). Header data includes the date of the census, type of aircraft/tail number, pilot, observer, time survey begins and ends, total flight time, weather, and assigned search area. Each caribou group is recorded on one line of the datasheet. Groups are numbered consecutively as they are observed, and the number of cows, calves, obvious bulls, and total caribou are recorded for the group. If the group contains one or more radiocollared animals, the frequencies of the radiocollars are listed on the same line with the caribou group. For each group, indicate whether the group was seen during the survey as yes (Y) or no (N) and whether it was inside (IN) or outside (OUT) of the survey area. For group location data, the GPS waypoint number is recorded as well as the latitude and longitude. Record any comments appropriate to the observation.

[illegible]

Figure 3. Herd size estimate for the Mentasta Caribou Herd.

# Standard Operating Procedure (SOP) # 4 Fall Sex and Age Composition Survey

Version 1.0 (December 15, 2004)

## Revision History Log:

| Previous Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
|--------------------|---------------|--------|--------------|-------------------|---------------|
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This Standard Operating Procedure gives instructions on how to conduct the caribou fall sex and age composition survey. Fall composition surveys provide data to determine calf recruitment to fall (calf:cow ratio) and adult sex ratios (bull:cow ratio) used in estimating herd size and evaluating bull survival.

## Preparation and Equipment Procurement

### *Timing*

Fall sex and age composition surveys should be conducted during the peak of the annual rutting period when adults of both sexes are most likely to be well-mixed and generally occur in large groups. Composition counts should be conducted annually and will require 1-2 days to complete.

*Mentasta Caribou Herd:* Composition surveys must be conducted the first week of September to avoid the migratory incursion of Nelchina Caribou Herd caribou. This survey is usually conducted in association with fall captures. *Chisana Caribou Herd:* Composition surveys should be conducted in early to mid-October. The Yukon Department of the Environment assumes responsibility for completing the composition survey in the Yukon while the responsible agencies in Alaska complete the composition survey in Alaska.

### *Equipment*

#### ***Aircraft and Personnel***

Composition surveys will require a helicopter and pilot for determining the sex and age composition of caribou and a fixed-wing aircraft and pilot with radio tracking ability to assist with locating caribou. Commonly used helicopters for composition work include the Robinson 44 (R-44) and Hughes 500. The helicopter and pilot should be scheduled at least 3 months in advance of the operation. The helicopter crew consists of one pilot, one front seat biologist observer to determine the sex and age of each animal, and one or two back seat observers to record data. All crew members assist in locating caribou groups. The pilot should be experienced in conducting caribou composition surveys. The front seat biologist must be proficient in caribou sex and age classification.

## **Conducting the Sex and Age Composition Counts**

A day or 2 prior to the composition count, all radio collared caribou should be located using fixed-wing aircraft (SOP #4) to delineate a survey area that encompasses nearly all the radioed caribou and to facilitate quick relocation of animals during the survey. For the Chisana Caribou Herd, the Yukon Department of the Environment assumes responsibility for completing the composition count in the Yukon while the responsible agencies in Alaska complete the composition count in Alaska. A coordinated effort is made to complete the composition count on the same day, if weather permits. Ideal survey conditions include clear or high overcast skies with either no snow or complete snow cover. Mottled, incomplete snow cover is the most difficult condition for conducting the survey.

Starting at one end of the survey area, the fixed wing aircraft should fly ahead of the helicopter with the telemetry receiver on, scanning for radiocollared caribou. As caribou groups are located using telemetry, the fixed wing aircraft directs the helicopter to each group for classification. The helicopter crew also helps to visually locate caribou, including groups without radiocollared animals, while flying to and from marked groups. To determine sex and age composition of the groups, caribou must be observed from the rear. Therefore the helicopter pilot must fly low and behind the group, keeping animals together and using the terrain to help maneuver the group. Very large groups should be herded into smaller groups so that animals are easier to sex and age, and are not missed or double counted. For annual composition surveys not associated with obtaining herd size estimates, it is not necessary to locate and classify all the caribou in a defined survey area, however sampling effort should be allocated throughout the herd.

All caribou encountered are classified as cows, bulls, or calves based on their appearance and external sex characteristics. Bulls are further classified as small (antlers and body size indistinguishable from cows), medium (antlers and body size larger than adult cows, but with smaller beam diameter, shorter length, and fewer points than fully-mature bulls), or large (large-bodied individuals with fully developed antlers (3+ feet) with thick beams, long antler length, and many points). The most reliable method of determining sex of caribou is observation of their rumps when their tails are raised. Females of all ages show a black vulval patch, while males of all ages generally show only white in that area, with sometimes a slight faecal staining. The white rump patch is narrower on bulls than cows. Small antlered adults that do not have a calf at heel should be classified as unclassified adults, if a rear view is not achieved. Calves are distinguished from adults primarily by their smaller size, shorter faces and somewhat darker coats. A calf in the fall has velveted spikes between 10 cm - 24 cm.

## **Recording the Data**

As the helicopter flies behind the group, the front seat biologist calls out the sex or age of each animal (e.g. cow, cow, calf, large bull, medium bull, cow, calf, etc.) and the back seat biologist records the data using a row of connected hand held tally counters, each counter representing a sex or age category (Figure 4). After each group is tallied, results are recorded on the datasheet (Figure 5) and the counter is zeroed out for the next group composition. If there is not a second biologist to record data, the primary biologist can record data into a small hand-held digital voice recorder or use



Figure 4. Tally device used during the caribou sex and age composition survey.

the hand held tally counter. The frequencies and or visual collars of radiocollared caribou in each group is recorded on the datasheet. A geographic coordinate should be obtained and recorded as a waypoint number for each caribou group using a hand held or aircraft GPS. The corresponding waypoint number is recorded on the data sheet. If a digital voice recorder is used, the data is transcribed onto the datasheet and the voice recording is archived.

[illegible]

Figure 5. Sex and age composition datasheet.

# Standard Operating Procedure (SOP) # 5 Techniques for Radiotracking of Collared Caribou

Version 1.0 (December 15, 2004)

## Revision History Log:

| Previous Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
|--------------------|---------------|--------|--------------|-------------------|---------------|
|                    |               |        |              |                   |               |
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This Standard Operating Procedure explains the procedure for radio-tracking collared caribou. Radio-tracking caribou provides information on seasonal distribution, female survival, the number of caribou missed during herd size estimates, and facilitates location of caribou for fall sex and age composition surveys.

## Preparation and Schedule

### *Timing of Surveys*

Ideally, caribou should be radiotracked from fixed-wing aircraft approximately every 2 months, however budgets probably cannot accommodate this intensity. The minimum annual radio tracking schedule is 1) mid-June to determine postcalving distribution and an as part of the postcalving census for the Mentasta herd, 2) late September to mid-October to assess distribution for fall composition surveys, survival over the summer, and rutting distribution, 3) late January to document survival and midwinter distribution, and 4) mid-March to determine late winter distribution and survival. As funding allows, additional radiotracking flights should be conducted in 1) mid-May to determine productivity of radiocollared females by observation of calves at heel, retained hard antlers, or distended udders, 2) late July to determine survival and summer distribution, and 3) late November to determine survival and early winter distribution. Additional radio-tracking will be required to support conducting herd size estimates (SOP 3) and fall sex and age composition surveys (SOP #3).

### *Equipment*

Equipment required for radio-telemetry is listed in Appendix A. WRST has several ATS Model R4000 radiotracking receivers as well as tracking antennas and cables. Receivers should be fully charged prior to the flight. If possible, a second receiver should be carried in the aircraft as a back-up. Prior to a flight, the radio frequencies of all animals that will be sought are entered into the telemetry receiver's memory bank. The R4000 has four memory banks, so that frequencies can be divided into geographic areas to avoid scanning for collars that are not nearby thereby improving the efficiency of the mission. With the receiver turned on and the bypass switch in bypass mode, a memory bank (A,B,C,D) is selected, the last four digits of the desired frequency are dialed in with

the four frequency selectors, and the ADD/DELETE switch is pressed momentarily to the ADD position to place the frequency in the memory bank. The procedure is repeated for each desired frequency. Typically, the frequencies that are 1/1000<sup>th</sup> of a megahertz above and below the desired frequency are also added, in case the frequency has 'drifted' from the frequency of the originally built crystal. This process is known as bracketing.

Newer telemetry receivers like the ATS R4500 can be programmed by direct hookup to a computer database. Another advantageous feature of the R4500 is the availability of animal identity notes on the LCD readout, so that the sex and age of an animal can be seen when the frequency is addressed. This feature is also available on the inexpensive Communications Specialists R-1000 receiver. The receiver needs to be charged according to manufacturer's instructions, before the flight. The operator's manual for the R4000 receiver can be found in the Supplements folder for this monitoring protocol.

Before beginning an aerial radiotracking flight, the telemetry receiver must be connected to the aircraft's intercom system, and to the antenna system. Coaxial cables from the two wing-mounted antennae connect to a switchbox capable of selecting either the right or left antenna or both at once. A single coaxial cable runs from the switchbox to the antenna connector on the telemetry receiver. The audio output (labeled "headset") on the receiver is connected to the aircraft intercom system with a ¼ inch phone cable, either plugged directly into the intercom (if a dedicated telemetry input is provided) or through a splitter, available at Radio Shack.

### ***Aircraft and Personnel***

The standard aircraft for radio telemetry is the Piper PA-18 Supercub. The tandem seating allows for full visibility by pilot and passenger when circling in either direction, the ability to fly slowly for effective observations, and the ability to land in a wide variety of locations. Occasionally, when long distances must be traveled for telemetry work, or during very short mid-winter days, a faster aircraft such as the Cessna 185 may be favored. Experience has shown that aerial radio-tracking is performed most efficiently when the pilot operates the switchbox, so that the aircraft can be oriented in response to changes in signal strength. This requires a period of training and practice for pilots. Expertise at radiotracking, along with the many challenges of safe flying in the remote and mountainous terrain of Alaska and the harsh weather conditions often encountered, provide strong arguments for careful selection of pilots for this work. The observer should have experience operating the telemetry receiver and be able to tolerate tight circling by the aircraft.

### **Aerial Radiotracking Procedures**

The aircraft proceeds to the area where the first collared animal is thought to be, with the antenna switchbox in the "both" position, so that signals from both sides of the aircraft can be heard. The RF gain switch on the receiver should be turned all the way up, and the attenuation switch, if present, should be in the off position. The volume knob is adjusted for a comfortable level. When a signal is heard, the scanner is stopped on that frequency, then the switchbox is used to listen to each antenna separately, and the aircraft is turned in the direction of the louder signal. When the aircraft is headed directly toward the source of the signal, the volume from the left and right antenna are equal, or the

signal may be lost altogether because neither antenna is pointed toward the signal source. As the radiocollared animal is approached, the RF gain knob is turned progressively lower, and when the signal is quite loud the attenuation switch (if present) is turned on if needed. The lower gain level makes it easier to discriminate between slight differences in signal strength between the two antennae. If the collar is passed, there will be an abrupt decrease in signal strength. The aircraft is maneuvered around the signal while using the switchbox to select between the antennae. When the aircraft is circling the collared animal, the signal from the inside wing is consistently louder, all around the circle. In open country, particularly in winter, the collared animal and other caribou may already have been sighted by this time. If the caribou is concealed by vegetation, it may never be seen, but the accuracy of the tracking system should allow its location to be estimated to within 100 meters or less. Once the pilot and observer have seen the animal or determined its location, a latitude and longitude coordinate (waypoint) is collected with the aircraft's GPS receiver. Care must be taken to mark the waypoint when the aircraft is directly over the animal location.

Once a collared animal has been located, its frequency is deleted from the memory bank for the remainder of the flight. Typically, two or three memory banks on the receiver are used for different geographic areas, with missing or dispersing caribou being programmed into more than one bank. When searching for the next caribou to locate, the attenuation switch (if present) is turned off, the RF gain switch returned to its maximum position, the antenna switchbox is returned to the "both" position, and the aircraft regains altitude. Because VHF telemetry signals are more or less "line of sight", the range at which collars can be heard varies greatly, and increases with increased altitude of the tracking aircraft. Practical range can vary from 60 kilometers or more when an animal is on a mountaintop with nothing between it and the aircraft to less than a kilometer when an animal is in a canyon or behind a mountain.

