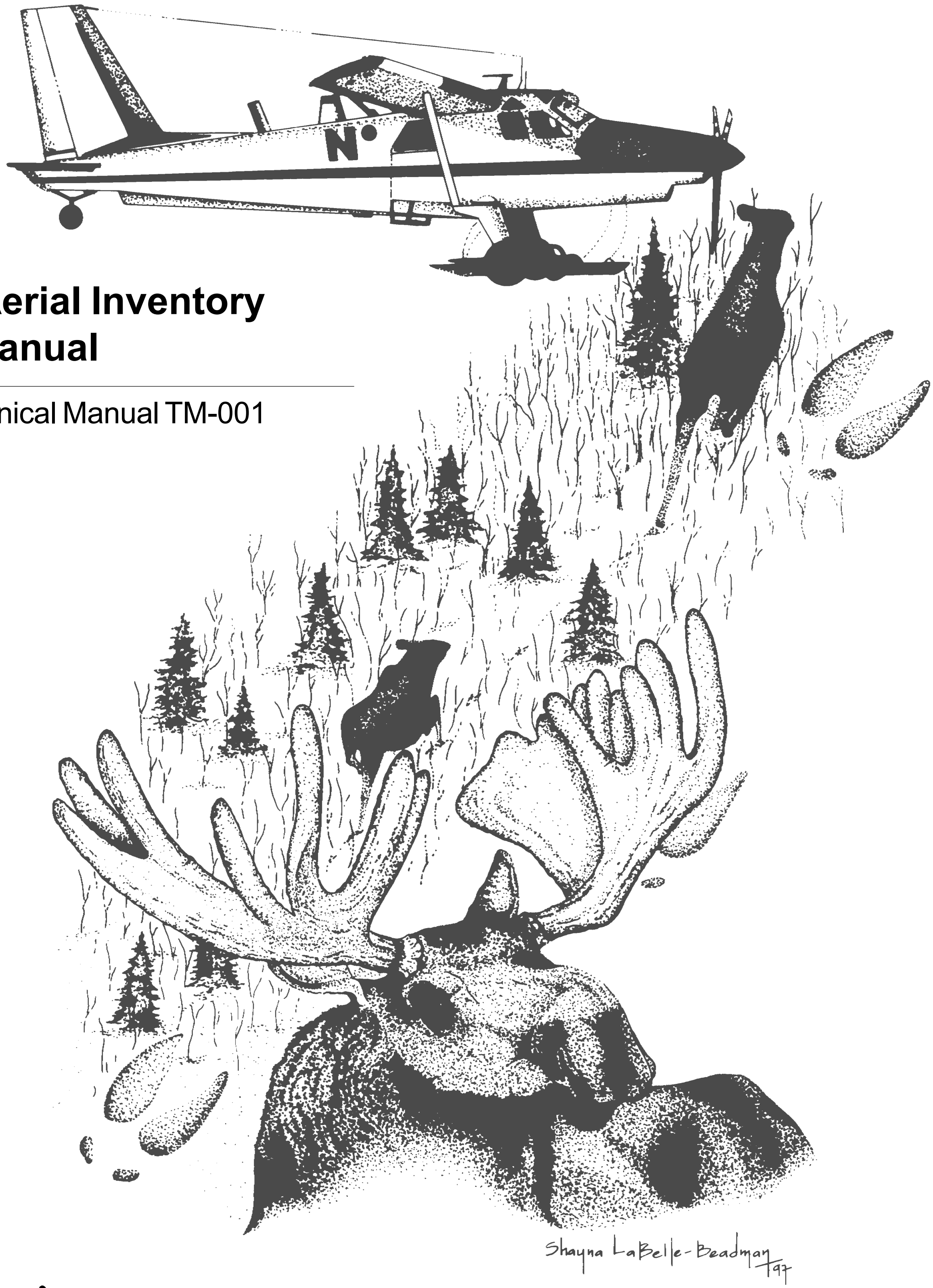

Moose Aerial Inventory Pilot's Manual

NWST Technical Manual TM-001
March 1998

Ontario

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Introduction

Aerial moose population surveys are one of the cornerstones of moose management. The opportunity to see and directly count animals is something of a rarity and this technique provides a decided advantage for Ontario game managers.

