Mackenzie Nature Observatory's

Protocol for

Migration Monitoring at Mugaha Marsh

Program is part of
BC Migration Monitoring Program
and
Canadian Migration Monitoring Network

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ACKNOWLEDGEMENTS

Mackenzie Nature Observatory has worked with the Canadian Wildlife Service (CWS) throughout this time. Rhonda Millikin, Wendy Easton, Kevin Fort and Shawna Pelech have all contributed to this program. Rhonda started this revision and Wendy Easton completed it.

This protocol has evolved through time with so many individuals contributing their thoughts on how the protocol could be improved. Firstly, our thanks to the Institute for Bird Populations for allowing us to incorporate the text from Monitoring Avian Productivity and Survivorship 2004 Protocol for assessing brood patch, cloacal protruberance, skull ossification, feather wear, and fat deposition and to Danielle Kaschube for sharing her expertise in qualifying the skull chart we drew. Thanks to David Hussell and Audrey Heagy for their input on how what we do when there is a backlog of birds can impact the data we collect.

Mackenzie Nature Observatory (MNO) members have devoted considerable time and effort to the development and updating of the protocols through out the years. They are the people involved locally and have the first hand knowledge of the problems that need to be addressed. Members working on this revision (2006) were Vi Lambie, David Lambie, Martina Frey, Laird Law and Sandra Kinsey.

We thank our banders for pointing out what was lacking or unclear in the protocol and for suggesting how it could be improved. Our banders: at Gagnon, Jul Wojnowski (fall 1994) and Rinchen Boardman (fall 1995); and at Mugaha, Kevin Hannah (fall 1995), Kevin Hannah and Christine Jamieson (fall 1996), Kevin Hannah and Rainer Ebel (fall 1997), Jim Tuck (1 week spring 1998) and Paul Prior (fall 1998), David Bostock (fall 1999), Jukka Jantunen (fall 2000-2002, 2005), Cindy Cartwright and Tyler Flockhart (fall 2003), Pierre Goulet and Myles Falconer (fall 2004) and Amèlie Rousseau (fall 2005).

Special thanks to members who helped with previous versions of our protocol: Ryan Bichon, Christy Butt, Derek Connelly, Linnea Cross-Tallman, Cheryl Freeman, Martina Frey, Sandra Kinsey, John, Vi & David Lambie, Laird Law, Cheryl Omand, Alan Simcoe, Donna Thornton, Cynthia & Jim Tuck, and Rob Weaver. Hopefully no one has been missed as everyone's help has been greatly appreciated.

Questions

Questions regarding the BC Migration Monitoring Program should be directed to Wendy Easton (landbird biologist) at the Canadian Wildlife Service's Pacific Wildlife Research Centre at (604) 940-4673. Please contact the Mackenzie Nature Observatory's Bird Committee regarding questions on this protocol.

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Banding is a Privilege

The Bander's Code of Ethics (*adapted from the North American Banding Council 2001a*)

1. ***Banders are primarily responsible for the safety and welfare of the birds they study so that stress and risks of injury or death are minimized. Some basic rules:***
   - handle each bird carefully, gently, quietly, with respect, and in minimum time
   - capture and process only as many birds as you can safely handle
   - close traps or nets when there are known predators in the area
   - do not band in inclement weather
   - frequently assess the condition of traps and nets and repair them quickly
   - trainees must be properly trained and supervised
   - check nets as frequently as conditions dictate
   - check traps as often as is recommended for each trap type
   - properly close all traps and nets at the end of the banding
   - do not leave traps or nets set and untended
   - use bird bags only once before washing to prevent the spread of disease
   - use the correct band size and banding pliers for each bird
   - treat all bird injuries in the most humane way

2. ***Continually assess your own work to ensure that it is beyond reproach***
   - reassess methods if an injury or mortality occurs
   - ask for and accept constructive criticism from other banders

3. ***Offer honest and constructive assessment of the work of others to help maintain the highest standards possible***
   - publish innovations in banding, capture and handling techniques
   - educate prospective banders and trainers
   - report any mishandling of birds to the bander
   - if no improvement occurs, file a report with the Banding Office

4. ***Ensure that your data are accurate and complete***

5. ***Obtain prior permission to band on private property and on public lands where authorization is required***

6. ***Obtain all necessary banding permits***
   - ensure you have the appropriate permissions on your banding permit (including net type, species, adding additional markers beyond metal band).
   - obtain provincial or territorial permits to band provincial species.
   - obtain federal scientific permits to take samples from birds or tag with more markers.
   - obtain federal Species at Risk permits to work on federally-listed species.
   - ensure you have permission and the appropriate permits to sample on private property.

INTRODUCTION

The Mackenzie Migration Monitoring Station was established in 1994 by Rhonda Millikin of the Canadian Wildlife Service (CWS), Alan Simcoe of Fletcher Challenge Canada: Mackenzie Wood Products Division (now Canadian Forest Products Limited) and the Environment Section of Mackenzie Fish and Game Association. In 1997, the Mackenzie Nature Observatory (MNO) was formed as a separate incorporated society and registered charity by the Mackenzie Fish and Game Association's members to coordinate its environmental work, including the neotropical migration monitoring. The Mackenzie station is a cooperative project that has been supported by various government and non-government organizations and foundations, local business and industry, the community of Mackenzie, and many, many volunteers. It is part of the BC Migration Monitoring Program with CWS, the Canadian Migration Monitoring Network (CMMN) coordinated by Bird Studies Canada (BSC) and an international network through Partners in Flight. The CMMN is a cooperative program of member stations, BSC and CWS that is coordinated by BSC. At the last CMMN meeting in October 2005 an interim Steering Committee was established for the CMMN.

The station is coordinated by MNO and operates under the CWS master banding permit, BC-CWS-DELTA #10365. MNO's Bird Committee supervises the seasonal operation of the station, raises funds, obtains permits, hires banders, and submits all appropriate data to the Canadian Bird Banding Office, CWS-Pacific Wildlife Research Centre (CWS-PWRC) and BSC. CWS-PWRC is responsible for regional analyses of migration data and BSC for national analyses. MNO and CWS fully support and encourage companion bird studies that complement the long-term monitoring work at Mackenzie.

Many North American landbirds concentrate at the edge of large bodies of water, desert or in limited patches of suitable stopover habitat during migration. The primary banding station is situated at Mugaha Marsh, along the Williston Reservoir, a prominent funneling feature in the landscape. Mackenzie lies in the Rocky Mountain Trench, a large valley immediately west of the Rocky Mountain range. Therefore, it is a suitable location to monitor migration of species that breed in the forests and mountains of northern British Columbia, Yukon and Alaska. To provide a broader understanding of migration patterns in the area, censuses, using the transect method, were also conducted at Gagnon Creek and Chichouyenily Creek from 1994 - 2002 and at Mugaha Marsh from 1995-2002 (see the 2000 revision of the station protocol for a complete description of transects and methods used). Gagnon served as a banding station in 1994 and 1995. Mugaha was tested for its suitability during two weekends in 1994. The first full season of banding at Mugaha was in 1995. Mugaha became the primary banding station in 1996. An alpine banding site, Morfee Mountain, will be added when time and funding are available. Figure 1 is a map showing the entire study area.

The number of birds observed and/or captured in nets, at a stopover site during the day, provides a sample of the actual population of migrants. Through consistent counting methods, repeated over a number of years, these numbers can be used to monitor population trends. Even still, other factors such as weather, surrounding habitat change and insect outbreaks can influence the proportion of migrants counted. By controlling for variation in the counting method, and noting other factors that may influence bird numbers, variation due to population change can be separated out.

The methods described here were derived from the Long Point Bird Observatory (McCracken et al. 1993), the Regional Migration Monitoring protocol (Millikin 1994), MAPS Manual for fat, breeding condition, skull ossification, and feather wear (DeSante et al. 2004) and on-site expertise.

GOALS AND OBJECTIVES

The migration monitoring program in Mackenzie has three broad goals:

1. To monitor changes in the populations of small landbirds, that use and migrate through the Mackenzie area by providing annual indices of population numbers and structure, species composition, migration timing and possibly survival rates and indices of productivity. Of particular concern are those species not effectively monitored by other survey methods (e.g. Breeding Bird Survey) and species showing declines in other regions (Appendix 1).
2. To understand migration ecology and its relationship to breeding dynamics and management issues, particularly the significance of Mugaha Marsh as a stopover site.
3. To build partnerships within the community and between industry, naturalists, academia, First Nations, governments and interested citizens.

Specifically, we have several objectives:

1. To identify and count individuals (observed and captured) of each species or subspecies, new and recaptures, daily using standard, nationally-accepted protocols during fall migration.
2. To determine the age and sex composition of captured birds.
3. To augment public interest and local knowledge of environmental issues through involvement and training opportunities.
4. To produce annual reports: MNO and the banders will produce an annual report summarizing the season, containing numbers and composition of captures and recaptures, comments on habitat changes, weather conditions and other factors that may have affected the capture of birds locally. CWS will support annual trend analyses. CWS will also produce regular analyses and interpretation of data, placing observations in the context of local and regional landscapes, regional weather conditions, population surveys and studies, and other environmental factors.
5. To investigate the use of migration numbers as an index of productivity, particularly for forest birds.
6. To support further integrated research.
7. To reduce, where possible, biases in sampling by improving survey protocols and skills of observers, maintaining local vegetation structure and composition, and supporting consistency of the surrounding landscape of Mugaha Marsh. We will investigate the best measurements and influences of variation in capture population (e.g. age, sex, migratory status, moult, mass gain) and other, uncontrollable potential sources of biases (e.g. weather, habitat change in the surrounding landscape, insect outbreaks, water levels) on the observed trends and adjust analyses accordingly.
8. To follow a standard protocol that meets the scientific requirements of CWS and the Canadian Migration Monitoring Network.

STUDY AREA

The Station

Mackenzie Nature Observatory's migration station is located at Mugaha Marsh, 14 km northwest of Mackenzie (Figure 1). The station lies within the Mugaha Marsh Sensitive Area, which was proclaimed under the Forest Practices Code of BC Act in 2001.

The station includes a banding and living site, 31 net lanes and a daily census route centered on the public wildlife-viewing site (Figure 2). A permanent banding lab has been built and a viewing platform constructed. This site can be used for spring and fall banding.

Recording area

The Recording Area boundary extends from the trees at the southwest edge of the marsh, to the trees bounding the northeast bank of the pond, to include species not observed elsewhere in the marsh. For passerines and near passerines (woodpeckers, hummingbirds, swifts and kingfishers), the Recording Area boundary extends west along the main road until hydro pole # 115, south along the main road until hydro pole # 107, and north in the forest along the trail to Tutu Bay, until the aspen with three red ribbons at the fork to net lanes 7 and 8. There is no set distance for all other non-passerines.

Census route

A standard, one hour census route (Figure 2) is established at the station and a detailed description of route is given under Census in BIRD SURVEYS.

Net lanes

Thirty-one net lanes are established (Figure 2) and UTM's are marked (Appendix 2).

OPERATION OF THE MIGRATION STATION

Pre-season preparations

Before fall monitoring begins there are a number of necessary preparations. Winter duties include: repairing nets, sewing bird bags, ordering bands, updating data forms and species lists, ordering equipment, reviewing bird tapes and advertising for banders and volunteers.

Any serious pruning or removal of dead trees that needs to be done on net lanes or along the road should be done in the fall after banding or in early spring allowing time for the vegetation to come back before fall banding starts. Maintenance of buildings and trailers should be done at this time as well.

Holding nature hikes in the spring and summer will help new volunteers improve their bird identification skills.

During the week immediately before fall banding commences the net lanes should be checked to see if any additional maintenance needs to be done. The water level of Williston Reservoir can impact on which net lanes can be used, as can beaver activity; therefore water levels should be monitored so the decision can be made on which net lanes are to be used.

The protocol, including completion of data forms, should be reviewed with the volunteers and banders at or prior to the beginning of the season.

Health and safety of personnel

All banding station personnel should be informed about various bird diseases and the potential to pass diseases from bird to bird and/or bird to human. The North American Banding Council Banders' Study Guide (North American Banding Council 2001a) outlines many of the diseases and disorders that can potentially be transferred from birds to humans. The Public Health Agency of Canada is the best website for information on risk of any disease to human safety (http://www.phac-aspc.gc.ca/id-mi/index.html), including avian influenza (http://www.phac-aspc.gc.ca/influenza/avian_e.html). CWS works with the

Canadian Cooperative Wildlife Health Centre (http://wildlife1.usask.ca/en/CCWHC_home.php) to monitor West Nile virus (http://wildlife1.usask.ca/en/west_nile_virus/wnv_home.php) and avian influenza (http://wildlife1.usask.ca/en/aiv/index.php). The Canadian Cooperative Wildlife Health Centre also provides additional information on wildlife disease (e.g. salmonella http://www.nr.gov.nl.ca/agric/animal_diseases/wildlife/pdf/salmonell04.pdf). BIRDNET also offers information to banders, including about West Nile virus (http://www.nmnh.si.edu/BIRDNET/WNV.html) and avian influenza (http://www.nmnh.si.edu/BIRDNET/OC/avianinfluenza.html). Maintaining good hygiene is the best defense against contracting any viral or bacterial diseases from birds. ALWAYS wash your hands after handling birds. Use each bird bag only once and wash afterwards. Keep banding instruments, banding table and lab clean with the antiseptic spray provided. A broom, dust pan and wash bucket are supplied for cleaning the lab floor.

Children are welcome at the station at all times if they act responsibly and safely. Children should only visit net lanes with the permission of the bander or experienced volunteers assisting at the station that day. During any monitoring procedure, like all volunteers, young people must be trained and accompanied by more experienced individuals until their skill level and maturity is suitable for the task at hand.