In order to accurately determine the distribution and survival of caribou within a herd, it is very important to locate all the caribou during each radiotracking bout if at all possible. On occasion, a few caribou will be difficult to locate and invariably some will be missed. Commonly, these animals either determine the extremes of the herd's distribution or are dead in areas where the radio signal range is limited due to terrain. It is imperative that the number of missed animals is kept to a minimum and that they are noted and additional efforts are made to locate them in the subsequent radiotracking bout.

### **Recording the Data**

Once a radiocollared caribou has been located, information is recorded on the data sheet (Figure 6). If there is more than one radiocollared caribou in a group, place each radiocollared animal on a separate line of the datasheet. Associated animals are indicated by using the same group number and can also be noted in the comments column. As associated animals are on adjacent rows of the data sheet, ditto marks can be used to indicate that data is the same. Header data includes the herd being tracked (Mentasta or Chisana), date, type of aircraft/tail number, pilot, observer, time of departure and return to base station, and total flight time. Information recorded for each radiocollared caribou located include the animal ID, radiocollar frequency, and visual collar color/number. Because frequencies are recycled on different animals over time, it is important to record the animal ID as this

**Caribou Radiotracking Form**

|                         |                |                         |
|-------------------------|----------------|-------------------------|
| Herd _____              | Aircraft _____ | Time Depart _____       |
| Date (mm/dd/yyyy) _____ | Pilot _____    | Time Return _____       |
|                         | Observer _____ | Total Flight Time _____ |

| Grp # | Animal ID | Freq | Visual Collar | Time 24 hr | Mode | Accuracy | Bull | Cow | Adult | Calf | Total | GPS # | Latitude | Longitude | Comments |
|-------|-----------|------|---------------|------------|------|----------|------|-----|-------|------|-------|-------|----------|-----------|----------|
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
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|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
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|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
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|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |
|       |           |      |               |            |      |          |      |     |       |      |       |       |          |           |          |

Mode = A (active); M mortality      Accuracy = 1 (see caribou/collar); 2 (low level, no visual); 3 (high altitude no visual)

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# Standard Operating Procedure (SOP) # 6 Data Management

Version 1.0 (February, 2017)

## Revision History Log:

| Previous Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
|--------------------|---------------|--------|--------------|-------------------|---------------|
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## Introduction

Data management for the WRST caribou monitoring program follows a specific life cycle as shown in Figure 7. Data deliverables described in the protocol are realized during periodic caribou capture and collaring events, aerial surveys, and automated GPS collar data downloads. Deliverables are processed for quality and integrated with the master databases. The deliverables are then documented and archived in the IRMA Data Store in case they are needed in the future. Certified data suitable for analysis and reporting is published to the WRST caribou program's authoritative certified Dataset reference in the Data Store.

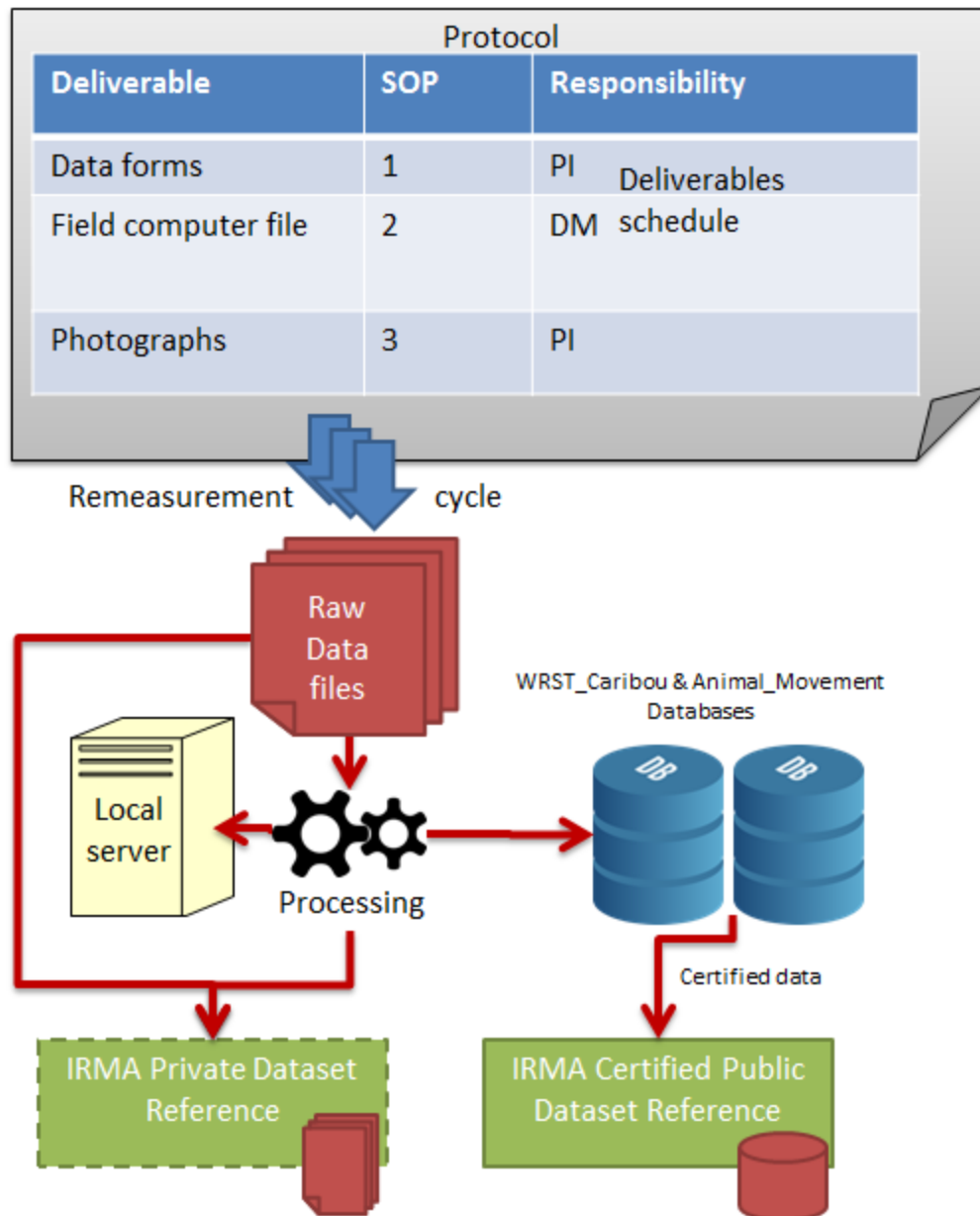


Figure 7. WRST caribou data management life cycle.

### GPS Collared Caribou Data Management Procedures

The GPS collar data collected by the WRST caribou monitoring program is managed by the regional GIS team in their Animal Movement database and application. The Animal Movement tool is available to NPS personnel at X:\GIS\Apps\AnimalMovement. Extensive documentation on using the database and application are available in GitHub at: <https://github.com/regan-sarwas/AnimalMovement/tree/master/Documentation>.

## Capture, Collaring and Aerial Survey Deliverables Management Procedures

Major data deliverables collected during caribou capture, collaring, and aerial survey flights consist of paper data forms, GPS waypoints and tracklogs. Descriptions and specifications for these and all other deliverables are in Appendix D.

Field data files should be downloaded, organized and backed up daily at each survey field base station using a single, authoritative data storage device ('field laptop') and one or more external storage drives for backup (Figure8). On the first day of the survey campaign designate a primary field data manager whose job it will be to oversee daily file management activities such as downloading cameras and GPS units, collecting paper data forms and organizing them in the survey campaign's \Data directory (Table 1). Designate a separate backup field data manager who will be responsible for making sure deliverable files, including paper data forms, are copied and backed up daily to one or more external storage drives. The backup manager also ensures that the backup drives and paper files are stored securely and separately from the primary repositories.

Table 1. Field data manager and backup data manager roles and responsibilities.

| Primary field data manager                                                                                                                                                                                                                                                                                                                                                                                                                              | Backup field data manager                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Manage field laptop</li> <li>• Create standard directory structure</li> <li>• Daily downloading and organization of field data deliverables (Appendix I) including: <ul style="list-style-type: none"> <li>• Data collection forms</li> <li>• GPS tracklogs and waypoints</li> <li>• Images</li> <li>• Other deliverables</li> </ul> </li> <li>• Secure deliverables</li> <li>• Secure field laptop</li> </ul> | <ul style="list-style-type: none"> <li>• Copy/scan/photograph field data collection forms</li> <li>• Check deliverables organization, security and completeness on the field laptop</li> <li>• Create daily backup of field laptop on external storage</li> <li>• Secure physical file copies</li> <li>• Secure backup storage device</li> </ul> |

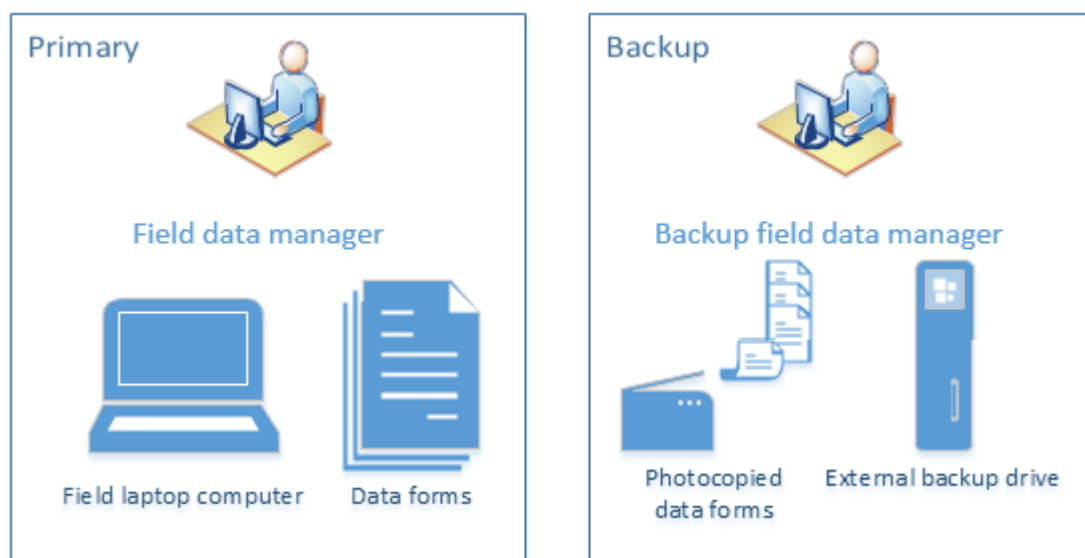


Figure 8. Field data management personnel and equipment architecture. The project leader designates a primary field data manager and backup field data manager to be responsible for safeguarding data deliverables. Physical files and copies are organized and secured daily. Digital files are downloaded to a field laptop and backed up to an external storage device every day.

### **Meticulously Organizing and Naming Deliverables on the Field Laptop is Critically Important.**

If the data deliverables are well curated in the field then permanent archival of raw data deliverables on the ARCN shared drive and in the IRMA Data Store is relatively straightforward without a great deal of time spent reorganizing files and puzzling out inconsistent methods. Following file naming and organizational specifications has the added benefit of causing inconsistencies to jump out at the eye revealing problems in the field where the possibility of remedy still exists.

### **Standard Field Survey Directory Structure**

The WRST caribou monitoring program has a standard field directory structure. Each data collection campaign has its own top level directory and subdirectories for organizing deliverables. Deliverable directories and files are named according to the identifiers and specifications in the deliverables schedule (Appendix D). An example standard directory structure for a Mentasta herd composition count survey appears below:

```
\2016 Mentasta Caribou Herd Composition Count Survey
\Deliverables
  \CC-01 Chisana composition count survey completed paper data collection forms
  \CC-02 Chisana composition count survey scanned data forms
  \CC-03 Chisana composition count survey waypoints file
  \CC-04 Chisana composition count survey tracklog file
```

Other data collection campaigns would use a similar structure.