Pilots are an integral part of the success of this program. They are directly responsible for the safety of the crew. Indirectly, they contribute substantially to the quality of the survey through their skill in navigating the survey plots. Many pilots are devoutly interested in the surveys as hunters or conservationists and often see more moose than the observers.

A number of pilots have expressed concern that surveys have been conducted very differently in different areas. These differences have included diverse altitudes (100 to 600 feet), airspeeds (50 to 120 knots) and number of flight lines (four to six) per plot.

The objective of this manual is to help pilots understand the survey process better and to increase consistency of population estimates and cost efficiency through a more rigorously standardized protocol.

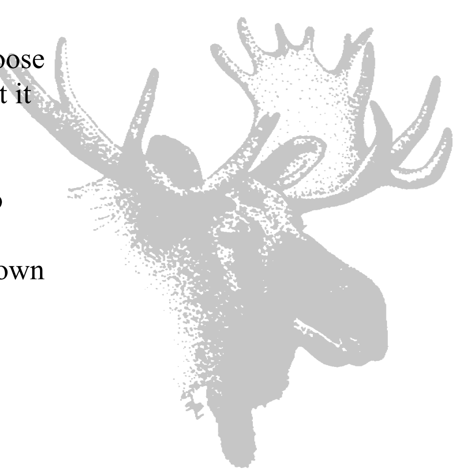
Program Overview

The three most important questions regarding moose populations are: How big is the population? What is the age-sex structure? Is the population increasing or decreasing? There are several survey techniques which may answer these questions.

Moose surveys are generally conducted by sampling randomly selected plots and extrapolating the observations to the entire Wildlife Management Unit (WMU). Surveys may be done with either fixed or rotary wing aircraft. Stratification (identifying areas where moose densities are expected to be similar) helps to improve estimates by putting most of the search effort where it will do the most good. A larger proportion of plots are flown in high density strata because they tend to have more variable moose densities. For example, you might expect to find 11 to 40 moose per plot (a range of 30 moose) in a high strata, and surveying a greater number of plots increases confidence that the survey estimate will be correct. Relatively few low density plots (e.g. zero to two moose per plot) are surveyed because they tend to be more uniform (a range of three moose) and flying a large number of such plots would be wasting time and resources.

Transect surveys with fixed-wing aircraft may be used in larger units where the population density is very low (normally north of the core moose range). This technique is statistically less desirable than plot surveys but it does provide cost effective information on distribution and population trends where management decisions are less critical.

Helicopter transects (usually done in early December) may be used to estimate age-sex structure. However, it is desirable to do these in conjunction with fixed-wing plot surveys for population size, usually flown a little later in the winter.



All moose observed in any type of survey should be classed by age and sex, if possible. While this is easier to achieve with rotary wing aircraft, evidence suggests that estimates of population structure using fixed-wing aircraft are not really different.

While accurate estimates of population size are desirable, they are nearly impossible to achieve at reasonable cost, because some moose will be in dense cover and a great deal of time may be required to find them all. The main objective is to get an acceptable level of accuracy which can be used to reliably assess population trends. This is done through standardised survey procedures and the use of techniques to estimate the error in accuracy through visibility bias. The techniques to estimate bias include counting track aggregates for moose believed to have been missed, doing random plot resurveys and research with radio collared moose.

There are many different opinions on what constitutes a good survey and these change with factors such as the objective for doing surveys, terrain, whether moose are migratory (as in parts of Alaska) or not, snow and weather conditions. Guidelines have been written to clarify objectives and standardize procedures. The standard protocols that are important to pilots are:

> Airspeed: as *close to 80 knots* as possible.
> Altitude: *between 300 and 400* feet AGL (90 to 120 metres).
>
> Flight lines: *five lines* (with individual exceptions), *flown inside the plot boundary*. All lines will permit spotting on both sides of the aircraft.
>
> Circling: *reasonable periods* of time should be spent circling or hovering around tracks to determine if moose are present and their age and sex. On occasion, it may be valuable to spend more time searching specific areas where a lot of tracks were observed, but no moose were detected.

With airspeed relatively constant, the amount of survey time (search effort) on each plot will be dictated by the number of moose and the amount of circling required. It is not possible to exactly plan survey times and costs. Survey staff should concentrate on survey quality (within the intent of the guidelines) and pay less attention to cost. Pilots can play a lead role in standardization and quality control by ensuring that the survey protocol is followed as closely as possible.