Pets present during banding should be kept on a leash and should not visit net lanes or be in the lab when birds are being banded as it adds to the stress of the birds. In addition, pets running loose could easily get tangled in a net and cause considerable damage.

The banding lab has a cell phone for emergency use. Please be aware that Mugaha is on the limits of cell phone range and you will often need to go to the road in front of the lab to make the connection. There are short-distance walkie-talkies for individuals checking the far nets. There is a first aid kit in the lab and another in the electrical building. Bear awareness brochures are provided, please read them! Please do not store food or garbage outside as it will attract bears. Garbage should be taken in to town when the banders go in or they can ask the volunteers to take it in. A can of bear spray is provided.

Permits for operation

Site
MNO has a Licence of Occupation for the banding site at Mugaha Marsh from the BC government (BC Lands).

Banding
Banding is conducted under the master permit of BC-CWS-DELTA 10365 for federal birds and under Vi Lambie's provincial permit for provincial birds. The banders must have the appropriate banding permits/sub-permits highlighting whether they can band passerines, near passerines, hummingbirds, raptors, shorebirds, waterfowl, waterbirds, and use mist nets. There must also be additional authorizations on the banding permit for other additional auxiliary markers and tags, including colour bands. There are additional CWS Scientific Permits required for sampling feathers and blood, using radio tags, etc. (contact Gloria White at gloria.white@ec.gc.ca).

Habitat assessment and maintenance

To provide standard bird counts annually at the migration station, we minimize the variation of the structure, density and composition of vegetation on the floodplain and document the remaining variations Notes on seasonal vegetation changes, including significant events like flooding, are included in MNO's annual report.

Fluctuations in water levels in Williston Reservoir can result in flooding of the marsh and has helped

maintain the same general height of vegetation over the years. This periodic flooding has resulted in some change in the species composition in parts of the marsh. Species such as alder, twinberry, and lodgepole pine have died out when flooded for extended periods of time. If the vegetation is not maintained by periodic flooding, MNO, led by John Lambie, will annually trim shrubs within 5 m of the net lanes to maintain a constant height of 3 to 4 m. Trees greater than 7 m in height within a radius of about 30 m of each net lane are topped to 5 m or removed if healthy replacement trees of the same species are present. Vegetation along the roadside is kept pruned back to maintain a good view of the marsh and ensure road safety.

Digital pictures of each net lanes should be taken each year from the same location(s) framing the net lane and including the most detail of the vegetation. This will usually be from the end of the net lane. The photos should be taken at the beginning of the banding season, and once half way through the season. Photos at the end of the season should be taken if there is a real change in vegetation, e.g. serious dropping of leaves, vegetation change due to receding water levels, etc. The change in vegetation density, structure and composition may help to explain some of the variation observed in long-term population trends; therefore, the habitat is assessed every five years (1998, 2003, etc.) in August, using the method described by James and Shugart (1970). CWS-Pacific Wildlife Research Centre (CWS-PWRC) hires someone to do this assessment.

Notes on vegetation management and natural changes in habitat are documented in MNO's annual reports. Details are kept in MNO's vegetation binder along with the list of species identified in the vegetation analysis. An Operation Plan for Vegetation Management in a portion of the Mugaha Sensitive Area (2002) was developed by Ryan Bichon in consultation with MNO members and CWS-PWRC. This plan was not implemented but is kept in the binder for future reference.

Training

Time spent at the Mackenzie Migration Station is an excellent opportunity for training and internship for volunteers, including students. Training of volunteers, especially of local participants, is a top priority for the station. The banders are responsible for training volunteers and ensuring there is ample and high quality opportunities for volunteers to improve their skills during the daily operation of the station. A volunteer's role should be determined by a combination of experience, interest and ability (Table 1). No job is better than another; every role is important. If the volunteers or bander feel it would be beneficial, the bander will complete a "Bander's Report Card" (from North American Banding Council 2001b, see Appendix 3) documenting the volunteer's progress over time. Volunteers should not be asked to do jobs they are not ready to do. CWS is committed to providing regular training opportunities for long-term volunteers of BC's migration monitoring program; the trainers will be highly experienced banders.

Table 1. Volunteer role and experience required.

Role	Experience required; expected time-frame
Net runner/bird extractor	Patience, dexterity; days as an apprentice
Data recorder	Accuracy, understanding codes; hours
Weigh, measure	Accuracy, proper techniques; hours
Bander	Species, keys to age and sex, fat, skull, moult, 2 seasons
Census	Species by sound and site, one season as apprentice

Roles and responsibilities

MNO Bird Committee

The station is run and coordinated by the MNO Bird Committee, a group of volunteers. The duties are wide-ranging and include raising funds to run the migration station, hiring and supervising banders,

ensuring that necessary permits are in place, conducting field preparations, maintaining equipment, managing vegetation, scheduling volunteers, summarizing and maintaining quality control of data collection, submitting data to the Bird Banding Office, CWS-PWRC and BSC, submitting permit reports, and, finally, producing an annual report. MNO Bird Committee and CWS- PWRC strive to ensure that the monitoring protocol meets international standards and is consistent with surveys at other migration stations. In addition (but not limited to), the MNO Bird Committee also conducts valuable outreach to community members, industry, naturalist groups, students and academia, etc. Organized visits to the station should include a technical session with a permitted bander whenever possible.

Bander-in-Charge and Assistant Banders

The bander(s) are responsible for the welfare of the birds, teaching volunteers, daily census (could be delegated) and collection, compilation and proofing of data. This includes ensuring all of the data forms are completed daily. The banders are responsible for computerizing the data and for checking that it has been entered correctly (Volunteers may be asked to assist with this).

The bander is responsible for maintaining a professional atmosphere in the banding lab, providing opportunities for learning, while maintaining a high quality of data collection. The experience of each volunteer will be assessed before assigning a level of participation. The bander(s), or the individual the banders have appointed to be in charge, should address problems with daily procedures. Difficulties with volunteers and or the general public are to be resolved with the help of the MNO Bird Committee.

When possible the bander should be available to help volunteers set up and take down the station.

To maintain interest the bander (a volunteer may assist with this) should the number of each species banded to date, the total number of birds banded to date, the number of birds banded the previous day information on special birds, etc. Posting the band numbers and alpha codes and year banded of each return generates interest and allows for a quick check to know if there is a current retrap card for a return. Volunteers can help keep the list of returns, it can be made up in Excel and printed.

The bander(s) will also produce a summary of the season.

Volunteers

At the station
Volunteers are responsible for assisting the bander, according to their expertise. For example, volunteers can assist with opening and closing nets, extracting birds, banding, recording data, conducting the census, general observations, and helping MNO's Bird Committee by bringing water and firewood out to the station, washing bird bags, and helping with set-up and takedown of the station at beginning and end of season.

MNO Bird Committee may appoint someone to coordinate community visits. Organized visits should include a technical session with a permitted bander whenever possible. Volunteers should always sign in and out at the station in the book for volunteers and should encourage all visitors to sign the guest book.

After the end of the field season
After the end of the field season there is still much work to be done that the local volunteers can help the Bird Committee do. The holes in the nets need to be marked, and the nets mended noting if any of the nets need to be replaced. The condition of all other equipment should be checked before storing. The data needs to be checked to ensure that it was all entered, and that the date is on all pages of the daily log. The number of birds banded and birds recaptured entered in Band Manager must agree with the numbers

entered in the DET program. Once these checks are done all the data needs to be copied before the originals are sent to the Canadian Wildlife Service. The annual report needs to be prepared and sent out.

CWS and BSC

CWS will support annual trend analyses. CWS will also produce regular analyses and interpretation of data, placing observations in the context of local and regional landscapes, regional weather conditions, population surveys and studies, and other environmental factors. CWS-PWRC will submit annual contributions for MNO's annual report. BSC will conduct national trend analyses, which are then posted on their website http://www.bsc-eoc.org/national/migmain.jsp. CWS-PWRC will contribute direct financial support as well as equipment, help with permit applications and references for proposals; CWS-PWRC will also conduct a vegetation survey every 5 years, provide regular training opportunities for long-term volunteers, and help to maintain rigorous protocols.

BIRD SURVEYS

Three survey methods (observations, census and banding) are used simultaneously throughout the season to monitor fall migration. If the volume of birds is high and help is limited, banding is the priority survey method.

Dates of operation

Banding should begin approximately July 20 and extend to approximately 23 September annually. The season runs for approximately 67 days. Summary of the daily activities are recorded within the Daily Log (Figure 3).`

Weather conditions

The bander should record wind direction and strength (Table 2), sky condition (Table 3), visibility (Table 4), percent cloud cover, and temperature at sunrise, 6 hrs after sunrise and dusk in the Daily Log (Figure 3). Weather conditions at the start of census should be recorded in the Daily Log by the person doing the census.

Table 2. Beaufort Scale

Beaufort number.	Mph	Km/hr	Term	Wind speed indicators
0	< 1	< 1	Calm	Smoke rises vertically
1	1 - 3	2 - 5	Light air	Wind direction shown by smoke drift
2	4- 7	6 - 11	Light breeze	Wind felt on face, leaves rustle
3	8 -12	12 - 18	Gentle breeze	Leaves and small twigs in constant motion,
4	13 - 18	19 - 30	Moderate breeze	Small branches move, raises dust, leaves and paper
5	19 - 24	31 - 39	Fresh breeze	Small trees in leaf begin to sway
6	25 - 31	40 - 50	Strong breeze	Large branches in motion
7	32 - 38	51 - 61	Near gale	Whole trees in motion
8	39 - 46	62 - 74	Gale	Twigs and small branches break off trees
9	47 - 54	75 - 87	Strong gale	Large branches break off trees; slight structural damage
10	55 - 63	88 - 102	Storm	Trees broken, minor structural damage
11	64 - 72	103 - 117	Violent storm	Widespread damage
12	73+	118 - 132	Hurricane	Violent movement of trees and much destruction

Table 3. Sky condition.

Scale	Sky condition indicator	Scale	Sky condition indicator
0	Clear or a few clouds	5	Drizzle
1	Partly cloudy or variable sky	7	Snow
2	Cloudy or overcast	8	Showers
4	Fog or smoke		

Table 4. Distances to help measure extent of visibility.

Location (distance from banding station to these locations)	Direction	Distance
Highest point across marsh, across Williston	SSW	21.5 km
Little Morfee (point showing across pond)	NE	10 km
Old Friend Mountain	NE	41
Mount Scovil, the peak with a tower	S	21.5 km
Distance between hydro poles		80 - 100 m
Distance across to the far side of marsh where there is a duck box		
Distance across pond to Osprey stand		

When a drastic change in the weather forces the closure of nets or cancellation of the census, the bander should note this in the narrative of the Daily Log. Further weather data (e.g. the daily max-min temperature, cloud cover and overnight winds) can be obtained from permanent weather stations at the Mackenzie airport.

General observations

Daily observations should include birds present (by sight or sound) in the Recording Area (described under Study Area) during standard banding ('Obs') and outside of the standard banding period ('Other Obs'), noting any banded birds. As noted, observations of passerines and near passerines (woodpeckers, hummingbirds, swifts and kingfishers) are recorded only within the described Recording Area, and all other non-passerines are counted with no limit set on distance. All observations should be reported to the Bander-in-Charge at the end of the day. Final tallies of the general observations are recorded in the Daily Species Totals form (Figure 4).
Note: prior to 2000, all observations were combined.

Census

A one hour census of all birds along a standardized route (Figure 2) should be conducted daily during the banding season. Ideally, this count should take place at mid-morning at similar periods after sunrise and when bird activity is good. Ensuring that there is adequate assistance for doing the banding takes priority over doing the census. If the census is interrupted because banders need help, then complete the remaining census later (Hussell, personal communication), noting times in the Daily Log (Figure 3). Walk the census route recording all birds seen or heard in the daily census notebook. Doing the census early or later if there is a shortage of help is better than doing no census. Record start and end times and weather conditions in the Daily Log (Figure 3). Enter the number of birds and species observed on the Daily Species Total form (Figure 4).

Volunteers and banders may be asked to verify the level of their knowledge by undergoing a standardized test of common bird identification, including the songs and calls they will need to know. When faced with a choice, the observer should focus on the identification and count of landbirds over monitoring of waterbirds. Unidentified waterbirds can be identified after the census.

The census route begins at the banding station and goes north along the road towards the gate to what used to be Chico Wood Fiber to approximately half way between hydro poles # 114 and # 115; do not count birds beyond pole # 115. Go back towards the station and take the trail that goes to Tutu Bay and to net lanes 7 and 8. Continue to the aspen marked with three red ribbons, counting all birds seen and heard. Return along the trail until it branches. Follow the fork to the left to nets 5 and 6, then go back along the trail past net lane 18 and down the hill to net lane 9. Continue along the net lane and-up the bank to the road. Walk along the road towards town as far as hydro pole # 108. Count passerines over the pond out to a line even with the beaver house and parallel to the road. Count only non-passerines observed beyond the beaver house. On the other side of the road, count only non-passerines beyond the willows at the edge of the marsh as shown in Figure 2. When you stop at pole # 108, count passerines up to pole # 107 only, and any non-passerines heard or observed beyond pole # 107. Backtrack towards the station along the road, being careful not to double count birds, focusing on counting any species missed during the first pass.

Banding

Standard Banding

Standard banding is running twelve mist nets for six hours following sunrise on a daily basis during fall or spring migration, weather permitting. Closing time may be extended to eight hours after sunrise to make up time lost earlier in the morning. Please note the extended hours in narrative of the Daily Log (Figure 3) and on the Net Hour form (Figure 5).

Non-standard banding

Non-standard banding refers to banding done using station bands outside the standard banding period and monitoring protocols for diurnal migration. Non-standard banding other than nocturnal owl banding at Mugaha is discouraged to avoid compromising the standard banding effort for diurnal migration monitoring.