### **Procedure (Project leader)**

1. Designate a primary field data manager
2. Designate a backup field data manager

### **Procedure (Field data manager)**

1. Designate a single laptop as the authoritative repository for all data files for the remainder of the survey.
2. Designate an external drive as the authoritative backup repository for field data files.
3. Create a survey campaign master directory structure on the field laptop.
4. Check the datasheets for legibility and completeness. Order them and give them to the backup field data manager to copy or photograph.
5. Download the survey GPS units using DNRGPS. Export the data in WGS84 Geographic Coordinate System (lat/long) to comma separated values text files. Optionally, also download the data as shapefiles.
6. Name the GPS waypoint and tracklog files according to their specifications (Appendix I) and file them in the appropriate deliverables subdirectory.
7. Secure the field laptop in a safe location.
8. Retrieve the original paper data collection forms and secure them.

**Procedure (Backup field data manager)**

1. Copy/scan/photograph field data sheets and name the files according to the deliverables specifications (Appendix E).
2. Save the resulting files to the appropriate deliverables directory on the field laptop.
3. Return the original data sheets to the primary field data manager.
4. Account for each field data deliverable by checking files against the deliverables schedule and the master survey directory.
5. Back up the main survey directory on the laptop to the backup device.
6. Secure backup device in a safe location separate from the field laptop.
7. Secure the copies of the data sheets.

**Post Field Campaign Procedures**

After field data collection events all data deliverables are copied from the field laptop to the WRST Caribou directory on the CAKN shared drive (J:\Monitoring\Caribou\WRST). Contact the Network data manager for access. Data deliverables are organized in the \Data subdirectory according to a specific file management scheme an example of which appears in Table 2. Deliverables are archived hierarchically according to data collection event type and herd.

Table 2. Example directory structure for the WRST caribou monitoring program.

---

|                    |
|--------------------|
| \Data              |
| \Capture           |
| \Chisana           |
| \Mentasta          |
| \Composition Count |
| \Chisana           |
| \Mentasta          |
| \Population        |
| \Chisana           |
| \Mentasta          |
| \Radiotracking     |
| \Chisana           |
| \Mentasta          |

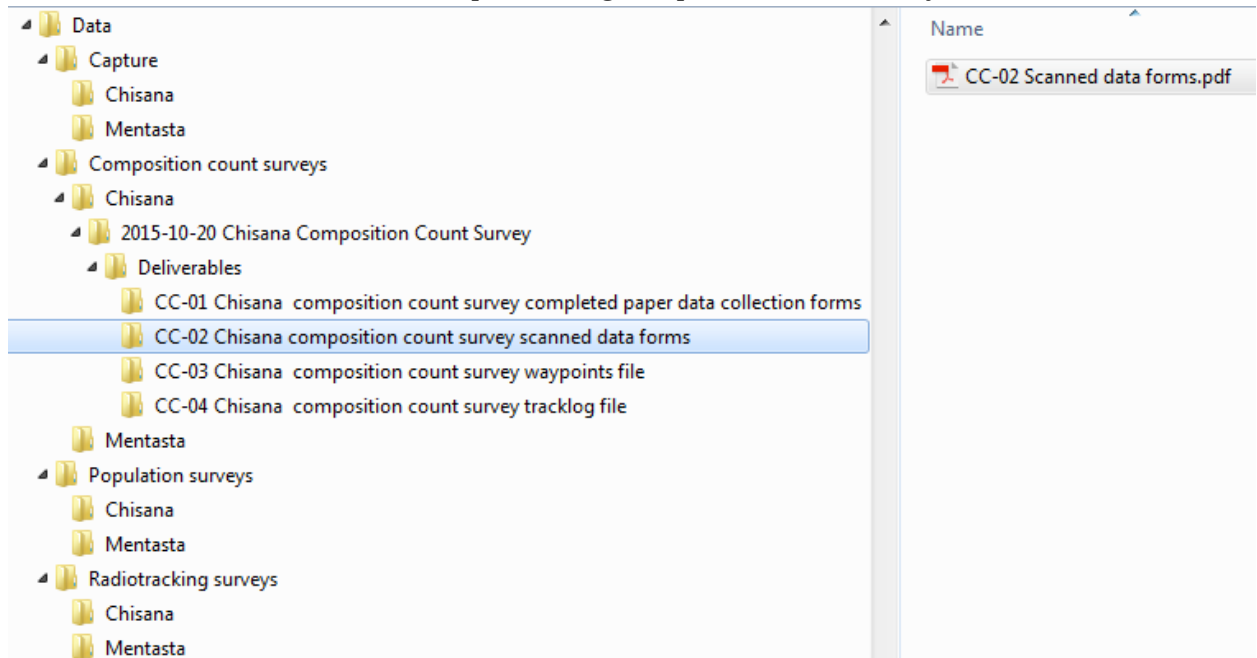
---

Note: these directories are working directories. The authoritative repository for finished data deliverables is always the IRMA Data Store.

**Procedure:**

1. Navigate to the WRST Caribou master directory on the CAKN shared drive.
2. Open the \Data subdirectory
3. Navigate the subdirectories respecting the data collection effort type and herd

4. Copy the data collection event's standard field directory into the most logical subdirectory. See the screenshot below for an example of filing composition count survey deliverables.



5. Verify the deliverables copied completely
6. Write Readme or metadata files as needed to describe and document the files
7. Proceed with quality control procedures, database integration and final archiving in the IRMA Data Store.

## Data Entry/Deliverables Integration

Disparate field data deliverables must be integrated with the Animal Movement and WRST\_Caribou databases. Data entry and integration procedures related to GPS collars is covered in the Animal Movement documentation at <https://github.com/regan-sarwas/AnimalMovement/blob/master/Documentation/Documentation.rst>.

Capture and aerial survey data deliverables are integrated with the WRST\_Caribou database through data entry applications and scripts, all of which are documented and available at <https://github.com/NPS-ARCN-CAKN/WRST-Caribou>.

## Quality Control

### *Data verification against data sheets*

Data verification is critical to maintaining the WRST caribou monitoring dataset at a high level. Methods include:

- Verifying data transcription by eye.
- Having a second person verify the entered data.

- Summing counts by rows and columns on the data collection forms and comparing to the same summaries using SQL database queries.
- Running analytical procedures and examining the results for anomalies.

### ***Data verification using GIS***

Verify the spatial data for each survey against the data source using GIS. See SOP #8 for information on accessing the WRST\_Caribou database using GIS. Compare GPS waypoints against the composition count, population and radiotracking data and correct/document anomalies.

#### GPS Collar Dataset

Obtain the Animal Movements Database Application from the regional GIS drive (X:\GIS\Apps\AnimalMovement\). The Animal Movement application has tools to create a layer (.lyr) file that, when opened in ArcMap, pulls the spatial data from the Animal Movement for display and validation. Consult the Animal Movement help at <https://github.com/regan-sarwas/AnimalMovement/blob/master/Documentation/Documentation.rst> for more information.

#### WRST Caribou Dataset

Spatial data related to capture events and aerial surveys may be viewed in ArcMap through the use of Query Layers (SOP#8). Validate the spatial data in the GIS, the Access database application and the field sheets.

### ***Data verification using DBQualityReport stored procedure***

The WRST\_Caribou database has a stored procedure called DBQualityReport which, when executed, will give an informational summary of database contents. This stored procedure is useful for tracking data entry progress, assessing data quality and isolating problems in the dataset that should be rectified or documented before certification.

#### **Procedure:**

1. Start SQL Server Management Studio (SSMS)
2. Connect to the CAKN SQL Server. Contact the Network data manager for the server name
3. Click the 'New query' button
4. Right click the query panel and select 'Results to' and then 'Results to text'.
5. Execute the two lines below (send the results to text rather than a grid; see SSMS help for details):
  - `USE WRST_Caribou`
  - `EXEC DBQualityReport`
6. The data quality report will appear. Examine the report carefully and correct or document any errors or anomalies.

### ***Data verification using R***

Preliminary data analysis often brings dataset defects to light and can serve as a tool for enhancing data quality. R pulls data from preconfigured database views formatted for easy analysis using the

RODBC package (<https://cran.r-project.org/web/packages/RODBC/index.html>). Standard Operating Procedure #6 describes the analytical process to be used for this monitoring protocol. Execute the procedures in SOP #6 and examine the results for data quality problems. Any anomalies trigger another round of data quality checks.

## Archiving Field Deliverables in IRMA

All products generated by the WRST caribou monitoring program are archived in a series of related references in the IRMA Data Store (Figure9). The master Project reference for the WRST caribou program (upper left in Figure9) is available at <https://irma.nps.gov/DataStore/Reference/Profile/2217176>.

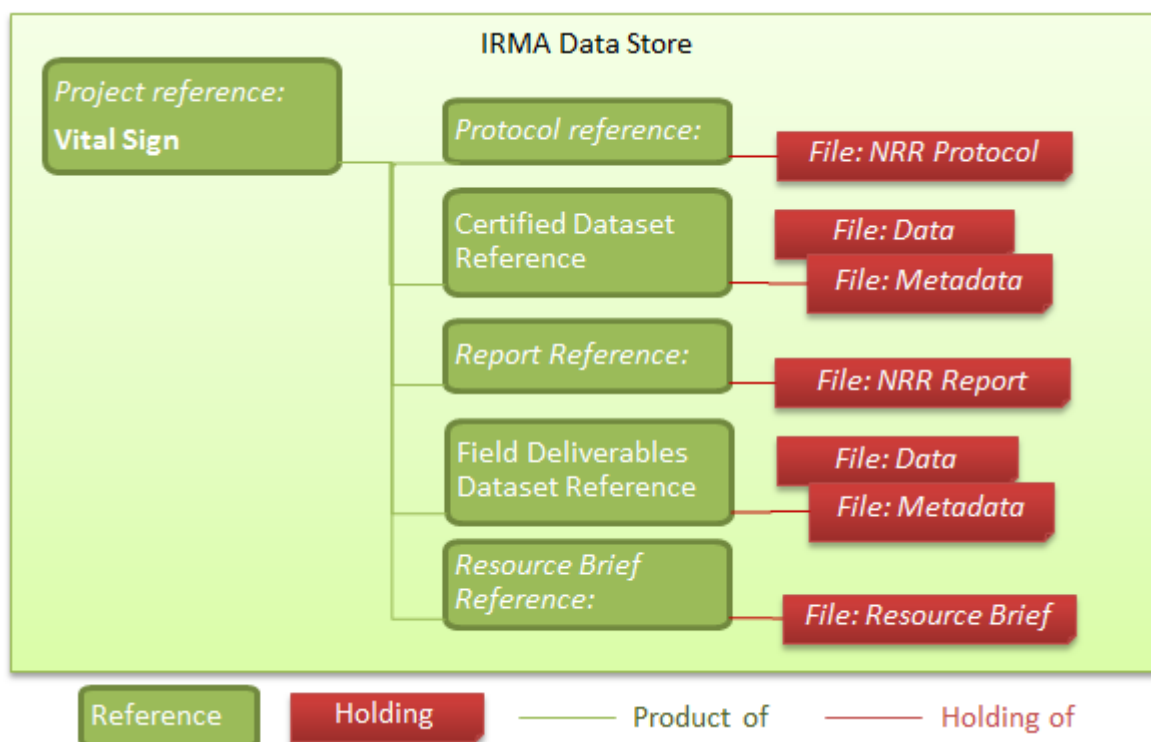


Figure 9. Architecture of WRST caribou monitoring references in the IRMA Data Store.

Products generated by the program are each documented in a reference and uploaded as holdings. Important holding types include the protocol, certified dataset, reports, field data deliverables and resource briefs.

While most references can be created by the project leader easily using the Data Store help files, field data deliverables require more explanation. Field data deliverables consist of such items as completed data forms, GPS waypoints, etc., and are archived in the IRMA Data Store in private Generic Dataset references. Deliverable files are labeled with the deliverable identifier from the deliverables schedule and uploaded as holdings of the field data deliverables Dataset reference.

When the Dataset reference is finished it should be linked as a product of the master WRST Caribou monitoring Project reference.

**Procedure:**

1. Create a new IRMA Dataset Reference and give it an informational title. Example: '2015 Chisana Caribou Herd Population Survey Deliverables'.
2. Fill out as much metadata as possible.
3. **Ensure the Dataset is tagged as 'Sensitive' under the Information Resource Evaluation tab with the justification of 'Commercial Value'.** Also tick the 'Operations' justification. Raw, uncertified data should not be easily available to the public (certified data will be available minus the sensitive data through the main caribou monitoring dataset in IRMA).