The foregoing does not mean that some flexibility will not contribute to a more efficient survey. When flying over areas of open terrain (lakes, bogs, young clearcuts) or forests with very open canopies (mature maple uplands) it is possible to fly faster and higher and still see tracks which may be searched at lower altitudes and at slower speeds. The time saved can be used for more thorough searching in other areas.

The following information from surveys with fixed-wing aircraft may provide some insight into survey needs. Seventy-four percent of the total plots (13,673) flown between 1974 and 1995 took less than 35 minutes, had an average of three moose per plot, and a range from zero to 52 moose per plot. The remaining 3,566 plots took an average of 50 minutes, had an average of 7.6 moose per plot and a range of zero to 70 moose per plot. These values are based on past, inconsistent surveys. The very great range of moose seen in relation to search time highlights the need for standard protocols. Clearly, surveys with a 25 to 40 minute average time per plot should be appropriate for most WMUs. Only units with very high densities might require more time. For example, the Aulneau Peninsula, with an average of 23 moose per plot, required an average of 52 minutes per plot with helicopter.

Under some circumstances, enhanced surveys may be undertaken to meet local needs. These may require extra search effort through slower flight speeds, more transect lines, or searching specific habitats more intensively. In such cases, the initial search of each survey plot should be flown according to the standard protocol. Moose observed during this period should be recorded separately. Once this is completed, additional searching may begin in the manner described by the survey navigator, with a second record produced for the total flight. In this way, information is essentially the same as resurvey plots and will help to assess visibility bias while meeting the objective for the survey enhancement.

Pre-Survey Planning

Survey Objectives

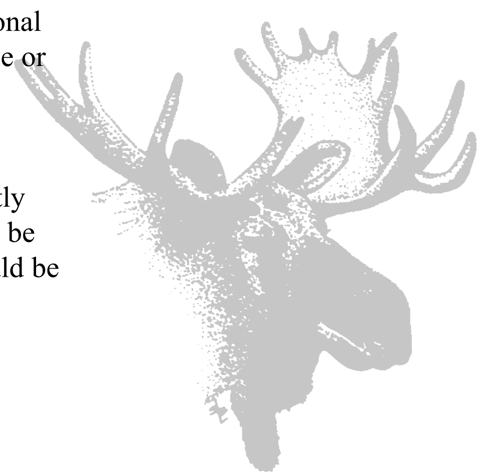
Most surveys should follow the standard protocol. When enhanced surveys are approved, this information will be given to the Provincial Coordination Centre flight coordinators for aircraft requisitioning and scheduling.

Pilots should determine the type of survey (standard or enhanced) from the dispatcher and gain some idea of the objective of the enhancement from either the district survey coordinator, the regional coordinator or the wildlife inventory program leader. This will allow pilots to help control the search effort, through airspeed and altitude adjustments, to the level required to meet the objective.

Aircraft schedules for moose surveys are planned using regional strategies which include a priority ranking of the importance of the individual WMUs. If one survey is delayed or takes longer than expected, it will affect following surveys. If a survey appears to be taking longer than planned, both the Provincial Coordination Centre dispatcher and regional program coordinators will need to know in order to adjust the schedule or make decisions on acquiring extra aircraft or dropping surveys.

Fuel Caches

Fuel caches may save a lot of ferry time, but drum fuel is more costly than airport fuel. Decisions on use of caches and their location should be made collectively by pilots, survey leaders and dispatchers. This should be done well in advance of the survey to permit fuel positioning.



Whenever possible, refuelling at caches should be planned to occur at mid-day lunch break. Refuelling at caches should also occur at the completion of the days flying, prior to returning to base, for safety reasons or if bulk fuel is not available at the base.

Visual Navigation Program

Andy Todd and Scott Christilaw of the Southcentral Science and Technology Unit developed a Global Positioning System (GPS) based computer program which aids navigation and records moose and other observations. If the program is going to be used for navigation, it must be positioned in the front passenger seat to allow easy viewing for the navigator and as a cross reference for the pilot. If it is only going to be used to record location and observation information, it may be placed with an observer in the rear seat.

While this program is simple to use, some pre-programming is still required. All MNR aircraft currently have GPS and RS-232 computer ports and 110 AC volt inverters. During the implementation of this program it is hoped that pilots will take the lead and assist other survey staff to understand GPS and the related programs.