Playback

Playback is only used to target owls and perhaps other research or rare species observed but not captured. This technique is used outside of the six hour standard banding for tracking songbird migration. Play a recorded song of the species at the net using continuous play. Monitor nets every 10-30 minutes.

Selection of net lanes

Twelve out of the 31 net lanes should be used for standard banding (Figure 2). Alternative net lanes were established due to occasional flooding, predator or nesting activity. To maintain consistency between years, a combination of six nets close to the banding lab and six nets away should be used. Preference should be given to those net lanes with a higher number of bird captures, considering species composition and habitat conditions of previous years. The preferred net lanes to be used are 3, 4, 9, 11, 12, 19, 20, 21, 25, and 26 along with two of 17, 22, or 28. They are to be used unless there is a threat to bird safety, excessive wind, uncontrollable predation, or active nesting. Net lanes 5 and 6 and 30 are used for banding owls. If alternative net lanes are required then MNO, with input from the Bander-in-Charge, will decide what net lanes to use. Historical numbers and species composition of birds captured in the chosen net should be similar to the closed net. The number of years of net activity must also be considered.

Type of mist nets

During standard banding, use only four-panel, 12 m, 30 mm mesh, black, tethered, nylon mist nets. For owl banding, use deep pocket, passerine nets or four-panel, 60 mm mesh, black, tethered, nylon mist nets.

COLLECTION OF BANDING DATA

Standard banding effort

Open nets at or near sunrise daily and monitor them for six hours. Instead of adjusting the opening time daily as sunrise changes, nets are opened at the 15 minute interval (e.g. 5:30, 5:45). Nets should be closed in the same order they were opened. One 12 m net operated for one hour represents an effort of 1.0 net hour. Record the time each net is opened and closed on the Net Hour Form (Figure 5), calculate the number of hours each net was open and summarize the hours in the Daily Log (Figure 3). The time of the net round is used for the time opened or closed unless it is opened or closed at a different time for some reason. The reason for late openings or early closures should be noted in the Daily Log (Figure 3).

Nets may be closed due to inclement weather or threat to bird safety. Re-open nets as soon as possible, keeping track of all net hours in the Net Hour Form (Figure 5). If, as a last resort, nets must be closed due to a high volume of birds, then close all nets and do not re-open until the backlog is cleared. Bird safety is paramount.

If a mist net is destroyed by a mammal replace the net as soon as it is safe to do so and reopen it, being sure to record the times it was closed (damaged) and the new net opened.

Making up missed effort
Lost net hours during standard banding may be recovered by opening longer, up to eight hours after sunrise. However, these extended hours beyond the standard six hour window, although still considered "standard banding," should be noted.

Frequency of net rounds
Nets are to be visited every 30 minutes and more frequently when conditions warrant it (the temperature is at or below 0ºC, it's damp and cool, the temperature is above 25ºC, the wind speed increases, there is concern about a predator, or volume is particularly intense). If a net is in the full sun, and the temperature is above 25°C it must be checked even more frequently or perhaps even closed.

Extraction

People removing birds from nets must have apprenticed under an experienced person and have the approval of the bander-in-charge or trainer. "Extractors" should always carry a walky-talky on net rounds for emergencies or assistance, particularly when checking the far nets. The banders or experienced volunteers should accompany new volunteers on net rounds to give the new volunteer more learning opportunities. New people may not know that some flycatchers in particular will play dead, thrushes are susceptible to becoming tongued, blackbirds may injure their pin feathers if placed in an overly big bag, and so forth. Helping new volunteers to learn in a safe, respectful and enjoyable manner is a priority during the daily operation of the station.

A clean bird bag should always be used. There should be extra bags kept at one of the far nets. Place a clothes peg, noting net number (including yellow 'F' pegs for flycatchers and red 'R' pegs for retraps), on cord of the bird bag. Use the 24-hour clock method to note time of net round.

Notify the bander when you have young with pin feathers, hummingbirds or stressed birds, so these can be processed in order of priority.

Stressed birds
Birds can be stressed by heat, cold and even just handling. Be aware of what birds are more susceptible to stress and know how to deal with them (North American Banding Council. 2001a)

Hummingbirds
Unless the bander is qualified to band hummingbirds and the station has the appropriate bands, release hummingbirds at the net after recording, if possible, their species, age, sex, time of day and net number. This information will be used for the daily log and estimated totals (ETs).

Local young
For any young with pin feathers, ensure they are released in the area where they were captured. Release the young birds with their accompanying adult if they are caught together.

Order of processing

Process stressed birds first, followed by hummingbirds, local young, new birds and recaptures. **Only individuals of known species can be banded. The details of the data to be collected from each bird are listed in the following section, RECORDING OF BANDING DATA.**

Priority of banding data
Except during **rare**, extreme activity peaks, all of the banding data should be collected and recorded on the Banding Data Sheet (Figure 6) for all of the birds as outlined in the subsequent section RECORDING OF BANDING DATA. This includes primary data required by the banding office and for calculating population trends: band number, species, age, how aged (if aged determined), sex, how sexed (if sex determined), moult (present or absent), status, date, net number and time of net round. It also includes supplemental banding data such as, in the order of priority: wing chord, weight, fat, and moult cards. Depending on the species, some of the supplemental data will need to be noted to complete the primary assessment.

If there is a large influx of Pine Siskins that the bander cannot handle, then it is appropriate to only collect the primary banding data noted above for Pine Siskins until the volume of birds is more manageable. If reducing the data collected for Pine Siskins still doesn't help in removing the backlog of birds then close the nets using the appropriate procedures as noted under Standard Banding Effort. The welfare of the birds takes first priority, and we always advocate quality over quantity in data collection. It is **unacceptable** to classify birds as unknown ages and sexes just to band more birds.

Suggestions for processing birds quickly
Before the season commences, it is critical that banders are familiar with the banding protocol and criteria, as well as the western species and subspecies regularly captured at the Mackenzie station. Be familiar with how to: separate brood patches from bare bellies of juveniles, recognize flight feather moult, age and sex Pine Siskins quickly; identify flycatchers (review Flycatcher Identification Key, Figure 10) and use the Flycatcher Chart to aid identification, (Figure 9); distinguish between Orange-crowned and Tennessee Warblers; and determine the subspecies of Dark-eyed Juncos, Orange-crowned, Wilson's and Yellow-rumped Warblers. The banders should know the plumage features that help separate the Solitary Vireo complex, and the identifying features of the various sapsucker species and hybrids.

Difficult birds should be left to the end. A trained volunteer can easily scribe for two banders or extract birds exclusively. Banders can also divide tasks during busy times such as one processing recaptures while the other processes new birds. Taking a list of the first band numbers of each band size used that day with you on net rounds can eliminate bringing back same day recaptures.

Identification of species/subspecies

Only individuals of known species can be banded. Use Pyle et al (1997) to identify species and sub-species, as well as for aging and sexing passerines. Other helpful guides are: for identifying warblers (Curson et al. 1994, Dunn and Garrett 1997), sparrows (Byers et al. 1995, Rising and Beadle 1996), waders (Prater et al. 1987) and difficult species (Kaufmann 1990). Sibley (2000), Kaufmann (2000) and National Geographic Society (2002) are useful guides for all birds.

Flycatchers
Use the flycatcher chart (Figure 9) if you need to key out a species. A quick reference to the characteristics of the empidonax flycatchers is provided in Figure 10.

Dark-eyed Juncos
The northwestern Cassiar Slate-coloured Junco (*J.h. cismontanus*) represent a stable population of apparent hybrids between Slate-coloured (*J.h. hyemalis*) and Oregon (*J.h. oreganus*) Juncos and are intermediate in colouration between the two (Rising and Beadle 1996). According to the Canadian Bird Banding Office (Metras, personal communication), these birds should be classed as Slate-coloured Junco (*J.h. hyemalis*).

Recaptures of birds

Recaptures (also called Retraps) are captures of previously banded birds. Birds banded and recaptured on the same day are called “same day retraps” or “same day recaptures”. The most common recapture is a bird that was banded earlier in the same season. A return is a recapture of a bird that was banded in a previous year or a previous season. A foreign recapture is the recapture of a bird banded elsewhere (also considered a foreign encounter). A bird banded in non-standard banding and recaptured in standard banding the same season is considered a non-standard banding recapture the first time it is recaptured, in subsequent recaptures it is considered a normal recapture.

Recaptured birds banded or recaptured earlier on the same day are to be released without being processed. If the extractor knows from the band number that a bird was banded that day they may release it at the net.

Process all other recaptures similar to new birds except record the data on the appropriate Retrap Card (Figure 11). It is critical to double-check the number for accuracy and review the original data while the bird is still in hand. When a bird is recaptured put a check in the Recapture column on the original banding data sheet. This lets the bander know there is a retrap card for that particular individual. If a bird was unsexed when banded and can be sexed at the date of recapture this should be noted. Some juncos may be Unidentified Dark-eyed Junco when banded, but may be identifiable when recaptured. The date the junco is identified to its subspecies should be noted on the original banding data sheet.
Note: Please take particular care to ensure fat and weight are measured as accurately as possible for studies assessing quality of stopover sites. If possible, complete a moult card (Figures 12 or 13) on these individuals after reviewing the section on ‘Moult’ under RECORDING OF BANDING DATA.

Returns and foreign recaptures are of special interest and should be noted in the narrative of the Daily Log (Figure 3).

Owl Banding

Playback is used to target owls. Play a recorded song of the species at the net using continuous play. Monitor nets every 10-30 minutes. In the past, Boreal and Northern Saw-whet Owl and Northern Pygmy

Owl calls have been used. The number of owls banded each day is added to the Non-standard Banding totals for that day.

RECORDING OF BANDING DATA (*almost no rewording just reordering..*)

It is critical to measure the bird accurately and record the data carefully on the banding data sheet (Figure 6) using the appropriate banding codes (Figure 7). Use the standard alpha codes (Figure 8) provided by the banding office for bird species and subspecies. Use the band sizes recommended by the Bird Banding Office and noted in the North American Bird Banding Manual (Gustafson et al. 1997) or in updated reports from the banding office..

Banding Data Sheet

Each banding data sheet (Figure 6) is designed to hold data for 25 out of the 100 bands on a single string. Consequently, the first band number on a sheet should end in 01, 26, 51 or 76. If not, please count down the rows to enter your first band in the appropriate row, drawing a line through the row(s) above to indicate that the bands were previously used. Be sure to fill in the full band number of the first band used on each page. At the top of each page, enter the year, the band size, and note when the full page has been entered into Band Manager by initialing the first box above "Entered." If only some of the bands have been entered please make a note in the margin regarding which bands have been entered so far. Drawing a line with a highlighter under each day of data as it is entered at the end of the day helps prevent errors in the date. When the data has been printed out and a page has been checked please initial the second box at the top of the page.
When entering data (specifically the date, the status, the net number, the time and the Bander's Initials) if the information on the line above is the same you can draw a line through the appropriate spaces. If some information is not collected (for instance the weight) use x in the spaces or leave it blank

Region/station/ location
The region is Mackenzie, The station will normally be Mugaha Marsh. If banding is done in a different location be sure to take the GPS readings and note them on the sheet with the name you have used for that site. When Mugaha is the station the location code is 2. Gagnon was 1, Mackenzie (town) was 1A.

Band no. last 2 digits
Enter the last two numbers of the bird band and ensure it follows the same band sequence as listed in the column above it. If band numbers are recorded out of order, PLEASE make a note that they are indeed used in that order so it isn't considered a scribe error.

Species
Enter the four letter alpha code (Figure 8) for the bird species. Record BADE if the band is destroyed or BALO for a lost band.

Recap
Put a tick here if the bird is recaptured at a later date to indicate there is a retrap card for this individual.

Age
Enter a single digit code for the age class of the bird. Where possible, particularly closer to the spring and for many of the near passerines, please age the birds as precisely as you can. The codes are:

0 Unknown age. A bird that cannot be placed in any of the year classes below. Except in cases where data were not recorded or have been lost during the nesting season. Only birds banded after the

breeding season and before January 1 can be correctly coded unknown. This code may at times be used if a bird escapes prematurely.

1 After hatch year. A bird known to have hatched before the calendar year of banding, but whose exact year of birth is unknown. Birds that would have been unknown on December 31 “graduate” to class ‘after hatch year’ on January 1. Example: Banded 1987 - hatched before January 1, 1987

2 Hatch year. A bird capable of sustained flight known to have hatched during the calendar year in which it is banded. Example: Banded 1987 - Hatched 1987.

4 Local. A young bird incapable of sustained flight. Pyle suggests using this for birds that have not fledged.

5 Second year. A bird known to have hatched in the calendar year preceding the year of banding and in its second calendar year of life. Example: Banded 1987 - Hatched 1986.

6 After second year. A bird known to have hatched earlier than the calendar year preceding the year of banding, year of hatch otherwise unknown. Example: Banded 1987 - Hatched 1985 or earlier.

7 Third year. A bird known to have hatched in the calendar year preceding the year before the year of banding, now in its third year of life. Example: Banded 1987 - Hatched 1985.

8 After third year. A bird know to have hatched prior to the calendar year preceding the year before the year of banding, now in at least in its fourth calendar year of life. Example: Banded 1987 - Hatched 1984 or earlier.

9 Other

How aged

Enter a single digit code for how the bird was aged. Two codes may be entered. The codes are:

1 - Plumage.
2 - Skull.
3 - Eye colour.
4 - Wing length.
5 - Cloacal protruberance.
6 - Brood patch.
7 - Mouth/bill colour.
8 - Culmen length.
9 - Other.

Sex

Enter a single digit code for the sex of the bird. The codes are:

0 - Unknown sex. To sex the bird was attempted, but couldn’t be identified with confidence.
4 - Male.
5 - Female.