**Step 2: Create a Generic Dataset** (Required)

The screenshot shows the 'Information Resource Evaluation' tab in the IRMA system. The 'Sensitivity Evaluation' section is active, with the 'Sensitive' radio button selected. Below this, the text 'If Sensitive, Check 1 or More' is displayed. A grid of checkboxes is shown, with 'Operations' and 'Commercial Value' checked. The other checkboxes are 'Personal Info', 'Archeological', 'Indian Sacred Sites', 'Wells', 'Endangered', 'Threatened', 'Cultural', 'Security', and 'Paleontological'.

| Sensitivity Evaluation                         |                                              |                                     |                                                      |
|------------------------------------------------|----------------------------------------------|-------------------------------------|------------------------------------------------------|
| <input type="radio"/> Non-Sensitive            | <input checked="" type="radio"/> Sensitive   | <input type="radio"/> Unknown       |                                                      |
| If Sensitive, Check 1 or More                  |                                              |                                     |                                                      |
| <input checked="" type="checkbox"/> Operations | <input type="checkbox"/> Archeological       | <input type="checkbox"/> Endangered | <input type="checkbox"/> Security                    |
| <input type="checkbox"/> Personal Info         | <input type="checkbox"/> Indian Sacred Sites | <input type="checkbox"/> Threatened | <input checked="" type="checkbox"/> Commercial Value |
|                                                | <input type="checkbox"/> Wells               | <input type="checkbox"/> Cultural   | <input type="checkbox"/> Paleontological             |

4. Upload the data deliverables from the Deliverables Schedule above, one by one. Tag them with the date and deliverable ID in the filename and especially the holding description. An

example would be 'CPT-01: Caribou capture data sheets'.

Upload New Files

| Name                                        | Status   | Size  | Progress |
|---------------------------------------------|----------|-------|----------|
| CPT-01 2010 Caribou capture data sheets.pdf | Complete | 10 MB | clear    |
| CPT-02 Caribou capture data sheet scans.pdf |          |       |          |
| CPT-03 Caribou capture photographs.zip      |          |       |          |

Total: 1      10 MB of 10 MB

Select Files   Upload   Clear All Rows

---

1 File Uploaded

File Name: CPT-01 2010 Caribou capture data sheets.pdf

Description: CPT-01 2010 Caribou capture data sheets

5. Remove all permissions except for the PI and data manager (to reduce the risk of accidental publication of sensitive data).
6. Activate the reference.
7. Attach the finished reference to the main Dall's Caribou monitoring project reference using a 'product-of' relationship. Consult the IRMA help for information.

Your finished reference should be well documented, marked internal, active and sensitive and have a list of holdings that matches the list of data deliverables (Figure9). If archival is done well then the next step, annual closeout, will be little more than a glance at this reference to see that it is complete.

**Data Store**  
Integrated Resource Management Applications  
Part of IRMA

Home ▾ Search ▾ Reports Create ▾ My Content ▾ UPOC ▾

## Geospatial Dataset - (Code: 2224468)

**Title**
2013 Itkillik Sheep Survey Data Deliverables, Gates of the Arctic National Park

**Description**
Deliverables from the Arctic Network 2013 Itkillik Sheep Survey in Gates of the

**Full Citation**
Rattenbury KL. 2015. 2013 Itkillik Sheep Survey Data Deliverables, Gates of the Arctic National Park Inventory and Monitoring Program. Itkillik Preserve, Gates of the Arctic National Park

**Visibility**
Internal

| Files and Links (6) |               |                                                                             |                                                    |
|---------------------|---------------|-----------------------------------------------------------------------------|----------------------------------------------------|
|                     | Type          | Download Link                                                               | Description                                        |
| ?                   | Digital File  | NPS.gdb.zip                                                                 | DS01: NPS.gdb (Geodatabase, compressed)            |
| ?                   | Digital File  | NPS.gdbSQLInsertScripts.zip                                                 | DS01: NPS.gdb data converted to SQL Insert Scripts |
| ?                   | Digital File  | Itkillik2013_datasheets.pdf                                                 | DS08: Scanned field data collection sheets         |
| ?                   | Digital File  | 2013ItkillikSheepSurveyWaypoints.zip                                        | DS05: Survey waypoints (.shp, 20kb)                |
| ?                   | Digital File  | 2013ItkillikSheepSurveyTracklogs.zip                                        | DS06: Survey tracklogs (.shp, 1.9Mb)               |
| ?                   | External Link | <a href="https://science.nature.nps.gov">https://science.nature.nps.gov</a> | DS07: Survey photographs are available             |

Figure 10. Example of a data deliverables Dataset reference in the IRMA Data Store.

This example is from the Arctic Network sheep monitoring program but WRST caribou will be similar. The red rectangles in the screenshot show that the Dataset reference has an informative title, is tagged Internal and all of the data deliverables from the protocol's deliverables schedule have been uploaded and identified. Having deliverables organized and documented in one place simplifies annual closeout and data certification procedures and ensures the informational longevity of the data.

### Seasonal Close Out and Dataset Certification

Dataset certification is the part of the data processing life cycle where the project leader formally signifies that portions of the master dataset are fully processed, validated, documented and ready for analysis and publication.

Data are certified by entering a name and a date to certain database fields. Once the fields are filled in database triggers disallow further edits to those records and any related records. Releasable portions of certified records may then be extracted and published to the Certified Dataset reference in the IRMA Data Store.

Data certification is a benchmark in the monitoring project data life cycle that indicates that: a) the data are complete for the period of record; b) they have undergone and passed the quality assurance checks; and c) that they are appropriately documented and in a condition for archiving, posting and distribution as appropriate.

Seasonal close out is the best time to bring SOPs up to date and version their IRMA references if new data management tools or methods have been developed.

**Procedure:**

1. Verify protocol and SOPs are up to date and versioned in IRMA.
2. Verify QA/QC procedures have been run.
3. Verify field data deliverables (Appendix I) are documented and archived in IRMA Data Store with metadata.
4. Verify the information contained within the certified portion of the Animal\_Movement database.
5. Verify the information contained within the certified portion of the WRST\_Caribou database.
6. Ensure the certified Dataset reference in the IRMA Data Store is publicly available and informationally complete as possible.
7. The project leader authorizes the data manager to create deliverable WC-01 (Appendix I), representing the releasable, certified portions of the caribou monitoring databases.
8. The project leader authorizes the data manager to upload the releasable portions of the databases to the certified Dataset reference and advances the current version.



# Standard Operating Procedure (SOP) # 7 Data Analysis and Reporting

Version 1.0 (December 2004)

## Revision History Log:

| Previous Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
|--------------------|---------------|--------|--------------|-------------------|---------------|
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |

This Standard Operating Procedure (SOP) explains the procedures for estimating caribou herd size and composition and other population parameters, and procedures for reporting caribou monitoring data.

## Herd Size Estimate

### *Sightability Model*

A sightability model approach will be used to estimate the herd size. A caribou group is the basic unit for analysis and the probability of observing a marked (containing at least one radiocollared animal) group is modeled as a function of covariates. The statistical methods are described for use with the statistical freeware R (version 3.4.2) and the R Sightability Model Package (version 1.3, Fieberg 2014). R is a combination of a statistics package and a programming language and can be downloaded for free from <http://www.r-project.org/>. Several books have been published that demonstrate how to download, install and use R (Zuur et.al. 2009, Crawley 2012).

The SightabilityModel package implements a logistic regression sightability abundance estimator (Steinhorst and Samuel 1989) via the Sight.Est function. The package assumes that a set of sightability trials are performed using radiocollared animals and the resulting logistic regression model is applied to future operational surveys (herd size estimate) in which the same covariates, used to model detection probabilities from the trail data, are collected. Because radiocollared animals are maintained in the herd(s), the sightability trial data will be collected during the operational survey. The covariates are group size and survey crew. A model selection approach will be used, in which multiple models with different combinations of covariates are compared using AICc (small sample correction) values (Burnham and Anderson 2010). The four candidate sightability models are 1) the null model (intercept-only with no covariates); 2) Group size; 3) Survey crew; and 4) Group size \* Survey crew. The model with the lowest AICc value will be chosen.

### ***Formatting the Data***

The Sight.Est function requires 3 files; a sightability trial data frame (sdat), an operational survey data frame (odat), and a sampling information data frame (sampinfo). The Sight.Est function fits a logistic regression model to the sightability data frame (sdat) and applies the model to data from the operational survey (odat) to estimate population abundance.

In the sightability data frame (sdat), each row represents an independent sightability trial, and columns contain the response (a binary random variable = 1 if the animal was observed and 0 if not observed) and the covariates group size (Grp\_Size) and survey crew (Crew) used to model detection probabilities. As stated above, this data is collected during the operational survey and includes only groups containing a radiocollared animal within the survey area that was either observed by the survey crew or not observed by the survey crew during the survey.

| Observed | Grp_Size | Crew |
|----------|----------|------|
| 1        | 17       | 1    |
| 1        | 14       | 1    |
| 1        | 4        | 1    |
| 1        | 7        | 1    |
| 1        | 48       | 1    |
| 1        | 9        | 1    |
| 1        | 9        | 1    |
| 1        | 44       | 1    |
| 1        | 51       | 1    |
| 1        | 10       | 1    |
| 1        | 58       | 1    |
| 1        | 10       | 1    |
| 1        | 5        | 1    |
| 1        | 18       | 2    |
| 1        | 20       | 2    |
| 1        | 15       | 2    |
| 1        | 26       | 2    |
| 1        | 28       | 2    |
| 1        | 9        | 2    |
| 1        | 15       | 2    |
| 1        | 17       | 2    |
| 1        | 12       | 2    |
| 0        | 9        | 1    |
| 0        | 6        | 1    |
| 0        | 23       | 2    |
| 0        | 8        | 2    |
| 0        | 6        | 2    |
| 0        | 20       | 2    |

In the observational survey data frame (odat), each record corresponds to an independently sighted group of caribou with covariates for potential inclusion in the detection model. Columns contain the

plot level information (stratum, subunit), and the total number of caribou (total) observed in each independently sighted group along with the same covariates used to model detection probabilities. The variable total is redundant with Grp\_Size which is included to allow one to model detection probabilities as a function of group size. The Chisana and Mentasta caribou survey areas are not stratified and does not contain subunits, therefore the stratum and subunit variables will take on the single value '1'.

| stratum | subunit | total | Grp_Size | Crew |
|---------|---------|-------|----------|------|
| 1       | 1       | 17    | 17       | 1    |
| 1       | 1       | 14    | 14       | 1    |
| 1       | 1       | 4     | 4        | 1    |
| 1       | 1       | 7     | 7        | 1    |
| 1       | 1       | 48    | 48       | 1    |
| 1       | 1       | 9     | 9        | 1    |
| 1       | 1       | 9     | 9        | 1    |
| 1       | 1       | 18    | 18       | 1    |
| 1       | 1       | 4     | 4        | 1    |
| 1       | 1       | 9     | 9        | 1    |
| 1       | 1       | 44    | 44       | 1    |
| 1       | 1       | 51    | 51       | 1    |
| 1       | 1       | 4     | 4        | 1    |
| 1       | 1       | 5     | 5        | 1    |
| 1       | 1       | 10    | 10       | 1    |
| 1       | 1       | 3     | 3        | 1    |
| 1       | 1       | 58    | 58       | 1    |
| 1       | 1       | 5     | 5        | 1    |
| 1       | 1       | 10    | 10       | 1    |
| 1       | 1       | 5     | 5        | 1    |
| 1       | 1       | 1     | 1        | 1    |
| 1       | 1       | 1     | 1        | 1    |
| 1       | 1       | 1     | 1        | 1    |
| 1       | 1       | 6     | 6        | 1    |
| 1       | 1       | 18    | 18       | 2    |
| 1       | 1       | 20    | 20       | 2    |
| 1       | 1       | 3     | 3        | 2    |
| 1       | 1       | 12    | 12       | 2    |
| 1       | 1       | 2     | 2        | 2    |
| 1       | 1       | 15    | 15       | 2    |
| 1       | 1       | 26    | 26       | 2    |
| 1       | 1       | 28    | 28       | 2    |
| 1       | 1       | 9     | 9        | 2    |
| 1       | 1       | 2     | 2        | 2    |
| 1       | 1       | 15    | 15       | 2    |
| 1       | 1       | 17    | 17       | 2    |
| 1       | 1       | 4     | 4        | 2    |
| 1       | 1       | 5     | 5        | 2    |
| 1       | 1       | 12    | 12       | 2    |