Flying the Survey

Survey Information

Flight characteristics such as altitude (AGL), airspeed, outside air temperature, start and stop times are recorded for each plot. The pilot should provide this information to the navigator, before or after each plot is done. If the Visual Navigation Program is being used, the altitude and airspeed can be given in feet above ground and knots respectively, and the program will make the conversions.

If observations are being recorded on maps, the following conversions may be used change normal instrument readings to those recorded for surveys.

> *airspeed* in knots per hour x 1.84 = airspeed in kilometres per hour.

> *altitude* above ground in feet ÷ 3.3 = altitude above ground in metres.

Ice Landings (Fixed-wing)

Mid-day (1000 until 1400) is the best time for doing moose surveys, because it provides the best light. Within this narrow window, time must be taken for lunch or a break. Returning to base is a waste of time and money if an ice landing can be made safely near or between plots. This is clearly a pilot’s safety decision, but a lunch break in the field should be the normal pattern if safe ice is available.

If there is a long distance between plots, the crew may prefer to have lunch in the aircraft without a break. The desirability of this should be based to a large extent on the pilots level of fatigue. An enthusiastic and rested crew will generally do a better and safer survey and this must be balanced with getting the job done quickly.

Flying Tips

The following tips were provided by experienced pilots. They have proven their usefulness and resulted in better surveys.

1. When there is no, or light wind, start the survey at the south end of the plot. This puts three of the five lines with the sun behind the aircraft allowing for better visibility under the forest canopy and reduced sun glare for the crew.

2. Guidelines recommend against flying in winds above 20 kph, however, when there is a moderate wind, fly the first line into the wind. This reduces the average ground speed for the plot and improves the spotting potential.

3. If there is a cross wind, start on the downwind side of the plot and make turns into the wind. This reduces drift and angle of bank, and increases passenger comfort.

4. On windy days it is difficult to circle over a point to count or sex animals. Perhaps the best ways to complete this task are:

   - Drift off the site, approach it upwind, then do a steep turn over the desired point and drift off again.
   - Approach the site cross wind, with turning point on upwind side, before turning into wind. This will result in a full circle rather than a half circle over the site.

5. Helicopters should generally circle, rather than hover directly over an observed moose. Circling permits a better view into the vegetation so that other animals may be spotted. It also enables antlerless animals to be seen from different angles to determine their sex. Hovering can be used to move animals into the open if it can be done safely.

The above methods will provide the best opportunity to view the plot from fixed-wing aircraft under difficult conditions. Wind conditions, within the range suitable for surveys, should not affect the standard methods of survey operations for helicopters, therefore no special operating procedures are required.

Flight Coding

The correct coding of each flight is an important aspect of evaluating the effectiveness of surveys and planning for future surveys. Flights which are incorrectly coded distort survey statistics. Cost codes for personal expenses will be provided for each WMU.

Moose population surveys fall under only three service codes:

O	-	for positioning and de-positioning,
MP	-	for all plot surveys, and
MT	-	for all transect surveys, usually helicopter “age-sex” surveys in core units or fixed-wing population surveys in the north (e.g. Unit 1).

The latter two codes should only be used for moose population surveys. Inventory of other wildlife species (e.g. beaver house counts, caribou, elk) should be coded to census (J). Moose habitat surveys should be coded as WH (wildlife habitat). If an aircraft is positioned to do several WMUs from one base, it is desirable to charge positioning to one unit and de-positioning to another. Crew travel expenses should also be divided between the two units, at least in a general manner.

Post-Flight Debriefing

A Better Tomorrow

Effective communication is essential for improving surveys. Too often problems are perpetuated because they are not discussed. It may be easier for pilots to open the door to communication since clients may be reluctant to suggest change in case it is perceived as criticism. Simply ask "How'd it go today? Anything we can do to make tomorrow's work easier or better?"

If a request appears unreasonable or contrary to the guidelines, you should explain your concerns. Many moose observers are not familiar with the aerodynamic and safety limits of aircraft. Explaining to the survey crew why it might be dangerous to do certain things could resolve the issue and raise their confidence in your abilities as a pilot. Unresolved problems should be brought to the attention of the chief pilots, regional coordinators or the wildlife inventory program leader for their consideration.

With cooperation and a sense of team spirit, pilots, navigators and observers can deliver a quality, cost effective aerial inventory program to meet the needs of the public and the ministry. The ultimate result will be more effective moose management.

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