How sexed

Enter a single digit code for how the bird was sexed. Two codes may be entered. The codes are:

1 - Plumage.
2 - Skull.
3 - Eye colour.
4 - Wing length.
5 - Cloacal protruberance.
6 - Brood patch.
7 - Mouth/bill colour.
8 - Culmen length.

Wing

Wing chord. Measure the length of a closed, unflattened wing to the nearest mm. (Figure 14).

Weight
Use the electronic balance or a Pesola spring scale to record the weight of the bird to the nearest tenth of a gram.

Status
The status code contains three digits. The first digit provides the status of the bird and the second and third digits provide additional information. If in doubt as to what code to use explain in comments or on back of data sheet and fill it in later. The most commonly used code is "300". The first digit of "3" relates to a normal wild bird released in same 10 minute block as captured, held 24 hours or less. A "00" for the second and third digits means federal (USGS) numbered metal band only.

Another code you may use is "500". The first digit of "5" relates to a bird that is sick, exhausted, injured (old or new), crippled, or with a physical deformity; held 24 hours or less, may or may not be treated or transported. As above, the "00" for the second and third digits means federal (USGS) numbered band only. This code requires a remark in Band Manager.

The codes used to define the status of a bird are given in the North American Bird Banding Manual (Gustafson et al. 1997) with the shortened definitions below.

Table 5. Status and Additional Information Codes

Code	First digit	Second & third digits	Requires remark
200	Transported (see manual for details)	USGS band	Yes
300	Normal bird	USGS band	No
301	Normal bird	USGS band + colour leg band	No
308	Normal bird	USGS band + temporary markers (e.g. paint or dye)	No
318	Normal bird	USGS band + blood sample taken	No
319	Normal bird	USGS band + blood sample taken + auxiliary marker(s)	Yes
325	Normal bird	USGS band + two or more auxiliary markers	Yes
500	Sick, exhausted, Injured (old or new), crippled, or with physical deformity held <24hrs.	USGS band	Yes
700	Rehabilitated and held >24 hrs	USGS band	Yes
800	Held >24hrs for experimental or other purposes	USGS band	Yes

Date
Record two digit code each for day, month and year.

Trap
Record net number.

Time
Record time of net round.
Note: During the first few years, the actual time the bird was extracted was recorded.

Brood Patch (BP) *as adapted from 2004 MAPS protocol (DeSante et al. 2004)*
The extent/stage of a bird's brood patch (BP) is a standard measure of an individual's breeding condition and an opportunity to sex more species . Just prior to and during the time that the female (and in some species, the male as

well) is incubating eggs in a nest, the feathers of the lower breast and abdomen are lost, vascularization increases just below the skin, and considerable fluid collects below the skin. The purpose of these changes is, of course, to facilitate the transfer of heat from the incubating bird's body to the eggs. The scale shown below should be used to record the sequence of events in the development and regression of a brood patch.

Note: In hummingbirds and in juveniles of most species, the lower breast and abdomen are normally unfeathered. This can cause it to look like a brood patch of 1 or 4, but the area is darker red and unwrinkled and usually has a less distinct margin.

0 none: No brood patch is present. The lower breast and abdomen are more or less feathered. Unfeathered areas of the breast and abdomen are smooth without evident vascularization.
1 smooth: The lower breast and abdomen feathers are dropped and some vascularization can be seen, but most of the area is still rather smooth and dark red.
2 vascularized: Vascularization is evident, some wrinkles are present, and some fluid is present under the skin, giving the area a pale, opaque, pinkish colour as opposed to the normal, dark-red muscle colour.
3 heavy: The vascularization is extreme, the brood patch becomes thickly wrinkled, and much fluid is present under the skin. This is the maximum extent of the brood patch and corresponds closely to the time during which the bird is incubating eggs.
4 wrinkled: The vascularization mostly has disappeared and the fluid under the skin is mostly gone. The skin, however, retains many thin, dry-looking, contracted wrinkles.
5 moulting: The vascularization and fluid and most of the wrinkles are gone. New pinfeathers are present as the area begins to become re-feathered. Most birds do not reach class 5 BPs until the nesting season is over as the prebasic moult has begun.

The sequence of 0 to 5 is rather symmetric. Classes 1 and 5 resemble each other, class 5 being distinguished most easily by the growth on new feathers. Similarly, classes 2 and 4 resemble each other but class 4 can be distinguished by its dry, thin wrinkles, as opposed to the thick, fluid-filled wrinkles of class 2.

Cloacal Protuberance (CP) *as adapted from 2004 MAPS protocol (DeSante et al. 2004)*
The extent/stage of a bird's cloacal protruberence (CP) is a standard measure of an individual's breeding condition and an opportunity to sex more species. As the breeding season approaches, the cloaca of most male birds (and female Wrentits) begins to enlarge and forms an obvious protuberance which serves a role in sperm storage. The development of the cloacal protuberance is recorded according to a system shown below.

0 none: Cloaca not enlarged.
1 small: Cloaca somewhat enlarged and noticeably swollen. The shape of the protuberance is generally such that it is widest at the base and narrowest near the tip (conical). Since small cloacal protuberances (CPs) can be hard to discern, caution should be used in ageing or sexing birds on the basis of a CP of 1 alone. A CP of 1 can **NOT** be used to age or sex thrushes of the genera *Catharus*, *Hylocichla, Turdus,* or *Ixoreus*. We have found that unenlarged cloacas in these species have often been designated CP = 1, which regularly has led to incorrect age or sex determination.
2 medium: Cloacal protuberance large, with a diameter fully as large near the tip as at the base (cylindrical).
3 large: Cloacal protuberance very large and with a diameter considerably larger in the middle that at the base (bulbous).

Unlike a brood patch (see below), a regressing CP simply goes back down the scale: 3-2-1-0. CPs vary greatly in size and shape among species, being largest and most prominent in sparrows and thrushes and

much less prominent in jays and Wrentits. It may be possible to sex species that rarely show prominent CPs by examining the angle of the CP with respect to the body axis. In males, the CP seems to point straight out, more or less perpendicular to the body axis. In females, the cloaca seems to point toward the rear of the bird, somewhat more parallel to the axis of the body. This same tendency can be used with caution to distinguish the occasional slightly enlarged cloacal region of a female from a true class 1 CP of a male. Class 2 and Class 3 CPs of males, of course, cannot be confused with those of females in any species except, possibly, in Wrentits.

Note: All cloacas, whether enlarged or not, stick out. A true CP is characterized by firmness and lateral swelling. Note also that immature birds DO NOT get CPs.

Feather wear

Aging can be done using feather wear. Refer to the Identification Guide to North American Birds (Pyle et al. 1997, p. 210). Also, the 2004 MAPS Manual (DeSante et al. 2004) gives the following description of flight-feather wear:

The juvenal generation of flight-feathers (primaries, secondaries, and rectrices) is structurally weaker than later (adult) generations of feathers and thus may wear and fade at a faster rate. Furthermore, because young birds grow their juvenal flight-feathers considerably before adults moult their flight-feathers, at any given time during the following 12 months juvenal flight-feathers are older than the new generations of adult flight-feathers. The result is that juvenal feathers in the following spring are likely to show greater degrees of feather wear than do adult feathers at that time. If so, these data may help to determine the age of birds first captured in the spring. In addition, hatching year birds in the summer have very fresh, new flight-feathers, while adult flight-feathers, before they are moulted are very old and worn. This also helps facilitate the determination of age in mid summer birds. Examine only the outer 4 - 5 primaries to determine wear. Flight-feather wear should be classified according to the scale below:

0 none: No wear at all. The feather edges are perfect. A light-coloured edge exists all the way around the feathers, including the tips.
1. slight: Very little wear. Feather edges are only slightly worn and no actual fraying or nicks have occurred. Often, a light-coloured edge exists around the sides of the feathers but not at the tips.
2. light: Relatively light wear. The feathers are definitely worn but with very little fraying and very few actual nicks.
3. moderate: The feathers show considerable wear and some very definite fraying. Nicks and chips are obvious along the vanes.
4. heavy: The feathers are very heavily worn and frayed. The tips are often worn completely off.
5. excessive: The feathers are extremely ragged and torn up, and the shafts are usually exposed well beyond the vanes. All the tips are usually completely worn or broken off.

Feather shape

Another tool for aging is feather shape. Examples are provided in Pyle et al. (1997) and MNO's collection of photos for common species This photo of HY (on left) and AHY (on right) Blackpoll Warbler tails, from September 2001, shows the different feather shape by age.

Moult

Always record 1 or 0 (i.e. present/absent) in the moult column of the banding sheet. Complete a detailed assessment of moult on the moult card (Figure 12or 13) only if further handling of the bird will not put it or other birds at risk. Refer to Figure 15 and Figure 16 for the diagram of the bird's wing and the coding of the moult sequence, respectively. Keep a record of the species and ages for which moult cards have been done in that season and year. Priority birds are those of a species with little or no moult data. Two priority species are Northern Waterthrush and Yellow Warbler. The moult data can be used to evaluate the importance of stopover habitat. Ideally, there will be detailed moult sequences noted for 10-20 birds of each young and adults of all species in a season. Provide as many details as you can in the comments section of the banding data sheet using standard abbreviations (see Figure 17), when not completing a moult card. As moult cards basically score the stage of growth of moulting flight feathers use moult cards only for adult birds and HY birds that moult flight feathers. Record extent of moult on others in the comment section of the banding sheet. See Pyle et al (1997), Froehlich (2003) and Jenni and Winkler (1994) for a description of moult.

For individuals that are recaptured, the progression of their moult can provide further insight into the duration of stopovers as well as a more accurate measure of feather growth. Repeat moult cards should be done if their moult has changed since their previous record (about 5 days) and should be accompanied with successive weight and wing measurements documented on their retrap card.

Fat *as adapted from 2004 MAPS protocol (DeSante et al. 2004)*

Subcutaneous fat is a yellow or orange substance that is stored under the skin and is used as fuel for migratory flights and for maintenance during the cold winter months. Fat generally is stored in three discrete areas that usually begin filling in the following order: (1) the hollow in the furculum (wishbone) just below the throat at the top of the breast muscles; (2) the hollow directly under the wing, essentially in the “wingpit," and (3) the lower abdomen just anterior to the vent area. The stored fat can be seen clearly through the nearly transparent skin and contrasts with the dull, dark reddish colour of the breast muscles. It is seen most easily by holding the bird on its back while placing the index and middle fingers on the front and back of the bird’s neck, stretching the head slightly forward along a line parallel to the body, and gently blowing the feathers away from the upper breast to expose the furculum. Then check under the wing and on the abdomen, again by blowing the feathers gently out of the way. Fat generally can be assessed quite easily while checking for breeding condition and body moult. Use the codes shown below to record fat content:

0 none: No fat in the furculum or anywhere on the body.
1 trace: A very small amount of fat in the furcular hollow (less than 5% filled) but not enough to cover the bottom of the furculum. No or just a trace of fat under the wing, on the abdomen, or anywhere else on the body.
2 light: the bottom of the furculum is completely covered but the furcular hollow is less than 1/3 filled. A small amount of fat may be present under the wing, on the abdomen or both.
3 half: the furcular hollow is about half full (actually anywhere from 1/3 to 2/3). A covering pad of fat is definitely present under the wingpit and usually on the abdomen.
4 filled: The furcular hollow is full (actually anywhere from 2/3 full to level with the clavicles). A thick layer of fat also occurs under the wing and on the abdomen.
5 bulging: The furcular hollow is more than full; that is, the fat is bulging slightly above the furculum. The fat under the wing as well as that on the abdomen is also well mounded.
6 greatly bulging: Fat is bulging greatly above the furculum. Large mounds of fat occur under the wings and on the abdomen.
7 very excessive: The fat pads of the furculum, “wingpit,” and abdomen are bulging to such an extent that they join. Nearly the entire ventral surface of the body is covered with fat, and fat even extends onto the neck and head.

Skull *as adapted from 2004 MAPS protocol (DeSante et al. 2004)*

In order to determine the degree of skull pneumaticization, it is necessary to part the feathers of the head to get them out of the way (wetting them slightly may help), then gently rock the skin back and forth over the skull while looking through the skin to the skull. The best procedure is to start at the back of the skull and proceed toward the front looking for the pattern of the line that separates the pneumaticized area from the area that is not pneumaticized. A

pneumaticized skull consists of two layers of bone connected by tiny "struts" and filled with air, much like the wing of a plane. A pneumaticized skull appears opaque and grayish with tiny white dots. In contrast, an un-pneumaticized skull, consists of a single thin layer of bone, appears pinkish and somewhat translucent and never shows the minute dots characteristic of a pneumaticized skull. We very strongly recommend the use of a binocular magnifier such as the OptiVISOR for determining the degree of skull pneumaticiztion. See Ralph et al. 1993, and Pyle 1997 for more complete information on the determination of age by skull pneumaticization. See Figure 18, a chart showing skull pneumaticization that was drawn with assistance from Danielle Kaschube from the Institute of Bird Populations.

Skull should be recorded by means of the scale shown below:

0 none: Skull not pneumaticized; that is, only a single thin layer of bone covers the entire brain, which shows through the thin covering of bone and appears as an unmarked, pinkish color. Beware of thick-skinned species such as corvids and parids, whose skull can be very difficult to see because the skin itself tends to be rather opaque; and heavily-muscled species such as grosbeaks and cardinals, whose jaw muscles can obscure the rear of the skull.

1 trace: A trace of skull pneumaticization can be seen at the very back of the skull, usually appearing as an opaque, grayish crescent or a very small triangular area. Somewhere from 1 to 5% of the skull is pneumaticized.