The sampling information data frame (sampinfo) contains the sampling information pertaining to the observational survey and includes the variables stratum, nh (number of sampled units in stratum h),

and Nh (number of population units in stratum h). This data frame will contain a single record for the non-stratified survey design.

| stratum | nh | Nh |
|---------|----|----|
| 1       | 1  | 1  |

### **R Code**

The Sight.Est function is used both to fit a specified logistic regression model and estimate population abundance in a single step. Examples of R code to fit the various candidate sightability models are as follows.

```
# Any text after the # symbol isn't formally used by R, it is used to annotate any codes.

# First thing to do is load the 'SightabilityModel' package and 'Rcmdr' package

# If you use R Commander to load the data, you have to load the Sightability dataset (Resight Data
10 October.csv), the Observation dataset (Observation Data_Oct10.csv),

# and the survey information dataset (Survey Info_Oct10.csv)

# To import these files select Data -> Import Data -> from textfile, clipboard or URL. This will then
pull up a menu to let you select the file you want, from wherever you have saved it.

# When you import a data file you can call it whatever you like. I have used: sdat=Resight
Data_Nov2.csv; odat=Observation Data_Oct10.csv; and sampinfo=Survey Info_Oct10.csv

# The "form" item essentially tells R what logistic regression model to use. For example, if you ran:
"glm(Observed~Grp_Size, data=sdat, family=binomial)"

# you would get the exact same coefficients as when using the Sight.Est function.

#Code to fit a sightability model using group size as a covariate

fit.group_size<-Sight.Est(form=Observed~Grp_Size, sdat=sdat, odat=odat, sampinfo=sampinfo,
method="Wong", logCI=T, alpha=0.1, Vm.boot=T, nboot=1000)

fit.group_size #Provides the results from the model fitting

#Code to fit a sightability model having a constant sightability

fit.constant<-Sight.Est(form=Observed~1, sdat=sdat, odat=odat, sampinfo=sampinfo,
method="Wong", logCI=T, alpha=0.1, Vm.boot=T, nboot=1000)

fit.constant #Provides the results
```

#The AICc for the constant model is lower than for the Group Size model so I chose the constant model as most supported.

# Sight.Est doesn't calculate AICc (the small sample correction for AIC), I did that myself.

#To get the actual sightability correction factor use the following codes

```
fit.glm<-glm(Observed~1, data=sdat, family=binomial()) #This fits the sightability model
```

```
theta.SS<-1+exp(-coef(fit.glm)-summary(fit.glm)$cov.unscaled/2) #This gives you the sightability correction factor (theta)
```

```
theta.SS # Provides the actual number
```

### ***Marked caribou outside the survey area***

To account for radiocollared caribou located outside the survey area, the within-survey area population estimate will be adjusted by the proportion of all radiocollared caribou located in the survey area relative to the total number of collars in the herd as described by Adams and Roffler (2007). For example, if 3 of a possible 96 collars are located outside of the survey area, the within-survey area population estimate will be inflated by 3.1 %.

### ***Mentasta Caribou Herd***

As with the Chisana Caribou Herd, the sightability model approach will be used to estimate the Mentasta Caribou Herd size. However, the Mentasta Caribou Herd estimate is based on a postcalving (late June) census and a fall sex and age composition survey. The analysis may be complicated by low June caribou numbers and incursion of bulls from the neighboring Nelchina Caribou Herd during the fall composition survey. The basic approach will be to estimate the number of cows during the June census and add bulls and calves to the estimate based on the fall bull:cow and calf:cow ratios.

The first step is to estimate the number of adult caribou during the June census using the sightability model approach. Because radiocollared animals are maintained in the Mentasta herd, the sightability trial data will be collected during the operational survey. However, due to the small size of the herd, sightability data from previous surveys to estimate herd size will also be used along with the current year operational survey data to determine detection probabilities.

The second step is to subtract the estimated number of bulls from the estimated adult caribou. Caribou are classified from a fixed-wing aircraft during the June census, thus only obvious bulls (medium and large) are recorded as bulls while small bulls present are recorded as 'cows' because they are indistinguishable from cows when observed from a fixed-wing aircraft. Small bulls are estimated in proportion to the larger (medium and large) based on the subsequent fall composition survey.

The third step is to adjust the cow estimate in the survey area to account for radiocollared groups located outside the survey area. The within-survey area cow estimate will be adjusted by the proportion of all radiocollared caribou located in the survey area relative to the total number of

collars in the herd as described by Adams and Roffler (2007). For example, if 3 of a possible 31 collars are located outside of the survey area, the within-survey area cow estimate will be inflated by 9.6 %.

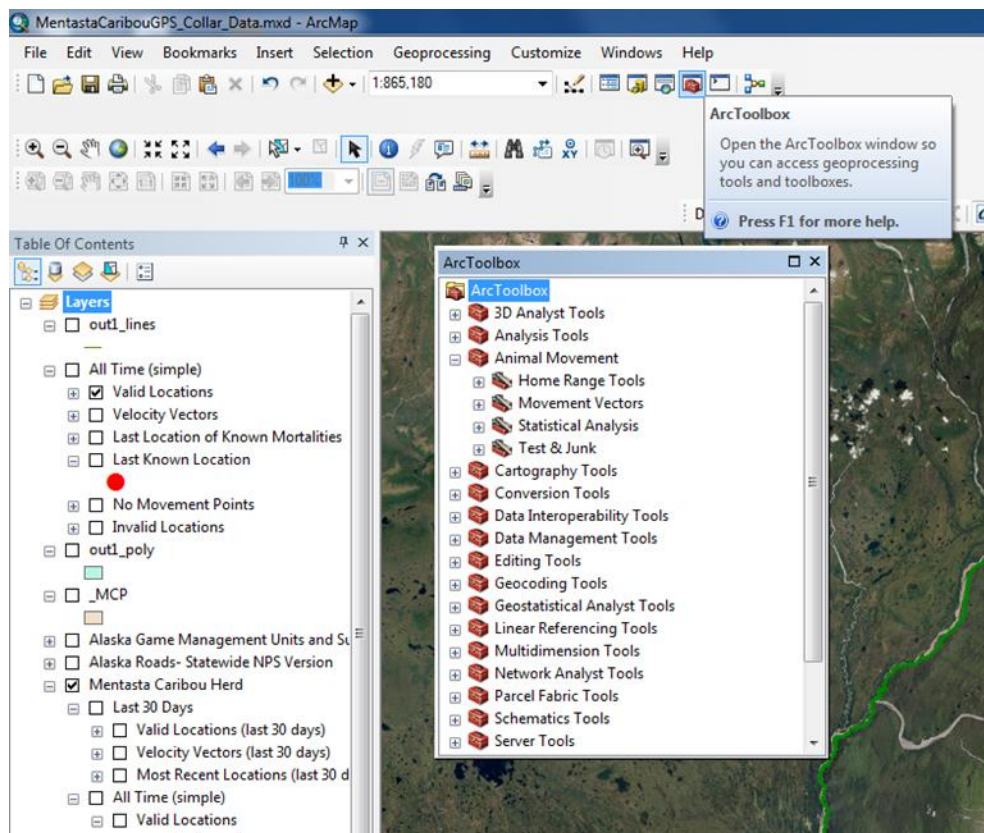
Finally, the fall calf:cow and bull:cow ratios will be used to derive a fall population estimate. For example if the fall calf:cow ratio is 22 calves per 100 cows, and the June cow estimate is 300, the number of calves in the fall population will be 66 ( $300 \times .22$ ). Due to the current incursion of Nelchina caribou bulls into the fall Mentasta range, observed bull:cow ratios in recent years are not biologically realistic given the years of low recruitment in the Mentasta Caribou Herd. A suggested solution is to use an estimate of 30 bulls:100 cows. The number of fall calves and bulls are then added to the June cow estimate.

### **Sex and Age Composition**

Sex and age ratios are expressed as the number of calves per 100 cows and the number of bulls per 100 cows. The number of calves (or bulls) is multiplied by 100 and then divided by the number of cows observed during the count. For example, if 359 cows and 59 calves were observed, the calf:cow ratio would be calculated as:  $(59 \times 100) \div 359 = 16.4$  calves per 100 cows. If 359 cows and 135 bulls were observed, the bull:cow ratio would be calculated as:  $(135 \times 100) \div 359 = 37.6$  bulls per 100 cows.

### **Radiotracking and GPS Radiocollar Data**

Display and analysis of radiotracking and GPS radiocollar data is demonstrated in SOP 8. A quick guide document can be developed for home range analysis the AnimalMovement toolbox in ArcMap.



## Reporting of Caribou Monitoring Data

Reports generated by the caribou monitoring effort, and the vital signs monitoring program in general, will be designed to be promptly produced, appropriate to their target audience, widely available, and visually accessible. Concise summaries will be a part of each report produced. Reports will conform to guidelines set by the CAKN and the Alaska Region Inventory and Monitoring Plan. Graphical methods, maps, and other visual aids will be used to make results readily understood.

2. Annual administrative report and workplan. This report is designed to be incorporated into the annual Report to Congress on the nationwide Vital Signs Monitoring Program. It will be produced in the fall of each year. The report will account for the expenditure of funds and FTEs, and describe the objectives, tasks, accomplishments, and products of the monitoring effort during the previous fiscal year. The report is designed to improve communication within each park, the CAKN, the Alaska Region, and the National Monitoring Program. Its intended audience includes park superintendents, network staff, regional coordinators, and Servicewide program managers. The report will be written by the park biologist implementing the Caribou Monitoring Protocol, and reviewed and approved by CAKN, Regional Office and Servicewide Program managers.

3. Annual report. A report will be prepared for publication each March, reporting the results of caribou monitoring efforts the previous calendar year. The annual report will be formatted according

to the usual resource report series template for natural resource data series (NRDS) reports with instructions located at <http://www.nature.nps.gov/publications/NRPM/index.cfm>.

The annual report will provide a summary of all caribou monitoring activities and data for the year, and describe the current condition of the caribou herds monitored. The report will also identify any data quality concerns and/or deviations from protocols that affect data quality and interpretation, and identify suggested or required changes to the protocol. Any changes in monitoring protocols will be documented. The intended audience for the annual report includes park resource managers, network staff, and external scientists. The report will be written by the park biologist implementing the Caribou Monitoring Protocol, and peer-reviewed within the CAKN.

Annual reports should present the dates, number of hours flown, and conditions for all tracking flights, composition counts, and population estimates. Other parameters to report include the number of caribou groups seen, the number of caribou classified, the number of calves, cows, and small, medium, and large bulls, the number of calves and bulls per 100 cows, and percent calves and bulls in the herd. For population estimates, report the number of radiocollared caribou in the herd and in the survey area, number of marked groups in the herd and in the survey area, and the number of marked groups and total number of caribou in the survey area observed by the survey crews. Distribution data from radiotracking flights and results of home range analysis will be displayed using ArcMap.

4. Other reporting. In addition to the two scheduled annual reports, results of the caribou monitoring effort will be presented at the biennial CAKN Vital Signs Monitoring Conference, and at other symposia, conferences, and workshops. Caribou monitoring data will be provided to park interpretive staff for written and oral presentation to visitors. Significant findings will be reported in scientific journals and popular publications.

# Standard Operating Procedure (SOP) #8 Viewing Data Using ArcGIS

Version 1.0 (June, 2016)

## Revision History Log:

| Previous Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
|--------------------|---------------|--------|--------------|-------------------|---------------|
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |

## Overview

Spatial analyses and data quality assurance procedures are done using GIS software, typically ArcGIS. This SOP describes how to connect ArcGIS 10.3 to the WRST\_Caribou SQL Server database.

## Prerequisites

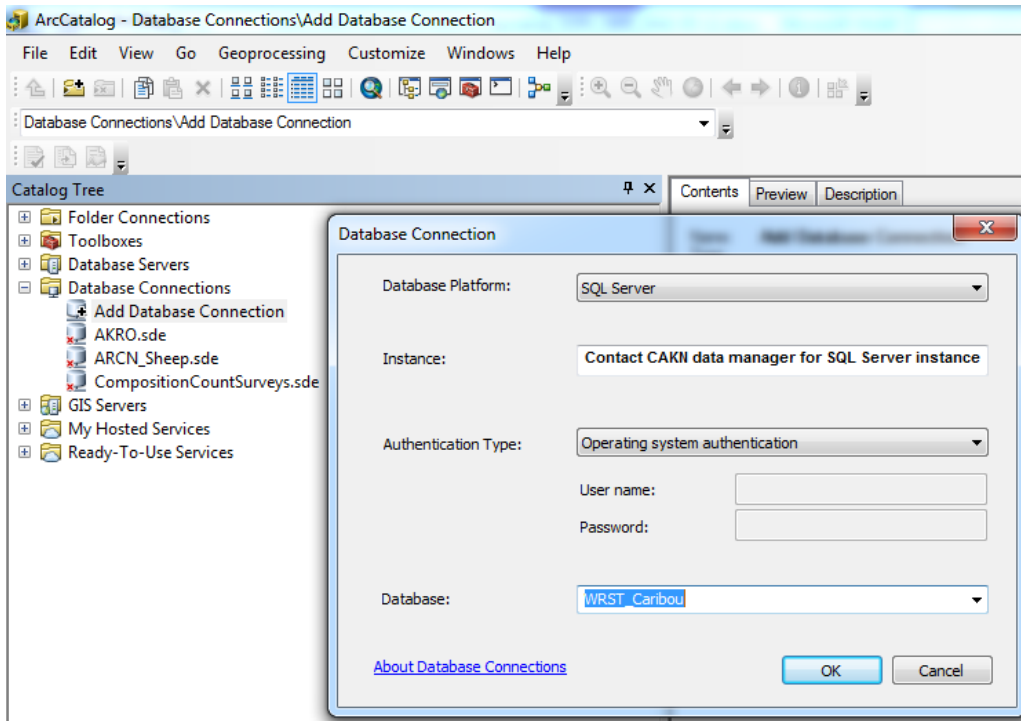
ArcGIS 10.3, *datareader* privileges on the WRST\_Caribou SQL Server database.

## Viewing capture and aerial survey data

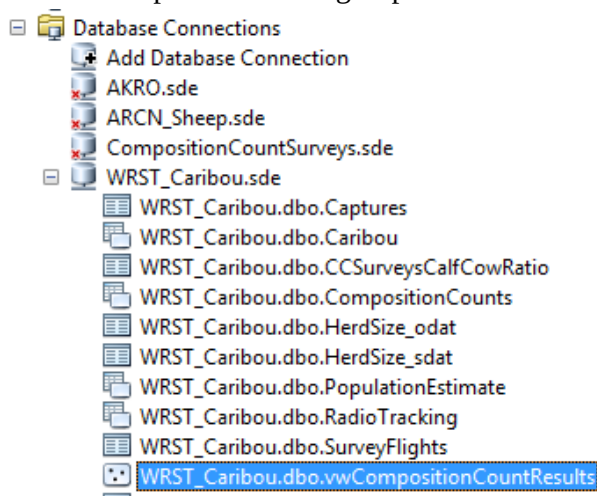
### Procedure:

1. Start ArcCatalog
2. Navigate to Database Connections in the Catalog Tree
3. Click Add Database Connection

4. The Database Connection dialog appears:

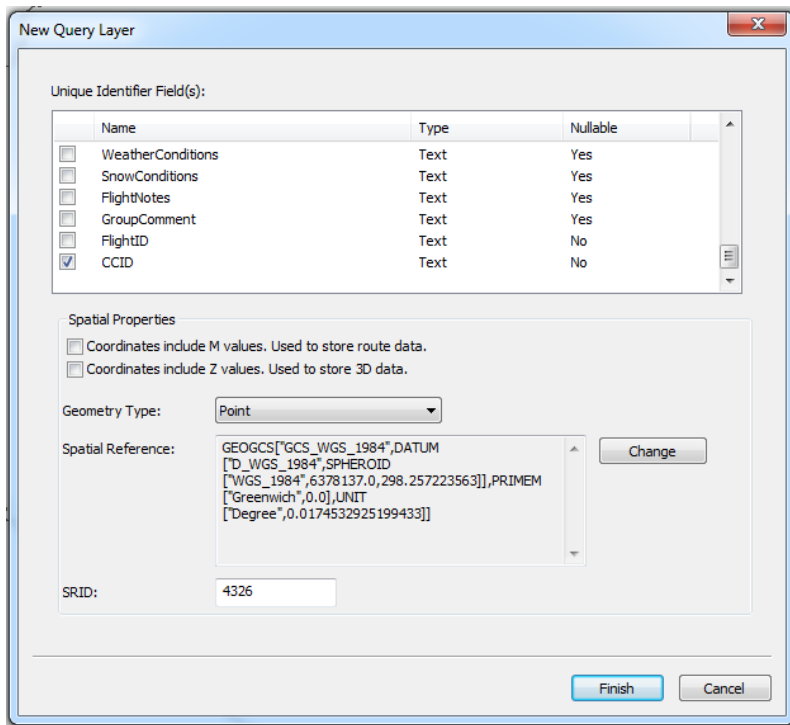


5. Enter the following into the dialog:
- Database Platform: SQL Server
  - Instance: Contact the CAKN data manager for the SQL Server instance
  - Authentication type: Operating system authentication
6. Click OK
7. Rename the database instance in ArcCatalog to something more informative
8. Right-click the Database Connection and select Connect
9. A list of tables and views appears. Views are prefixed by 'vw' and will be most useful for quality assurance and spatial data analysis. The screenshot below shows spatial locations and attributes of caribou composition count groups:



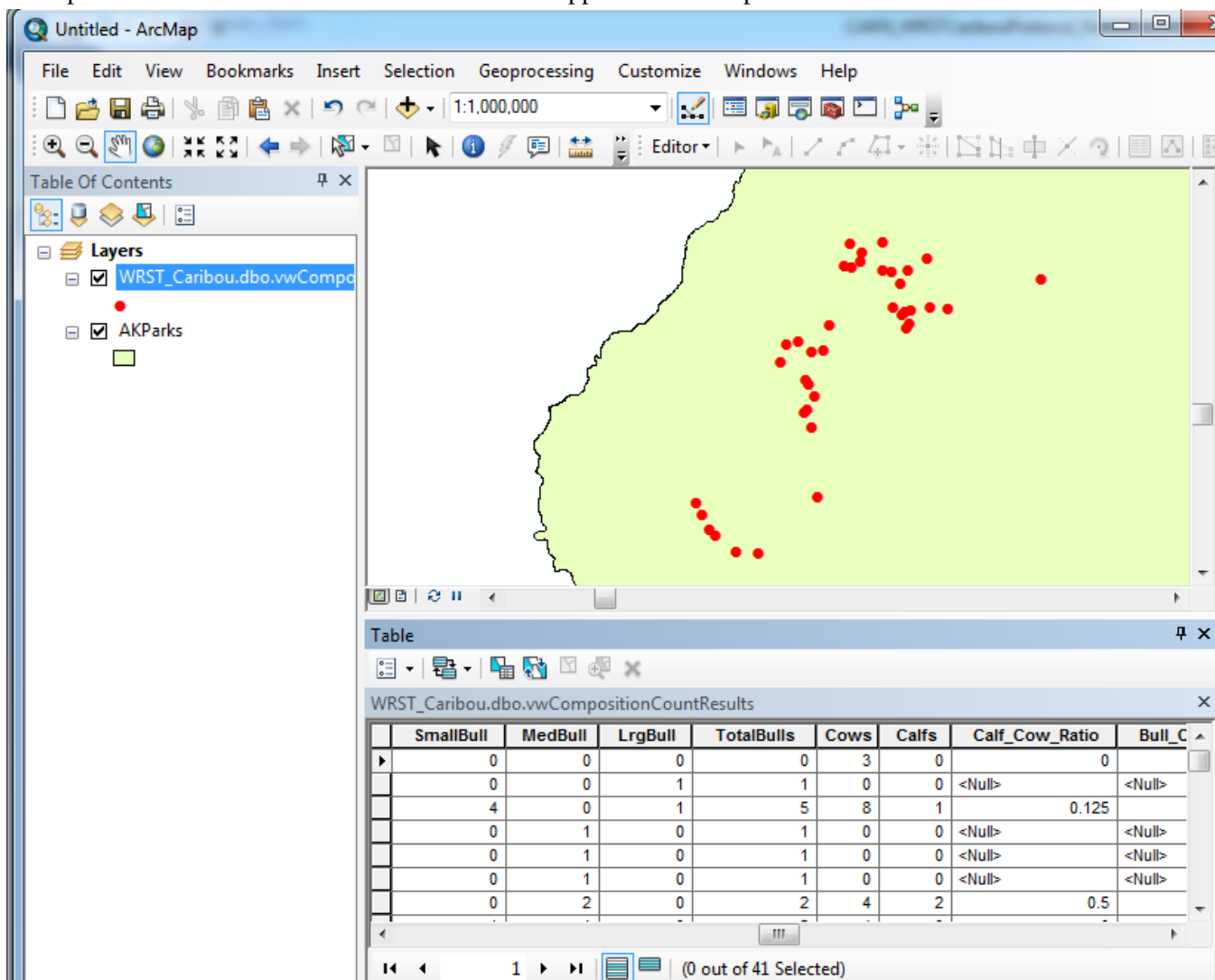
- 10.

11. ArcMap may require you to choose a unique ID for each record in the view. If you are unsure which column is unique contact the CAKN data manager.



12. Click Finish
13. Drag a view from the WRST\_Caribou Database Connection into ArcMap.
14. Optional: Save the Database Connection as a Layer file for easy re-use.

15. The spatial data and attributes in the view should appear in ArcMap:

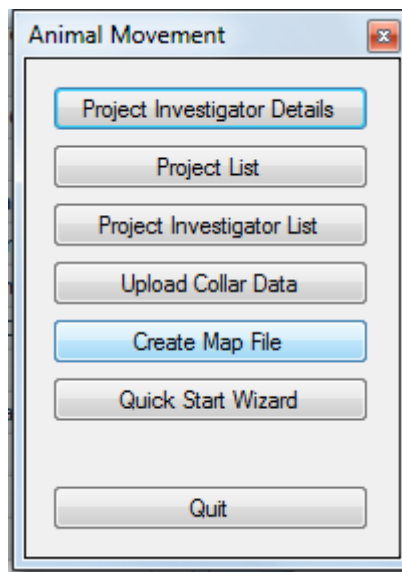


### Viewing GPS collar data

GPS collar data is managed by the Alaska regional GIS team through their Animal Movement database and tool. Documentation is available at <https://github.com/regan-sarwas/AnimalMovement/blob/master/Documentation/Documentation.rst>. The Animal Movement tool is available on the regional X drive.

### Procedure

1. Open the Animal Movement database tool



2. Click the Create Map File button

3. Constrain the data by project, species, animal and time frame as needed using the tools on the Create Map File form

Database: AKRO

Filter By

☒ Projects

- ☐ ARCN Muskox
- ☐ Denali Bear
- ☐ Denali Coyote
- ☐ Denali Wolf
- ☐ GAAR Bear
- ☐ GAAR Moose
- ☐ Katmai Brown Bear Changing Tides
- ☐ Lake Clark Brown Bear
- ☐ Lake Clark Sheep
- ☐ Lake Clark Wolf
- ☐ Western Arctic Caribou
- ☒ Mentasta Caribou Herd
- ☐ Yukon Charley Wolf

☒ Species

- ☐ Bear
- ☒ Caribou
- ☐ Coyote
- ☐ Moose
- ☐ Muskox
- ☐ Sheep
- ☐ Wolf

☐ Animals

- ☐ ARCN Muskox/09019
- ☐ ARCN Muskox/09020
- ☐ ARCN Muskox/09022
- ☐ ARCN Muskox/09024
- ☐ ARCN Muskox/09025
- ☐ ARCN Muskox/09027
- ☐ ARCN Muskox/09028
- ☐ ARCN Muskox/09029
- ☐ ARCN Muskox/09031
- ☐ ARCN Muskox/09032
- ☐ ARCN Muskox/09033
- ☐ ARCN Muskox/09034
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- ☐ ARCN Muskox/09037
- ☐ ARCN Muskox/09038
- ☐ ARCN Muskox/10039
- ☐ ARCN Muskox/10041
- ☐ ARCN Muskox/10044
- ☐ ARCN Muskox/10055
- ☐ ARCN Muskox/10085
- ☐ ARCN Muskox/10089
- ☐ ARCN Muskox/11102

All Clear All Clear All Clear

☐ Dates

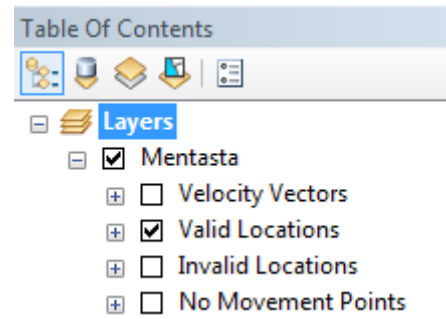
Start Date: 2016-02-15 00:00 ☐ Use Earliest

End Date: 2017-02-14 00:00 ☐ Use Latest

Generate

4. Click Generate
5. Save the resulting layer file to the directory of your choice
6. The tool will generate a layer file that you may drag into ArcMap.