2 less than 1/3: Skull less than 1/3 pneumaticized but some pneumaticization is obvious. Thus, somewhere from 6 to 33% of the skull is pneumaticized. Generally, the posterior part of the cranium has an inverted "u" or "v" shaped area of pneumaticization that is usually distinctly grayish and contrasts with the unpneumaticized area. The grayish area typically shows the characteristic, small, whitish dots of a pneumaticized skull.

3 half: Skull greater than 1/3 but less than 2/3 pneumaticized. In typical birds, most of the rear half of the skull is pneumaticized, as is a small portion of the front part extending back around the eyes. This front part of the skull is usually very difficult to see because the feathers of the forehead are dense and short and difficult to move out of the way. In most cases, a bird given a "3" skull will show a pneumaticized area extending up the midline or sides of the skull.

4 greater than 2/3: Skull at least 2/3 pneumaticized but at least small areas of the skull not pneumaticized. Thus, somewhere from 67% to 94% of the skull is pneumaticized. The un-pneumaticized areas generally show either as two oval, pinkish spots on either side of the cranium or (rarely) as a single spot in the center of the skull.

5 almost complete: Somewhere from 95 to 99% of the skull is pneumaticized. These birds have virtually a fully pneumaticized skull that shows one or two tiny, dull pinkish areas where the pneumaticization is incomplete. It should be noted that some birds, including many flycatchers, thrushes, and vireos, never develop a fully pneumaticized skull, even when adult, but retain a "5" skull throughout life. Thus, a "5" skull bird cannot necessarily be called a HY/SY bird because it could be an AHY/ASY bird whose skull never completely pneumaticized.

6 fully complete: Skull fully pneumaticized.

8. invisible: Skull examined but extent of pneumaticization not visible. **Do not** use this code if you have determined that pneumaticization is incomplete but are unsure of the appropriate score; in this case make your best guess.

Bander's initials
Record the initials of the person banding the bird.
Comments
Use this space to record moult, special measurements taken (exposed culmen, bill depth, bill width, comments on subspecies etc. If it is NSB this should be noted here.

Retrap Card

The top line of the retrap card (Figure 11) is for the data from the banding data sheet (Figure 6) when the bird was initially banded. The lower lines are for data taken when the species is recaptured. Collect the same data as you would on a new bird. Note if an unknown Yellow-rumped Warbler, or unidentified Dark-eyed Junco when banded can be identified to subspecies when recaptured. If a Solitary Vireo can be identified as a Cassin's Vireo or Blue-headed Vireo when recaptured this should be recorded. If you feel some of the original data conflicts with what you have recorded let the Bander-in-Charge know **before** the bird is released.

How to complete card (Figure 11):
Species: Write the species name out in full.

Band size: Size of band.
Band number: Write in the full band number, being sure to check that it is **accurately** read.
Permit no. It is not necessary to fill this in unless card is used other than at Mugaha and under a different permit.
Retrap code: 2 if Mackenzie banded using station bands, 3 if foreign banded.
Species code: fill in alpha code for the species.
AOU number: Not necessary to fill this in, Band Manager will fill it in automatically.

Moult Card

Do not complete moult cards (Figure 12 and 13) on birds that appear stressed or are in extremely heavy moult. Moult cards provide useful information, but the safety of the bird must take top priority at all times. Figure 16 shows the stages of growth of feathers. Study a chart of the wing so you know how to count the primaries and secondaries (Figure 15). The moult card in Figure 12 is only suitable for birds with 9 secondaries (3 tertials, 6 secondaries) and 9 or 10 primaries. Use the moult card in Figure 13 for species with more secondaries.

Species: Write the name of the species out in full
Age/Sex: use alpha codes for age and sex
Band No. write the full band number in space provided
Region: Mackenzie
Station: Mugaha or if used elsewhere please specify the name and GPS location
Date: Day/Month/Year
Wing: circle whether the data is taken on the left or right wing
Fill in the boxes with the appropriate code for each feather in the wing and tail. Score greater coverts if you can or just tick the appropriate line to indicate whether they are old, moulting or new.
Alula, or bastard wing: tick appropriate line to indicate whether is old, moulting or new.
Lesser & median coverts, under wing coverts, head, upper parts and under parts: indicate if there no moult, active moult or if the moult is apparently completed
Observer: Initials of the person scoring the moult.

SUMMARIZING DATA

The Bander-in-Charge is responsible for ensuring all of the forms listed below are completed daily.

Daily Species Totals Form

The region, station and date must be filled in on each page of the Daily Species Total Form (Figure 4).

The number of species counted daily by all volunteers and banders during general observations, the census, standard and non-standard banding are tallied on the Daily Species Total Form (Figure 4) and entered into BSC's Daily Estimated Totals (DET) program every afternoon/evening by the Bander-in-Charge or Assistant Bander. It is imperative that the Bander-in-Charge receives all of the observations of birds recorded by staff and volunteers, including when and where they were recorded, before leaving the site on a daily basis. Although the bander-in-charge is responsible for tallying all observations each day, it is best if everyone who volunteered participates. Ensure the total number of birds banded agrees with the total number of bands used (excluding any bands destroyed or missing) and the number of retraps agree with the number of retrap bands listed in the Daily Log (Figure 3). Please do not use < > or ~ or + or ( ) on the Daily Species Total Form as they can not be incorporated into the DET program when the data is entered. The codes on the Daily Species Total Form are:

SB Band - Standard banding. This is a total of the number of birds newly banded at the station.

SBNSB R - Standard banding-non-standard banding recaptures This is the total of first time recaptures of non-Standard banded birds recaptured during standard banding

NSB Band - Non-standard banding. This is a total of all birds banded during non-standard banding.

Rec.- Recaptures. This includes recaptures of birds previously banded other than first time recaptures of birds that had been banded in non-standard banding. It does not include recaptures of birds banded the same day as these are released at the net.

NSB Rec.- Non-standard banding recaptures. This is the total number of birds recaptured during non-standard banding.

Cens.- Census. This is a total of the number of birds seen or heard during the daily census.

Obs.- Observations. This is the number of birds observed during the standard banding period.

Other Obs.- Other observations. This is the number of birds seen or heard outside the standard banding period in the recording area.

PKS - Probable known stopover. This is a total of the number of birds identified as probable known stopovers with 80% confidence.

ET- Estimated total. This is a total of the number of birds estimated to be present or passed through the recording area during the day.

At the end of this Daily Species Totals Form (Figure 4), be sure to total the *Number of Individuals, Number of Species*, and *Number of Species Banded and Recaptured* for each column where appropriate and transfer these totals to the Daily Log (Figure 3).

Daily estimated totals and probable known stopovers

Estimated totals (ET) should include observations made outside of the banding time period (within the recording area). Try not to include multiple counts of the same individuals or residents. Record the number of probable or known stopovers (PKS) included in the daily ET by species. PKS are those birds recognized by their behavior or plumage as having been there on a previous day, recaptures or birds known to breed there. Only birds judged to be residents or stopovers with at least 80% certainty should be recorded as PKS. Some obvious ones for this list are the resident loons and Osprey, and families of birds you observe regularly such as the kingbirds in 1998. A brief summary of how ETs were done according to previous banders is presented in Appendix 4**.**

Sub-species and Species that have been split

The total number of species is based on standard American Ornithologists' Union (AOU) taxonomy. Sub-species should be grouped for the daily species totals. For example, the unidentified Dark-eyed Junco (UDEJ) S 567.7 and the two subspecies of Dark-eyed Junco, the Slate-colored Junco(SCJU) S 567.1 and Oregon Junco (ORJU) S 567.0, count as one species for the daily species total, but are totaled separately for each subspecies for the ET. This same counting procedure is used for subspecies of White-crowned Sparrow (WCSP), Northern Flicker (NOFL) and Unknown Yellow-rumped Warbler (UYRW). See the table of subspecies below. The S in front of the AOU number indicates subspecies. There may be a need for adjustments when doing the ETs. For instance, when individuals listed in the Census as Unknown Yellow-rumped Warblers are later identified as Audubon's Warblers the totals should be adjusted accordingly. If a Red-shafted Flicker (RSFL) was banded and a Northern Flicker counted on the Census, and there was likely only one flicker in the area, the Northern Flicker total would be left blank and 1 Red-shafted Flicker put in the total for the ET.

Table 6. Subspecies

Species and AOU number	**Sub-species and AOU numbers code**
DEJU (S567.7)	ORJU (S 567.1), SCJU (S 567.0), UDEJ (S 567.7)
WCSP (S 554.0)	GWCS (S 555.0)
NOFL (no code)	YSFL (S 412.0), FLIN (S 412.3), RSFL (S 413.0)
UYRW (S 655.6)	MYWA (S 655.0), AUWA(S 656.0)

`

Species the AOU has separated, e.g. the Solitary Vireo (SOVI) complex and Western Flycatcher (WEFL), can be totaled separately. The SOVI complex was divided into Cassin's Vireo (CAVI) and Blue-headed Vireo (BHVI). If 1 CAVI and 1 BHVI were banded and 3 SOVI were censused, the total would be 1 CAVI, 1 BHVI and 1 SOVI unless it was certain that the ones censused were different from the ones banded. When counting species you would still have only two species. If 2 SOVI are censused and 1 BHVI is banded you could only count 1 species as you only know for sure that you had BHVI.
The Western Flycatchers was also divided into two species, which should be counted separately (see below)**.**

Table 7. Species that were split

Species that was split and AOU number	Species they were split into and AOU numbers
SOVI (629.9)	BHVI (629.0), CAVI (629.2)
WEFL (464.9)	PSFL (464.1), COFL (464.0)

Net Hours Form

All net hours for each net (identified by number) during standard banding are recorded daily on the Net Hour Form (Figure 5), noting all opening and closing times for each net. The total daily number of net hours is also recorded on the Daily Log (Figure 3). One 12 m net operated for one hour represents an effort of 1.0 net hour. The use of any other traps is also recorded here.

Be sure to document net hours for owl banding, but keep these separate from standard banding.

Non-standard Banding Form

All non-standard netting should be recorded in the same manner as standard netting so birds per net hour can include the non-standard effort, if desired. Non-standard captures should be distinctly marked on the original banding sheet (NSB in the comments), and should be recorded separately from standard banding. Maintain two running totals on a daily basis: the Standard Season Total to Date, and the Non-standard Season Total to Date.
The Non-standard Banding should be documented on the Non-standard Banding data sheet (Figure 19) to maintain an NSB total to date and a quick reference to all NSB birds recaptured in Standard Banding.
Region: Mackenzie
Station: Mugaha
Day/Month/Year: Two digit codes of date bird is banded
Species: Alpha code for species banded
Band Number: Write out the full band number
Location: Location where banding was done, if not at Mugaha use GPS location
Trap: number of net where bird was captured
Time Trapped: time of net round
Total NSB to date: total number of birds banded in NSB this season
Date Recaptured in Standard Banding: First date this bird is recaptured in Standard Banding this season.

Daily Log

The Bander-in-Charge is to ensure the Daily Log (Figure 3) is completed daily.

Banders & Observers:
Each person contributing to the ET, should record their start (Start) and finish (End) times and total the number of hours **actively** observing (OBS. HRS), not time spent banding or recording.

Observer's code:
The observer's general ability to accurately detect a bird by sight and sound.

Table 8: Observer's Code

Code	Description
1	Able to identify 80 to 100% of the birds expected in the sampling area

2	70 to 80%
3	60 to 70%
4	50 to 60 %
5	Less than 50% of the birds expected in the sampling area

Other Assistants:
People who are helping at the station, but not observing or helping with ETs.

Visitors:
People who visited the station.

Weather:
Summarize information as explained under weather conditions on page 8 and write a general synopsis.

Census:
The individual who conducts the daily census should fill in the start and finish time for the census, the weather for the census and complete the census column on the Daily Species Total Form (Figure 4).

Coverage Code:
Depicts the effort observing birds during the day (Table 9).

Table 9. Coverage Codes

Coverage code	Explanation
0	No coverage
1	Casual observations or banding only (no census or ETs); training or set up day
2	Census only (no ETs)
3	Fair coverage. Census and ETs, but only some banding or ETs and banding, but no census (i.e. some species likely missed)
4	Good coverage. Census and at least six hours of banding and ETs
5	Excellent coverage. Above plus visible migration count or two or more observers were active basically the entire day, not just one observer

Additional Data:
Check off subject box for additional information noted in the narrative or elsewhere. This facilitates future data extraction.

Narrative:
Include comments on migration (progressive events, principal migrants, direction of movement, flocking behavior, etc.) and proportion of stopovers vs. residents (biases), rare birds, observations of other animals and plant phenology for events associated with migration. Note extreme migration dates (early and late), banded and/or colour-marked birds, details concerning bird mortality or injury (complete banding injury/casualty report form, Figure 20), highlights, and rare birds. Write species names out in full. Comment on observers and their experience, and any personnel changes.

Band Usage:
Record band numbers or ranges of numbers for each 100-band series used that day.

Summary:
Summarizes totals from Daily Species Totals Form (Figure 4), Net Hour Form (Figure 5), the volunteer hours ,and bands used - today's totals plus year to date totals.

Retraps:

Record the full band number and species code for each recaptured bird that was banded on a previous date. For **returns** please put the **year banded** in brackets after the species code.

Bird Injury/Casualty Report Form

Describe all injuries or casualties of birds during banding, noting if it was an existing problem or probably a result of the banding operation, caused by predation, etc on the Bird Injury/Casualty Report Form (Figure 20). Also, note the date, species (alpha code), trap (net number), band number if banded and the outcome/treatment.

Monthly summaries

Monthly summaries (daily summary for the month) for new birds, and recaptures should be prepared on an excel spreadsheet for each month. Volunteers can help with this.