7. The layer file configures ArcMap to pull four data formats including Velocity Vectors, Valid



Locations, Invalid Locations and No Movement Points.

# Standard Operating Procedure (SOP) # 9 Revising the Protocol

Version 1.0 (December 2004)

## Revision History Log:

| Previous Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
|--------------------|---------------|--------|--------------|-------------------|---------------|
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |
|                    |               |        |              |                   |               |

## Overview

This Standard Operating Procedure (SOP) explains how to make changes to the WRST Caribou Monitoring Protocol for the CAKN, and to the accompanying SOPs, and how to track these changes. Observers asked to edit the Protocol text or any one of the SOPs need to follow this outlined procedure in order to eliminate confusion in how data is collected and analyzed. All observers should be familiar with this SOP in order to identify and use the most current methodologies.

## Procedures

The WRST Caribou Monitoring Protocol narrative for the CAKN and accompanying SOPs have attempted to incorporate sound methodologies for collecting and analyzing caribou population data. However, all protocols, regardless of how sound, require editing as new and different information becomes available. Required edits should be made in a timely manner and appropriate reviews undertaken.

All edits require review for clarity and technical soundness. Small changes or additions to existing methods will be reviewed in-house by CAKN staff. However, if a complete change in methods is sought, than an outside review is required. NPS regional and national staff with familiarity in large mammal research and data analysis will be utilized as reviewers. Also, experts in caribou research and statistical methodologies outside of the NPS will be utilized in the review process.

Document edits and protocol versioning in the Revision History Log that accompanies the WRST Caribou Monitoring Protocol text and each SOP. Log changes in the section being edited only. Version numbers increase incrementally by hundredths (e.g. version 1.01, version 1.02, ...) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0 ...). Record the previous version number, the date of revision, and the author of the revision. Identify paragraphs and pages where changes are made, and the reason for making the changes along with the new version number.

Inform the Data Manager about changes to the WRST Caribou Monitoring Protocol or SOP so the new version number can be incorporated in the Metadata of the project database. The database may have to be edited by the Data Manager to accompany changes in the Protocol or SOPs. Post new versions on the internet and forward copies to all individuals with a previous version of the affected Protocol Narrative or SOP.



## Appendix A: Recommended Equipment List

| Item                                                                                       | WRST<br>Inventory |
|--------------------------------------------------------------------------------------------|-------------------|
| <b>Radiotelemetry</b>                                                                      |                   |
| Telemetry Receiver, ATS Model R4000 (4 Megahertz frequency range)                          | Y                 |
| Aircraft tracking antenna, RA-2A (Telonics) (pair)                                         | Y                 |
| Aircraft antenna brackets, TAB-3 (Telonics) (pair)                                         | Y                 |
| RW-3-17 coaxial antenna cables, 17 foot (Telonics) (pair)                                  | Y                 |
| RW-2 coaxial cable (to attach switchbox to receiver) (Telonics)                            | Y                 |
| Antenna switchbox (TAC-2, Telonics)                                                        | Y                 |
| 3-element folding handheld antenna (Telonics)                                              | Y                 |
| <b>Caribou Capture</b>                                                                     |                   |
| Radiocollars, GPS/ARGOS (Telonics) TGW-4680                                                | Y                 |
| Radiocollars, VHF (Telonics) MOD-600                                                       | Y                 |
| CR-2A collar release mechanism                                                             |                   |
| Shooting harness for helicopter                                                            | Y                 |
| Palmer Cap-Chur CO2 Short Range Projector                                                  | Y                 |
| Palmer Cap-Chur Extra Long Range Projector                                                 | Y                 |
| Extra Long Range blank adapters                                                            | Y                 |
| CO2 gas cartridges (4) for projector                                                       | Y                 |
| Cap-Chur charges 1cc-3cc (50) – expire after 1 year                                        |                   |
| Cap-Chur power loads- Brown (extra low velocity) Powder Charges (50) - expire after 1 year |                   |
| Cap-Chur Syringe- 3 cc with 3/4 inch barbed needle with tail                               | Y                 |
| Plunger lubricant                                                                          | Y                 |
| Positioning rod for dart assembly and disassembly                                          | Y                 |
| Syringe brush                                                                              | Y                 |
| Nut driver for collar bolts                                                                | Y                 |
| Sheet metal shears for cutting collars                                                     | Y                 |
| Calipers (metric vernier, stainless or plastic)                                            | Y                 |
| Tape measure (inches and centimeters)                                                      | Y                 |
| Plastic tackle box for capture equipment                                                   | Y                 |
| Scale, 300 kg capacity, 1 kg accuracy                                                      | Y                 |

| Item                                                                            | WRST<br>Inventory |
|---------------------------------------------------------------------------------|-------------------|
| Net and carabineers for weighing                                                | Y                 |
| Blindfold                                                                       | Y                 |
| Backpack for capture gear                                                       | Y                 |
| Small sharps container                                                          | Y                 |
| Digital and/or analog fever thermometer                                         | Y                 |
| 18 gauge needles, (green) Luer-Lock, 1 inch length, package of 100              | Y                 |
| 20 gauge needles, (pink), Luer-Lok, 1 inch length, package of 100               | Y                 |
| 1 ml Syringe with permanently attached needle, package of 100                   | Y                 |
| 3 cc Luer Lock Syringes, package of 100                                         | Y                 |
| 6 cc Luer Lock Syringes                                                         | Y                 |
| Vacutainer® serum separation tubes (red/gray tops), 9.5 ml draw, package of 100 | Y                 |
| Empty vacutainer tubes, (red tops)10 ml draw, package of 100                    | Y                 |
| EDTA blood collection tubes (purple top), 3 ml draw, package of 100             | Y                 |
| NUNC™ CryoTube® Vials, 2 ml, self standing, screw top, model 375418 (450 pack)  | Y                 |
| Flo-Cillin, 100 ml vial                                                         |                   |
| Sterile Water, 30 ml vial                                                       |                   |
| Nolvasan antibiotic ointment, 7 oz jar                                          |                   |
| Nitrofurazone antibiotic spray, 7 oz spray bottle                               |                   |
| Centrifuge                                                                      | Y                 |
| Small manila envelopes                                                          | Y                 |
| Surgical gloves                                                                 | Y                 |
| Disinfectant wipes                                                              |                   |
| <b>Other</b>                                                                    |                   |
| Clipboards, pencils, etc.                                                       | Y                 |
| GPS                                                                             | Y                 |
| Satellite Phone                                                                 | Y                 |
| Kennedy Cell Cet                                                                | Y                 |
| Hand held park radio                                                            | Y                 |
| Hand held aviation radio                                                        | Y                 |

## **Appendix B: Recommended Equipment and Supply Vendors**

### **Telemetry Equipment:**

Telonics, Inc.  
932 E. Impala Ave.  
Mesa, AZ 85204-6699  
(602) 892-4444  
[www.telonics.com](http://www.telonics.com)

Advanced Telemetry Systems  
470 First Avenue North  
Box 398  
Isanti, MN 55040  
(763) 444-9267  
[www.atstrack.com](http://www.atstrack.com)

### **Capture Equipment:**

Nasco – Modesto  
4825 Stoddard Road  
P.O. Box 3837  
Modesto, CA 95352  
(800) 558-595  
[www.enasco.com](http://www.enasco.com)

Palmer Cap-Chur Equipment, Inc.  
421 Tidwell Rd  
Powder Springs, GA 30127  
(770) 942-4395

### **Capture Drugs:**

ZooPharm, Inc.  
1230 W. Ash Street, Suite D  
Windsor, CO 80550  
(970) 795-0920  
[www.zoopharm.net](http://www.zoopharm.net)

### **Syringes, Medical Supplies:**

Alaska Scientific  
664 East Dowling Road  
Anchorage, AK 99518  
(907) 563-2758  
[www.alaskascientific.net](http://www.alaskascientific.net)

**Aviation Personal Protective Equipment:**

Gibson & Barnes

1675 Pioneer Way

El Cajon, CA 92020

(800) 440-5904

[www.flightsuits.com](http://www.flightsuits.com)

## Appendix C: Radio Collar Specifications

### VHF (Telonics) MOD-600 (NH)

Collar adjustment range: 14-26", centered on 18"

MS6A Mortality Sensor (4 HRS), 80 bpm

CLM Collar with CAST-2 Protective Casting

Cold temperature tested

### GPS/ARGOS (Telonics) TGW-4680

90 sec rep rate, 32 bytes.

GPS: 4 locations per day (every 5 hours)

ARGOS: 6-hour on times every 6 days @ 1800 UTC

VHF: October 1 – April 30; On 8 hours beginning @1700 UTC (8am - 4 pm AST or 9am - 5pm ADT), May 1 – September 30; On 12 hours beginning at 1600 UTC (7am – 7pm AST or 8am – 8pm ADT)

Collar adjustment range: 14-26", centered on 18"

VHF signal beats: Mortality 80 bpm

Dead battery 20 bpm

GPS fix 40 bpm

Missed fix 50 bpm

Cold temperature tested

Weight: Approximately 1115 grams

### CR-2A collar release mechanism

## Appendix D: Field Data Deliverables Schedule

| Identifier | Deliverable                                                             | Frequency           | Responsibility |
|------------|-------------------------------------------------------------------------|---------------------|----------------|
| CC-01      | Chisana composition count survey completed paper data collection forms  | Sample date +1 year | PI             |
| CC-02      | Chisana composition count survey scanned data forms                     | Sample date +1 year | PI             |
| CC-03      | Chisana composition count survey waypoints file                         | Sample date +1 year | PI             |
| CC-04      | Chisana composition count survey tracklog file                          | Sample date +1 year | PI             |
| CP-01      | Chisana population survey paper completed data collection forms         | Sample date +1 year | PI             |
| CP-02      | Chisana population survey scanned data forms                            | Sample date +1 year | PI             |
| CP-03      | Chisana population survey waypoints file                                | Sample date +1 year | PI             |
| CP-04      | Chisana population survey tracklog file                                 | Sample date +1 year | PI             |
| CPT-01     | Caribou capture paper data sheets                                       | Sample date +1 year | PI             |
| CPT-02     | Caribou capture data sheet scans                                        | Sample date +1 year | PI             |
| CPT-03     | Caribou capture photographs                                             | Sample date +1 year | PI             |
| CPT-04     | Caribou capture specimens, swabs, blood, hair, etc.                     | Sample date +1 year | PI             |
| CPT-05     | Caribou capture standard body measurements                              | Sample date +1 year | PI             |
| CPT-06     | Blood sample analysis results                                           | Sample date +1 year | PI             |
| CR-01      | Chisana radiotracking survey completed paper data collection forms      | Sample date +1 year | PI             |
| CR-02      | Chisana radiotracking survey scanned data forms                         | Sample date +1 year | PI             |
| CR-03      | Chisana radiotracking survey waypoints file                             | Sample date +1 year | PI             |
| CR-04      | Chisana radiotracking survey tracklog file                              | Sample date +1 year | PI             |
| MC-01      | Mentasta composition count survey completed paper data collection forms | Sample date +1 year | PI             |
| MC-02      | Mentasta composition count survey scanned data forms                    | Sample date +1 year | PI             |
| MC-03      | Mentasta composition count survey waypoints file                        | Sample date +1 year | PI             |
| MC-04      | Mentasta composition count survey tracklog file                         | Sample date +1 year | PI             |
| MP-01      | Mentasta population survey completed paper data collection forms        | Sample date +1 year | PI             |
| MP-02      | Mentasta population count survey scanned data forms                     | Sample date +1 year | PI             |
| MP-03      | Mentasta population survey waypoints file                               | Sample date +1 year | PI             |
| MP-04      | Mentasta population survey tracklog file                                | Sample date +1 year | PI             |
| MR-01      | Mentasta radiotracking survey completed paper data collection forms     | Sample date +1 year | PI             |
| MR-02      | Mentasta radiotracking survey scanned data forms                        | Sample date +1 year | PI             |
| MR-03      | Mentasta radiotracking survey waypoints file                            | Sample date +1 year | PI             |
| MR-04      | Mentasta radiotracking survey tracklog file                             | Sample date +1 year | PI             |
| WC-01      | Certified dataset                                                       | Sample date +1 year | DM             |

## Appendix E: Field Data Deliverables

### **Deliverable CC-01: Chisana composition count survey completed paper data collection forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Completed paper field data collection forms, with annotations.