Electronic data entry

The banding data should be entered daily into the Band Manager program and the resulting file named "MNOfxx", where MNO = Mackenzie Nature Observatory, f = fall, xx = year. Retraps should be entered into Band Manager program and the resulting file named “MNOFRxx, where MNO = Mackenzie Nature Observatory, f= fall, r = retraps and xx = year. Daily Species Totals should be entered into the DET program and the resulting file should be named "MNOfxx", where MNO = Mackenzie Nature Observatory, f = fall, xx = year. Whenever possible the person who checks the entered data should be different from the person who entered it. Contact David Lambie for questions regarding data entry.

Computer data will be forwarded to CWS-Delta and BSC for statistical analysis. Hard copies will be maintained by MNO and CWS-Delta, and will be made available to other birding groups upon request. Banding schedules should be proofed and sent to the Canadian Bird Banding Office within 30 days of the end of the season.

Reporting

The banders will produce a comprehensive report of the season. CWS-Delta will produce an annual analysis (based on last year’s data prior to the end of the current fall season) on banding data for inclusion in the MNO’s annual report. CWS will also produce a periodic report comparing migration in the Mackenzie area to regional migration patterns. MNO Bird Committee will prepare an annual report for the sponsors and volunteers using the bander's report and any analysis provided by CWS, plus additional information on program sponsors and volunteers, the season vegetation, water levels and other factors that may have affected the birds.

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Figure 1. Map of Study Area

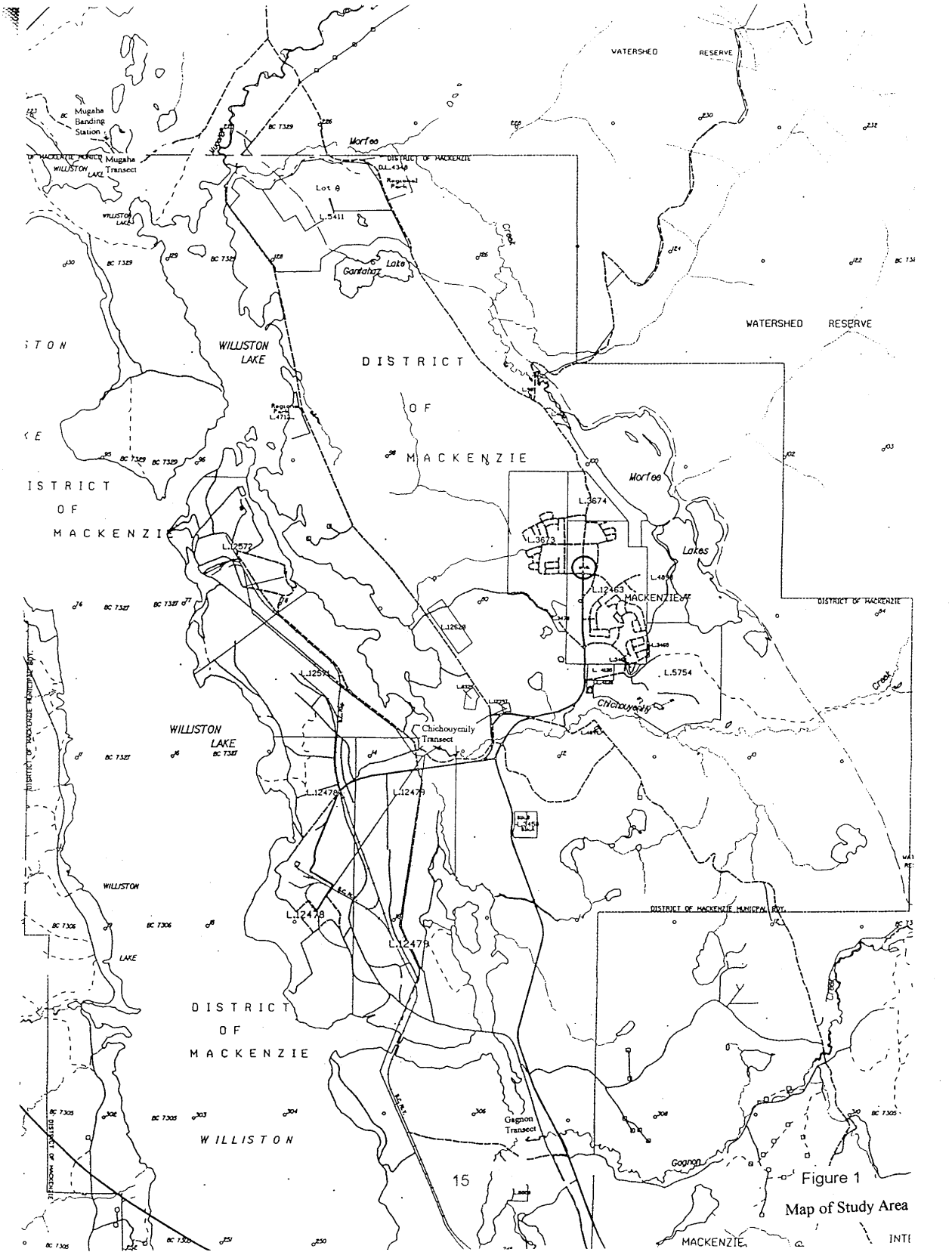


Figure 1
Map of Study Area

Figure2. Sketch showing net lanes and census route

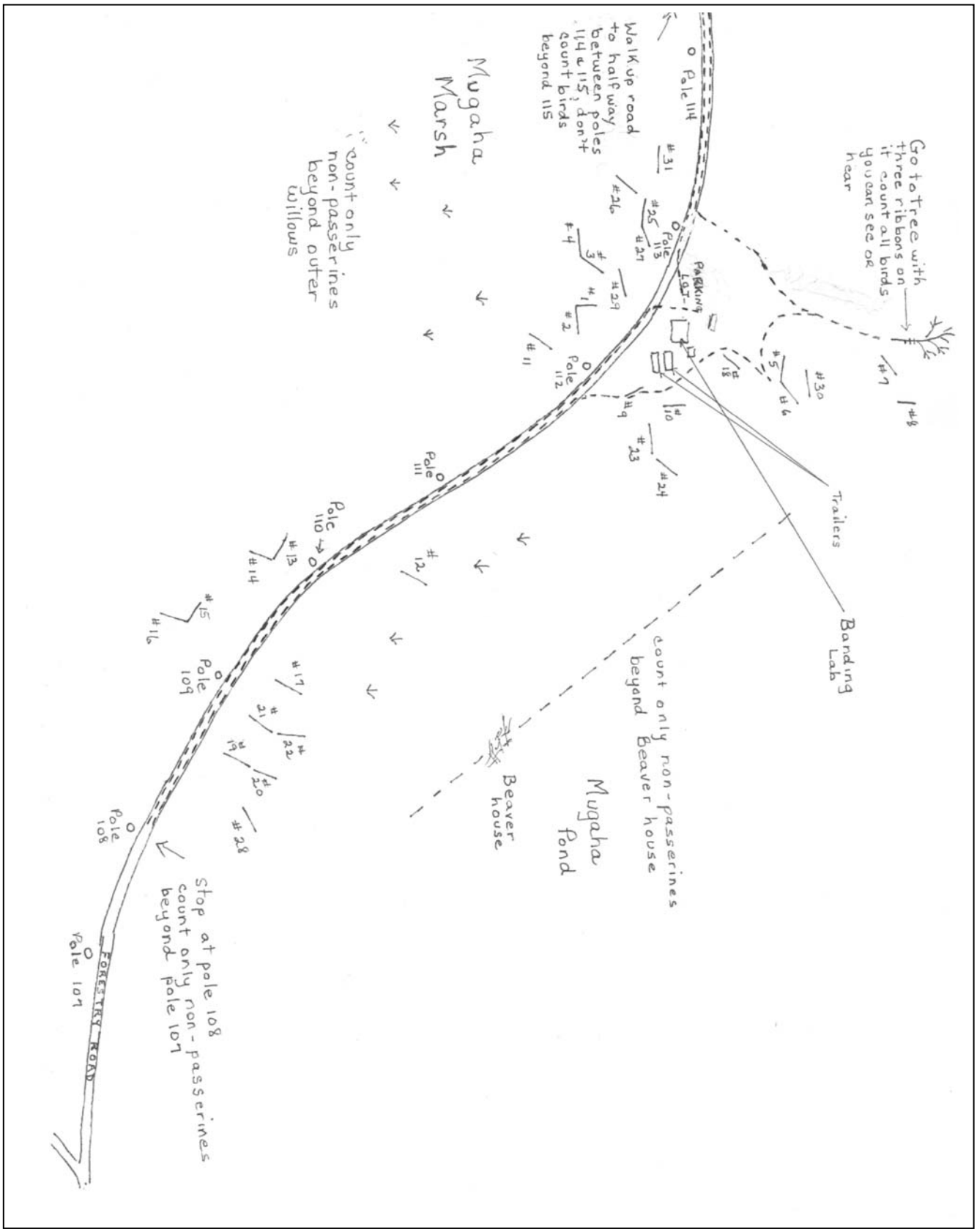


Figure 3. DAILY LOG

Region: Mackenzie Station: Mugaha Marsh

D		M			Y	

Banders & Observers	Code	Start	End	Vol. Hrs.	OBS –HRS SB	OBS –HRS Other
Other Assistants						
Visitors						

Weather	Sunrise	Cens.	6 hrs. after Sunrise	Dusk
Time				
Wind Dir.				
Strength				
Visibility				
Cloud %				
Temp. °C				
Sky Cond.				
Synopsis:				

Census

Start	End	Initials

Coverage Code

Additional Information

Nocturnal Migration		**Diurnal Migration**		**Rarity Report**		**Fauna Flora**		**Banding Casualty**		**Owls**		**NSB**	

Narrative

DAILY LOG

Narrative *continued*

D		M			Y	

Band Usage				
Band	**band numbers**	**used**	**BADE**	**BALO**
Size				
XS				
S				
0A				
0				
1C				
1				
1B				
1A				
2				
3				
3A				
3B				
4				
5				
6				
Today's total				

Summary				
		Today's Total	**Previous Total**	**Year to date totals**
SB	# birds			
	# species			
SBNSBR	# birds			
REC	# birds			
	# species			
NSB (owls)	# birds			
	# species			
Census	# birds			
	# species			
Obs	# birds			
	# species			
Other OBS	# birds			
	# species			
ET	# birds			
	# species			
Net hours	# hrs			
Vol hrs	# hrs			
Band Usuage	# used			
	# destroyed			
	# lost			

Retraps

Write Full ***Band Number*** & ***Species*** of **Each** RETRAP, not banded today. Put year banded in brackets for Returns.

Figure 4. Daily Species Totals

Region: Mackenzie **Station:** Mugaha Marsh **Date:** _____

D M Y

Species	SB Band	SBNSBR	NSB Band	Rec.	NSB Rec.	Cens.	Obs.	Other Obs.	PKS	ET	Code
Common Loon											COLO
Pied-billed Grebe											PBGR
Horned Grebe											HOGR
Red-necked Grebe											RNGR
Great Blue Heron											GBHE
Canada Goose											CAGO
American Wigeon											AMWI
Mallard											MALL
Blue-winged Teal											BWTE
Northern Shoveler											NSHO
Northern Pintail											NOPI
American Green-winged Teal											AGWT
Ring-necked Duck											RNDU
Greater Scaup											GRSC
Lesser Scaup											LESC
Bufflehead											BUFF
Common Goldeneye											COGO
Barrow's Goldeneye											BAGO
Hooded Merganser											HOME
Common Merganser											COME
Osprey											OSPR
Bald Eagle											BAEA
Northern Harrier											NOHA
Sharp-shinned Hawk											SSHA
Northern Goshawk											NOGO
Red-tailed Hawk											RTHA
American Kestrel											AMKE
Merlin											MERL
Peregrine Falcon											PEFA
Ruffed Grouse											RUGR
Sora											SORA
American Coot											AMCO
Sandhill Crane											SACR
Semipalmated Plover											SEPL
Killdeer											KILL
Greater Yellowlegs											GRYE
Lesser Yellowlegs											LEYE
Solitary Sandpiper											SOSA
Spotted Sandpiper											SPSA
Semipalmated Sandpiper											SESA
Western Sandpiper											WESA
Least Sandpiper											LESA
Pectoral Sandpiper											PESA
Short-billed Dowitcher											SBDO
Long-billed Dowitcher											LBDO
Wilson’s Snipe											COSN
Sub-total											

Daily Species Totals

Region: Mackenzie **Station:** Mugaha Marsh **Date:** _____

D M Y

Species	SB Band	SBNSBR	NSB Band	Rec.	NSB Rec.	Cens.	Obs.	Other Obs.	PKS	ET	Code
Bonaparte's Gull											BOGU
Mew Gull											MEGU
Herring Gull											HERG
Great Horned Owl											GHOW
Barred Owl											BDOW
Northern Saw-whet Owl											NSWO
Common Nighthawk											CONI
Calliope Hummingbird											CAHU
Rufous Hummingbird											RUHU
Belted Kingfisher											BEKI
Yellow-bellied Sapsucker											YBSA
Red-breasted Sapsucker											RBSA
Hybrid Sapsucker											HYSA
Downy Woodpecker											DOWO
Hairy Woodpecker											HAWO
Three-toed Woodpecker											TTWO
Northern Flicker											NOFL
Red-shafted Flicker											RSFL
Yellow-shafted Flicker											YSFL
Flicker Intergrade											FLIN
Olive-side Flycatcher											OSFL
Western Wood-Pewee											WEWP
Yellow-bellied Flycatcher											YBFL
Alder Flycatcher											ALFL
Least Flycatcher											LEFL
Hammond's Flycatcher											HAFL
Dusky Flycatcher											DUFL
Western Flycatcher											WEFL
Say's Phoebe											SAPH
Eastern Kingbird											EAKI
Northern Shrike											NSHR
Solitary Vireo											SOVI
Cassin's Vireo											CAVI
Blue-headed Vireo											BHVI
Warbling Vireo											WAVI
Red-eyed Vireo											REVI
Gray Jay											GRAJ
Steller's Jay											STJA
Blue Jay											BLJA
Black-billed Magpie											BBMA
American Crow											AMCR
Common Raven											CORA
Tree Swallow											TRES
Violet-green Swallow											VGSW
Northern Rough-winged Swallow											NRWS
Bank Swallow											BANS
Sub-total											

Daily Species Totals

Region: Mackenzie **Station:** Mugaha Marsh **Date:** _____

D M Y

Species	SB Band	SBNSBR	NSB Band	Rec.	NSB Rec.	Cens.	Obs.	Other Obs.	PKS	ET	Code
Cliff Swallow											CLSW
Barn Swallow											BARS
Black-capped Chickadee											BCCH
Boreal Chickadee											BOCH
Red-breasted Nuthatch											RBNU
Brown Creeper											BRCR
Winter Wren											WIWR
Golden-crowned Kinglet											GCKI
Ruby-crowned Kinglet											RCKI
Townsend's Solitaire											TOSO
Gray-cheeked Thrush											GCTH
Swainson's Thrush											SWTH
Hermit Thrush											HETH
American Robin											AMRO
Varied Thrush											VATH
American Pipit											AMPI
Bohemian Waxwing											BOWA
Cedar Waxwing											CEDW
Tennessee Warbler											TEWA
Orange-crowned Warbler											OCWA
Yellow Warbler											YWAR
Magnolia Warbler											MAWA
Unknown Yellow-rumped Warbler											UYRW
Audubon's Warbler											AUWA
Myrtle Warbler											MYWA
Townsend's Warbler											TOWA
Blackpoll Warbler											BLPW
American Redstart											AMRE
Ovenbird											OVEN
Northern Waterthrush											NOWA
MacGillivray's Warbler											MGWA
Common Yellowthroat											COYE
Wilson's Warbler											WIWA
Western Tanager											WETA
American Tree Sparrow											ATSP
Chipping Sparrow											CHSP
Clay-colored Sparrow											CCSP
Brewer's Sparrow											BRSP
Vesper Sparrow											VESP
Savannah Sparrow											SAVS
Fox Sparrow											FOSP
Song Sparrow											SOSP
Lincoln's Sparrow											LISP
Swamp Sparrow											SWSP
White-throated Sparrow											WTSP
Sub-total											

Daily Species Totals

Region: Mackenzie **Station:** Mugaha Marsh **Date:** _____

D M Y

Species	SB Band	SBNSBR	NSB Band	Rec.	NSB Rec.	Cens.	Obs.	Other Obs.	PKS	ET	Code
White-crowned Sparrow											WCSP
Gambel's White-crowned Sparrow											GWCS
Golden-crowned Sparrow											GCSP
Unidentified Dark-eyed Junco											UDEJ
Oregon Junco											ORJU
Slate-colored Junco											SCJU
Lapland Longspur											LALO
Red-winged Blackbird											RWBL
Rusty Blackbird											RUBL
Brown-headed Cowbird											BHCO
Pine Grosbeak											PIGR
Purple Finch											PUFI
White-winged Crossbill											WWCR
Pine Siskin											PISI
Evening Grosbeak											EVGR
Sub-total											
Number of Individuals											
Number of Species											
Number of Species Band &Rec.											

Figure 5 Net Hour Form

Region: **Mackenzie** Station: _____ Date: _____
D M Y

Net #	Opened		Closed		Reopened		Closed		Reopened		Closed		Total
	Time	Initials	Time	Initials	Time	Initials	Time	Initials	Time	Initials	Time	Initials	Hours

Region: **Mackenzie** Station: _____ Date: _____
D M Y

Net #	Opened		Closed		Reopened		Closed		Reopened		Closed		Total
	Time	Initials	Time	Initials	Time	Initials	Time	Initials	Time	Initials	Time	Initials	Hours

Figure 6. Banding Data Sheet

REGION: MACKENZIE STATION: _____ Sheet # _____

Full number of first Band on this sheet | | | | | | | | | |

Year | | | | |

Band Size | | Entered

Band No. Last 2 Digits		SPECIES	Recap	Age	How Aged		Sex	How Sexed		Wing Chord (mm)				Weight (gms)				Status			Date Day		Month		Year		Location	Trap	Time			BP	CP	FW	Moult	Fat	Skull	Bander's Initials	Comments

Full number of last band on this sheet | | | | | | | | | |

Species	No.	Species	No.	Species	No.	Species	No.	Species	No.	Species	No.

Figure 7. BANDING CODES

RECAPTURE

Retrap card	x

SEX

Unknown	0
Male	4
Female	5

AGE

Unknown age	0
After hatch year	1
Hatch year	2
Local (nestling)	4
Second year	5
After secod year	6
Third year	7
After third year	8
Other (specify)	9

HOW AGED AND SEXED

Plumage	1
Skull	2
Eye color	3
Wing length	4
Cloacal protuberance	5
Brood Patch	6
Mouth/bill color	7
Culmen length	8
Other (specify)	9

STATUS CODES

Code	First digit	Second & third digit
200	Transported (see manual for details)	USGS band
300	Normal bird	USGS band
301	Normal bird	USGS band + color leg band
308	Normal bird	USGS band + temporary markers (e.g. paint or dye)
318	Normal bird	USGS band + blood sample taken
319	Normal bird	USGS band + blood sample taken + auxiliary marker(s)
325	Normal bird	USGS band + two or more auxiliary markers
500	Sick, exhausted, injured (old or new), crippled, or with physical deformity, held < 24 hrs	USGS band
700	Rehabilitated and held > 24 hrs	USGS band
800	Held > 24 hrs for experimental purposes	USGS band

FEATHER WEAR

None	0	Moderate	3
Slight	1	Heavy	4
Light	2	Excessive	5

BREEDING CONDITION

Brood Patch (BP)

None	0
Smooth	1
Vascularized	2
Heavy	3
Wrinkled	4
Moulting	5

Cloacal Protuberance (CP)

None	0
Small	1
Medium	2
Large	3

MOULT

No	0
Yes	1

FAT

None	0
Trace	1
Light	2
Half	3
Full	4
Bulging	5
Greatly bulging	6
Very excessive	7

SKULL

None	0
Trace	1
Less than a 1/3	2
Half	3
Greater than 2/3	4
Almost complete	5
Fully Complete	6
Invisible	8

Figure 8.

Species Alpha Codes

Code	Species Names
RTLO	Red-throated Loon
PALO	Pacific Loon
COLO	Common Loon
PBGR	Pied-billed Grebe
HOGR	Horned Grebe
RNGR	Red-necked Grebe
WEGR	Western Grebe
DCCO	Double-crested Cormorant
AMBI	American Bittern
GBHE	Great Blue Heron
CAEG	Cattle Egret
GWFG	Greater White-fronted Goose
SNGO	Snow Goose
CAGO	Canada Goose
TRUS	Trumpeter Swan
TUSW	Tundra Swan
WODU	Wood Duck
GADW	Gadwall
AMWI	American Wigeon
MALL	Mallard
BWTE	Blue-winged Teal
CITE	Cinnamon Teal
NSHO	Northern Shoveler
NOPI	Northern Pintail
AGWT	American Green-winged Teal
CANV	Canvasback
REDH	Redhead
RNDU	Ring-necked Duck
GRSC	Greater Scaup
LESC	Lesser Scaup
HARD	Harlequin Duck
SUSC	Surf Scoter
WWSC	White-winged Scoter
LTDU	Long-tailed Duck
BUFF	Bufflehead
COGO	Common Goldeneye
BAGO	Barrow's Goldeneye
HOME	Hooded Merganser
RBME	Red-breasted Merganser
COME	Common Merganser
RUDU	Ruddy Duck
OSPR	Osprey
BAEA	Bald Eagle
NOHA	Northern Harrier
SSHA	Sharp-shinned Hawk
COHA	Cooper's Hawk
NOGO	Northern Goshawk
BWHA	Broad-winged Hawk
SWHA	Swainson's Hawk
RTHA	Red-tailed Hawk

Code	Species Names
RLHA	Rough-legged Hawk
GOEA	Golden Eagle
AMKE	American Kestrel
MERL	Merlin
GYRF	Gyrfalcon
PEFA	Peregrine Falcon
BGSE	Blue Grouse
WIPT	Willow Ptarmigan
ROPT	Rock Ptarmigan
WTPT	White-tailed Ptarmigan
RUGR	Ruffed Grouse
SPGR	Spruce Grouse
SORA	Sora
AMCO	American Coot
SACR	Sandhill Crane
BBPL	Black-bellied Plover
AMGP	American Golden-Plover
PAGP	Pacific Golden Plover
SEPL	Semipalmated Plover
KILL	Killdeer
GRYE	Greater Yellowlegs
LEYE	Lesser Yellowlegs
SOSA	Solitary Sandpiper
SPSA	Spotted Sandpiper
UPSA	Upland Sandpiper
WHIM	Whimbrel
SAND	Sanderling
SESA	Semipalmated Sandpiper
WESA	`Western Sandpiper
LESA	Least Sandpiper
BASA	Baird's Sandpiper
PESA	Pectoral Sandpiper
STSA	Stilt Sandpiper
SBDO	Short-billed Dowitcher
LBDO	Long-billed Dowitcher
COSN	Wilson's Snipe
WIPH	Wilson's Phalarope
RNPH	Red-necked Phalarope
REPH	Red Phalarope
PAJA	Parasitic Jaeger
BOGU	Bonaparte's Gull
MEGU	Mew Gull
RBGU	Ring-billed Gull
CAGU	California Gull
HERG	Herring Gull
BLTE	Black Tern
RODO	Rock Dove
MODO	Mourning Dove
GHOW	Great Horned Owl
SNOW	Snowy Owl

Code	Species Names
NHOW	Northern Hawk-Owl
NOPO	Northern Pygmy-Owl
BDOW	Barred Owl
GGOW	Great Gray Owl
LEOW	Long-eared Owl
SEOW	Short-eared Owl
BOOW	Boreal Owl
NSWO	Northern Saw-whet Owl
CONI	Common Nighthawk
BLSW	Black Swift
BCHU	Back-chinned Hummingbird
CAHU	Calliope Hummingbird
RUHU	Rufous Hummingbird
BEKI	Belted Kingfisher
YBSA	Yellow-bellied Sapsucker
RNSA	Red-naped Sapsucker
RBSA	Red-breasted Sapsucker
HYSA	Hybrid Sapsucker
DOWO	Downy Woodpecker
HAWO	Hairy Woodpecker
TTWO	Three-toed Woodpecker
BBWO	Black-backed Woodpecker
NOFL	Northern Flicker
RSFL	Red-shafted Flicker
YSFL	Yellow-shafted Flicker
FLIN	Flicker Intergrade
PIWO	Pileated Woodpecker
OSFL	Olive-side Flycatcher
WEWP	Western Wood-Pewee
YBFL	Yellow-bellied Flycatcher
ALFL	Alder Flycatcher
LEFL	Least Flycatcher
HAFL	Hammond's Flycatcher
DUFL	Dusky Flycatcher
WEFL	Western Flycatcher
PSFL	Pacific-slope Flycatcher
COFL	Cordilleran Flycatcher
SAPH	Say's Phoebe
EAKI	Eastern Kingbird
NSHR	Northern Shrike
SOVI	Solitary Vireo
CAVI	Cassin's Vireo
BHVI	Blue-headed Vireo
WAVI	Warbling Vireo
PHVI	Philadelphia Vireo
REVI	Red-eyed Vireo
GRAJ	Gray Jay
STJA	Steller's Jay
BLJA	Blue Jay
CLNU	Clark's Nutcracker

Species Alpha Codes

Code	Species Names
BBMA	Black-billed Magpie
AMCR	American Crow
CORA	Common Raven
HOLA	Horned Lark
TRES	Tree Swallow
VGSW	Violet-green Swallow
NRWS	Northern Rough-winged Swallow
BANS	Bank Swallow
CLSW	Cliff Swallow
BARS	Barn Swallow
BCCH	Black-capped Chickadee
MOCH	Mountain Chickadee
CBCH	Chestnut-backed Chickadee
BOCH	Boreal Chickadee
RBNU	Red-breasted Nuthatch
WBNU	White-breasted Nuthatch
BRCR	Brown Creeper
HOWR	House Wren
WIWR	Winter Wren
MAWR	Marsh Wren
AMDI	American Dipper
GCKI	Golden-crowned Kinglet
RCKI	Ruby-crowned Kinglet
MOBL	Mountain Bluebird
TOSO	Townsend's Solitaire
GCTH	Gray-cheeked Thrush
SWTH	Swainson's Thrush
HETH	Hermit Thrush
AMRO	American Robin
VATH	Varied Thrush
EUST	European Starling
AMPI	American Pipit
BOWA	Bohemian Waxwing
CEDW	Cedar Waxwing
TEWA	Tennessee Warbler
OCWA	Orange-crowned Warbler
YWAR	Yellow Warbler
MAWA	Magnolia Warbler
UYRW	Unknown Yellow-rumped Warbler
AUWA	Audubon's Warbler
MYWA	Myrtle Warbler
TOWA	Townsend's Warbler
BLPW	Blackpoll Warbler
BAWW	Black-and-White Warbler
AMRE	American Redstart
OVEN	Ovenbird
NOWA	Northern Waterthrush
MOWA	Mourning Warbler
MGWA	MacGillivray's Warbler
COYE	Common Yellowthroat