**Format:**

Completed paper data collection forms

**Specifications:**

Paper data forms. Legible with markup.

**File naming scheme:**

N/A

**Archival plan:** Filed with project leader in fireproof safe.

### **Deliverable CC-02: Chisana composition count survey scanned data forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Data sheet scans. Portable Document File (PDF) or Tag Image File Format (TIFF)

**Format:**

Portable Document File (PDF) or Tag Image File Format (TIFF)

**Specifications:**

Deliverable CC-02 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CC-02\_YYYY-MM-DD\_Chisana composition count survey scanned data forms.pdf or CC-02\_YYYY-MM-DD\_TAILNO\_Chisana composition count survey scanned data form.tif(f).

**Archival plan:**

Deliverable CC-02 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CC-03: Chisana composition count survey waypoints file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS waypoints collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable CC-03 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CC-03\_YYYY-MM-DD\_Waypoints.csv

**Archival plan:**

Deliverable CC-03 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CC-04: Chisana composition count survey tracklog file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS tracklog collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable CC-04 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CC-04\_YYYY-MM-DD\_Tracklog.csv

**Archival plan:**

Deliverable CC-04 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

**Deliverable CP-01: Chisana population survey paper completed data collection forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Completed paper field data collection forms, with annotations.

**Format:**

Completed paper data collection forms

**Specifications:**

Paper data forms. Legible with markup.

**File naming scheme:**

N/A

**Archival plan:** Filed with project leader in fireproof safe.

**Deliverable CP-02: Chisana population survey scanned data forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Data sheet scans. Portable Document File (PDF) or Tag Image File Format (TIFF)

**Format:**

Portable Document File (PDF) or Tag Image File Format (TIFF)

**Specifications:**

Deliverable CP-02 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CP-02\_YYYY-MM-DD\_Chisana composition count survey scanned data forms.pdf or CP-02\_YYYY-MM-DD\_TAILNO\_Chisana composition count survey scanned data form.tif(f).

**Archival plan:**

Deliverable CP-02 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CP-03: Chisana population survey waypoints file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS waypoints collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable CP-03 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CP-03\_YYYY-MM-DD\_Waypoints.csv

**Archival plan:**

Deliverable CP-03 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CP-04: Chisana population survey tracklog file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS tracklog collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable CP-04 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CP-04\_YYYY-MM-DD\_Tracklog.csv

**Archival plan:**

Deliverable CP-04 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CPT-01: Caribou capture paper data sheets**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Paper data collection forms.

**Format:**

Paper data collection forms

**Specifications:**

Paper data forms. Legible with markup.

**File naming scheme:**

N/A

**Archival plan:** Filed with project leader in fireproof safe.

### **Deliverable CPT-02: Caribou capture data sheet scans**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Data sheet scans. Portable Document File (PDF) or Tag Image File Format (TIFF)

**Format:**

Portable Document File (PDF) or Tag Image File Format (TIFF)

**Specifications:**

Deliverable CPT-02 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

Files will be named according to the following scheme: "CPT-01\_YYYY-MM-DD\_WRST\_Caribou\_CaptureDataForms.pdf" where YYYY-MM-DD represents the date the caribou capturing campaign began.

**Archival plan:**

Deliverable CPT-02 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CPT-03: Caribou capture photographs**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Image files with metadata. JPEG, JPG or TIFF format.

**Format:**

Images in JPEG, JPG or TIFF format

**Specifications:**

Deliverable CPT-03 will be in Tag Image File Format. Image files may be delivered in a zip archive.

**File naming scheme:**

Image files are named according to the following scheme: "CPT-02\_YYYY-MM-DD\_WRST\_Caribou\_CaptureImage-XXX.jpg" where YYYY-MM-DD represents the date the image was captured and XXX is a sequentially increasing number.

**Archival plan:**

Deliverable CPT-03 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CPT-04: Caribou capture specimens, swabs, blood, hair, etc.**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Physical specimens with inventory, metadata

**Format:**

Physical specimens

**Specifications:**

**File naming scheme:** N/A

N/A

**Archival plan:** Managed by project leader.

## **Deliverable CPT-05: Caribou capture standard body measurements**

### **Schedule:**

Sample date +1 year

### **Responsibility:**

PI

### **Description:**

Standard body measurements of caribou captured for collaring. <http://caff.is/resources/field-protocols>

### **Format:**

Comma separated values text file, with metadata

### **Specifications:**

Deliverable CPT-05 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

### **File naming scheme:**

CPT-05 Std body measurements.csv

### **Archival plan:**

Deliverable CPT-05 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

## **Deliverable CPT-06: Blood sample analysis results**

### **Schedule:**

Sample date +1 year

### **Responsibility:**

PI

### **Description:**

Blood sample analysis results as received from the laboratory. Copies of results transformed from proprietary formats into human/machine readable formats such as Comma separated values text files. All formats will include descriptive metadata.

### **Format:**

Results as received from lab. Human/machine readable transformations. Metadata.

### **Specifications:**

Deliverable CPT-06 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

### **File naming scheme:**

CPT-06 Blood sample results.csv

### **Archival plan:**

Deliverable CPT-06 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

**Deliverable CR-01: Chisana radiotracking survey completed paper data collection forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Completed paper field data collection forms, with annotations.

**Format:**

Completed paper data collection forms

**Specifications:**

Paper data forms. Legible with markup.

**File naming scheme:**

N/A

**Archival plan:** Filed with project leader in fireproof safe.

**Deliverable CR-02: Chisana radiotracking survey scanned data**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Data sheet scans. Portable Document File (PDF) or Tag Image File Format (TIFF)

**Format:**

Portable Document File (PDF) or Tag Image File Format (TIFF)

**Specifications:**

Deliverable CR-02 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CR-02\_YYYY-MM-DD\_Chisana composition count survey scanned data forms.pdf or CR-02\_YYYY-MM-DD\_TAILNO\_Chisana composition count survey scanned data form.tif(f).

**Archival plan:**

Deliverable CR-02 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CR-03: Chisana radiotracking survey waypoints file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS waypoints collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable CR-03 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CR-03\_YYYY-MM-DD\_Waypoints.csv

**Archival plan:**

Deliverable CR-03 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable CR-04: Chisana radiotracking survey tracklog file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS tracklog collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable CR-04 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

CR-04\_YYYY-MM-DD\_Tracklog.csv

**Archival plan:**

Deliverable CR-04 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

**Deliverable MC-01: Mentasta composition count survey completed paper data collection forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Completed paper field data collection forms, with annotations.

**Format:**

Completed paper data collection forms

**Specifications:**

Paper data forms. Legible with markup.

**File naming scheme:**

N/A

**Archival plan:** Filed with project leader in fireproof safe.

**Deliverable MC-02: Mentasta composition count survey scanned data forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Data sheet scans. Portable Document File (PDF) or Tag Image File Format (TIFF)

**Format:**

Portable Document File (PDF) or Tag Image File Format (TIFF)

**Specifications:**

Deliverable MC-02 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MC-02\_YYYY-MM-DD\_Chisana composition count survey scanned data forms.pdf or MC-02\_YYYY-MM-DD\_TAILNO\_Chisana composition count survey scanned data form.tif(f).

**Archival plan:**

Deliverable MC-02 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable MC-03: Mentasta composition count survey waypoints file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS waypoints collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable MC-03 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MC-03\_YYYY-MM-DD\_Waypoints.csv

**Archival plan:**

Deliverable MC-03 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable MC-04: Mentasta composition count survey tracklog file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS tracklog collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable MC-04 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MC-04\_YYYY-MM-DD\_Tracklog.csv

**Archival plan:**

Deliverable MC-04 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

**Deliverable MP-01: Mentasta population survey completed paper data collection forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Completed paper field data collection forms, with annotations.

**Format:**

Completed paper data collection forms

**Specifications:**

Paper data forms. Legible with markup.

**File naming scheme:**

N/A

**Archival plan:** Filed with project leader in fireproof safe.

**Deliverable MP-02: Mentasta population count survey scanned data forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Data sheet scans. Portable Document File (PDF) or Tag Image File Format (TIFF)

**Format:**

Portable Document File (PDF) or Tag Image File Format (TIFF)

**Specifications:**

Deliverable MP-02 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MP-02\_YYYY-MM-DD\_Chisana composition count survey scanned data forms.pdf or MP-02\_YYYY-MM-DD\_TAILNO\_Chisana composition count survey scanned data form.tif(f).

**Archival plan:**

Deliverable MP-02 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable MP-03: Mentasta population survey waypoints file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS waypoints collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable MP-03 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MP-03\_YYYY-MM-DD\_Waypoints.csv

**Archival plan:**

Deliverable MP-03 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable MP-04: Mentasta population survey tracklog file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS tracklog collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable MP-04 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MP-04\_YYYY-MM-DD\_Tracklog.csv

**Archival plan:**

Deliverable MP-04 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

**Deliverable MR-01: Mentasta radiotracking survey completed paper data collection forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Completed paper field data collection forms, with annotations.

**Format:**

Completed paper data collection forms

**Specifications:**

Paper data forms. Legible with markup.

**File naming scheme:**

N/A

**Archival plan:** Filed with project leader in fireproof safe.

**Deliverable MR-02: Mentasta radiotracking survey scanned data forms**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Data sheet scans. Portable Document File (PDF) or Tag Image File Format (TIFF)

**Format:**

Portable Document File (PDF) or Tag Image File Format (TIFF)

**Specifications:**

Deliverable MR-02 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MR-02\_YYYY-MM-DD\_Chisana composition count survey scanned data forms.pdf or MR-02\_YYYY-MM-DD\_TAILNO\_Chisana composition count survey scanned data form.tif(f).

**Archival plan:**

Deliverable MR-02 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable MR-03: Mentasta radiotracking survey waypoints file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS waypoints collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable MR-03 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MR-03\_YYYY-MM-DD\_Waypoints.csv

**Archival plan:**

Deliverable MR-03 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

### **Deliverable MR-04: Mentasta radiotracking survey tracklog file**

**Schedule:**

Sample date +1 year

**Responsibility:**

PI

**Description:**

Comma separated values text file of GPS tracklog collected during aerial survey. WGS84 Geographic Coordinate System (Lat/Lon).

**Format:**

Comma separated values text file, with metadata

**Specifications:**

Deliverable MR-04 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

MR-04\_YYYY-MM-DD\_Tracklog.csv

**Archival plan:**

Deliverable MR-04 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

**Deliverable WC-01: Certified dataset****Schedule:**

Sample date +1 year

**Responsibility:**

DM

**Description:**

The WRST caribou certified dataset consists of one or more human and machine readable text files representing the releasable portions of the master monitoring database, including embedded metadata.

**Format:**

Human/Machine readable database export file, with metadata

**Specifications:**

Deliverable WC-01 will be delivered in human and machine readable (comma separated values) text file format. Metadata is required.

**File naming scheme:**

Suggested file naming scheme includes the database snapshot date and descriptive title.

Example: YYYY-MM-DD\_WRST\_CaribouCertifiedDataset.sql, or similar

**Archival plan:**

Deliverable WC-01 will be uploaded as a holding of a field data deliverables Dataset reference in the IRMA Data Store.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS XXXXXX, Month Year (The Fort Collins Support Office will fill out this line for you)

**National Park Service**  
**U.S. Department of the Interior**



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**Natural Resource Stewardship and Science**

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