Code	Species Names
WIWA	Wilson's Warbler
CAWA	Canada Warbler
YBCH	Yellow-breasted Chat
WETA	Western Tanager
RBGR	Rose-breasted Grosbeak
DICK	Dickcissel
ATSP	American Tree Sparrow
CHSP	Chipping Sparrow
CCSP	Clay-colored Sparrow
BRSP	Brewer's Sparrow
VESP	Vesper Sparrow
SAVS	Savannah Sparrow
FOSP	Fox Sparrow
SOSP	Song Sparrow
LISP	Lincoln's Sparrow
SWSP	Swamp Sparrow
WTSP	White-throated Sparrow
HASP	Harris's Sparrow
WCSP	White-crowned Sparrow
GWCS	Gambel's White-crowned Sparrow
GCSP	Golden-crowned Sparrow
UDEJ	Unidentified Dark-eyed Junco
ORJU	Oregon Junco
SCJU	Slate-colored Junco
LALO	Lapland Longspur
SMLO	Smith's Longspur
SNBU	Snow Bunting
BOBO	Bobolink
RWBL	Red-winged Blackbird
YHBL	Yellow-headed Blackbird
RUBL	Rusty Blackbird
BRBL	Brewer's Blackbird
COGR	Common Grackle
BHCO	Brown-headed Cowbird
GCRF	Gray-crowned Rosy Finch
PIGR	Pine Grosbeak
PUFI	Purple Finch
HOFI	House Finch
RECR	Red Crossbill
WWCR	White-winged Crossbill
CORE	Common Redpoll
HORE	Hoary Redpoll
PISI	Pine Siskin
EVGR	Evening Grosbeak
HOSP	House Sparrow

Unknown/Unidentifiable Species

Code	Species Names
UNGR	Unidentified Grebe sp.
USWA	Unidentified Swan sp.
UNTE	Unidentified Teal sp.
USCA	Unidentified Scaup sp.
USCO	Unidentified Scoter sp.
UNGO	Unidentified Goldeneye sp.
UNME	Unidentified Merganser sp.
UNDU	Unidentified Duck sp.
UDAD	Unidentified Dabbling Duck sp.
UDID	Unidentified Diving Duck sp.
UNEA	Unidentified Eagle sp.
UNHA	Unidentified Hawk sp.
UNAC	Unidentified Accipiter sp.
UNFA	Unidentified Falcon sp.
USHO	Unidentified Shorebird sp.
UNPL	Unidentified Plover sp.
UNYE	Unidentified Yellowlegs sp.
USAN	Unidentified Sandpiper sp.
UNCA	Unidentified Calidris sp.
UNDO	Unidentified Dowitcher sp.
UNPH	Unidentified Phalarope sp.
UNGU	Unidentified Gull sp.
UNTN	Unidentified Tern sp.
UNOW	Unidentified Owl sp.
UNHU	Unidentified Hummingbird sp.
USAP	Unidentified Sapsucker sp.
UNWO	Unidentified Woodpecker sp.
UNEM	Unidentified Empidonax sp.
UNVI	Unidentified Vireo sp.
UNSW	Unidentified Swallow sp.
UNWR	Unidentified Wren sp.
UNKI	Unidentified Kinglet sp.
UNTH	Unidentified Thrush sp.
UVWA	Unid. Vermivora Warbler sp.
UDWA	Unid. Dendroica Warbler sp.
UNWA	Unidentified Warbler sp.
UGRO	Unidentified Pheucticus sp.
UNSP	Unidentified Sparrow sp.
UNBL	Unidentified Blackbird sp.
UNFI	Unidentified Finch sp.
UNCR	Unidentified Crossbill sp.

Figure 9. **Flycatcher Chart** **Region:** ***Mackenzie*** **Station: _____**

Date	Upperparts	Eye ring	Leg	Molt	Lower	Bill from	Bill	p6	Wing	Tail	Wing -	p9 - p5	p6 - p10	p10 - p5	longest p -	longest p -
D/M/Y	Color		Color		Mandible	Nares	Width	Emarg?	Chord		Tail				longest s	p6
Comments:												**Alpha Code**	**Band Number**			**Bander**
Comments:												**Alpha Code**	**Band Number**			**Bander**
Comments:												**Alpha Code**	**Band Number**			**Bander**
Comments:												**Alpha Code**	**Band Number**			**Bander**
Comments:												**Alpha Code**	**Band Number**			**Bander**
Comments:												**Alpha Code**	**Band Number**			**Bander**
Comments:												**Alpha Code**	**Band Number**			**Bander**

Figure 10. **A Key to Separating Flycatchers (adapted from the 1997 Identification Guide to North American Birds by Peter Pyle)**

	Upperparts	Eye Ring	Leg Color	Moult	Lower Manible	Bill from Nares	Bill Width	p6 emarg?	Wing Cord	Tail Length	Wing - Tail	p9 - p5	p6 - p10	p10 - p5	Longest p - longest s	Longest p - p6
Traill's ***(Alder or Willow)*** (page 224)	Brownish olive to green	pale, absent or incomplete	blackish		yellowish-pinkish	***Alder*** 7.64-9.24 ***Western Willow 8.41-10.3***	5.0-6.1	no	***Alder*** 66-77 *Western* ***Willow*** 61-72	***Alder*** 50-61 ***Western Willow*** 48-61	***Alder*** 12.4-20.3 ***Western Willow*** 7.1-14.6	***Alder*** 7.2-11.6 ***Western Willow*** 4.7-11.6	***Alder*** -1.4-3.3 ***Western Willow*** 2.0-7.0	***Alder*** 0.0-5.8 ***Western Willow*** -3.1-1.7	10.2-17.4	***Alder*** 4.0-7.4 ***Western Willow*** 1.7-4.8
Least (page 228)	Grayish Olive	complete, whitish and slightly almond shaped	blackish	HY partial (Jul-Oct) AHY complete (Jul-Nov) SY partial-incomplete (Jan-May) ASY partial (Feb-Apr)	variable dusky with yellow-orange base	6.3-8.4	4.4-5.1	yes	56-67	49-61	6-13	3.4-7.8	2.7-7.0		9.0-15.7	0.8-3.7
Hammond's (page 231)	Grayish olive to grayish	complete, white and slightly almond shaped	blackish	HY partial (Jul-Oct) AHY complete (Jul-Sep)	dusky with slightly paler base (AHY) to primarily orange (Juv.-HY)	6.0-8.0	4.0-4.6	yes	62-75	52-62	11-19	5.6-11.6	2.8-8.0		13.3-20.6	1.8-5.5
Dusky (page 232)	Grayish olive to grayish	complete, white and rounded	blackish	HY partial (Sep-Nov) AHY complete (Sept-Nov) SY partial (Feb-May) ASY limited-partial (Feb-Apr)	primarily dusky to dull horn or often horn indistinctly defined dusky tip	6.5-8.9	4.2-5.3	yes	61-73	57-68	3-12	2.2-5.5	6.0-10.8		9.2-15.2	0.0-3.0
Yellow-bellied (page 220)	Green	complete, narrow, yellowish and rounded or slightly almond shaped	gray or brownish	HY partial (Jul-Sep.) AHY incomplete-complete (Aug-Oct) SY incomplete (Mar-May) ASY partial-incomplete (Mar-Apr)	pinkish, pinkish-yellow, yellow	7.0-9.4	4.8-5.6	variable	60-72	46-55	12-19	5.8-11.5	1.9-6.3	0.8-5.1	10.3-17.5	2.2-6.7
Western (page 235)	Olive	complete, wide, whitish or yellowish, and almond shaped	gray	HY partial Sep-Dec) AHY complete (Aug-Nov) SY partial-incomplete (Mar-May) ASY partial (Feb-Apr)	yellow or flesh colored	7.7-9.2	5.0-5.8	yes	56-72	50-63	6-15	2.8-9.8	4.7-9.8	-4.4-0.3	8.6-17.1	0.2-4.4

NOTE: In **Dusky Flycatcher** p10 is shorter than p4

Figure 11. Retrap Card

Band No.

Species:

Band Size

Permit No.

Retrap Code

2 if Mackenzie banded
3 if foreign banded

Species code

AOU No.

Record original banding data above titles, retrap data below. Blank line for comments.

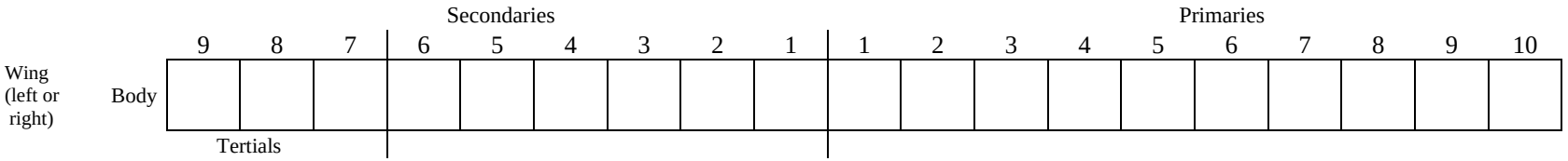
Age	How Aged	Sex	How Sexed	Wing Chord (mm)	Weight (gms)	Status	Date Day	Date Month	Date Year	Loc	Trap	Time Trapped	BP	CP	M	F	S	Banders initials

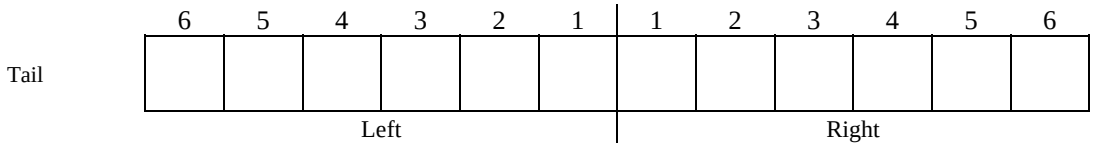
* M = moult, F = fat, S = skull

Band No.

Figure 12. **Moult Card**

Species:	Age/Sex:	Band No.:
Region:	Station:	Date:





Greater Coverts

___ Apparently old
___ Moulting (fill in above; if possible)
___ Apparently new

Bastard wing (alula)

___ Apparently old
___ Moulting
___ Apparently new

	No Moult	Active Moult	Moult app. completed
Lesser & medium coverts			
Under wing coverts			
Head			
Upper parts			
Under parts			

Observer

Figure 13. **Moult Card**

Species	Age/sex	Band No.
Region	Station	Date

Secondaries Primaries

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	9	10

Wing (circle one) left or right

	6	5	4	3	2	1	1	1	2	3	4	5	6
Tail													

left right

Greater Coverts (fill in if possible)

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

	Apparently old	Moulting	Apparently new
Greater Coverts	_____	_____	_____
Alula	_____	_____	_____

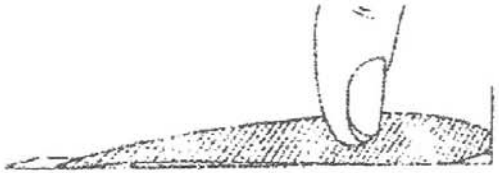
	No Moult	Active Moult	Moult app. Complete
Lesser and medium coverts	_____	_____	_____
Under wing coverts	_____	_____	_____
Head	_____	_____	_____
Under Parts	_____	_____	_____
Upper Parts	_____	_____	_____

Observer _____

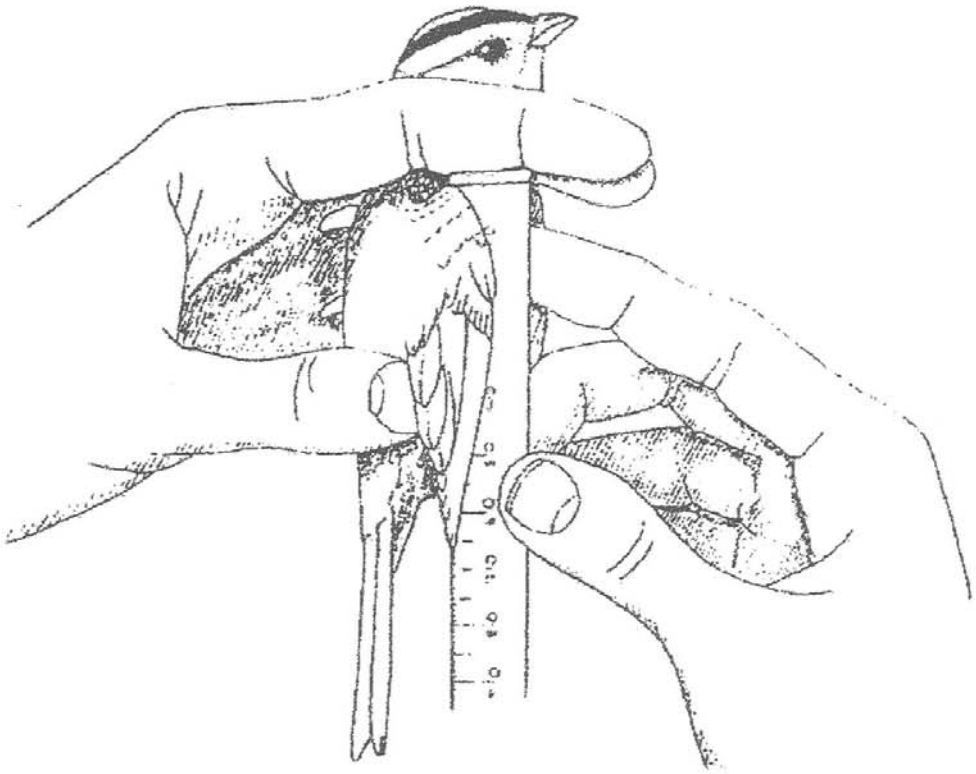
Figure 14. How to measure wing chord

Diagrams from Peter Pyle's Identification Guide to North American Birds

wing chord (wg)



flattened wing (wg) [flat])



A good hold for measuring the wing chord

Figure 15. Diagram of bird's wing

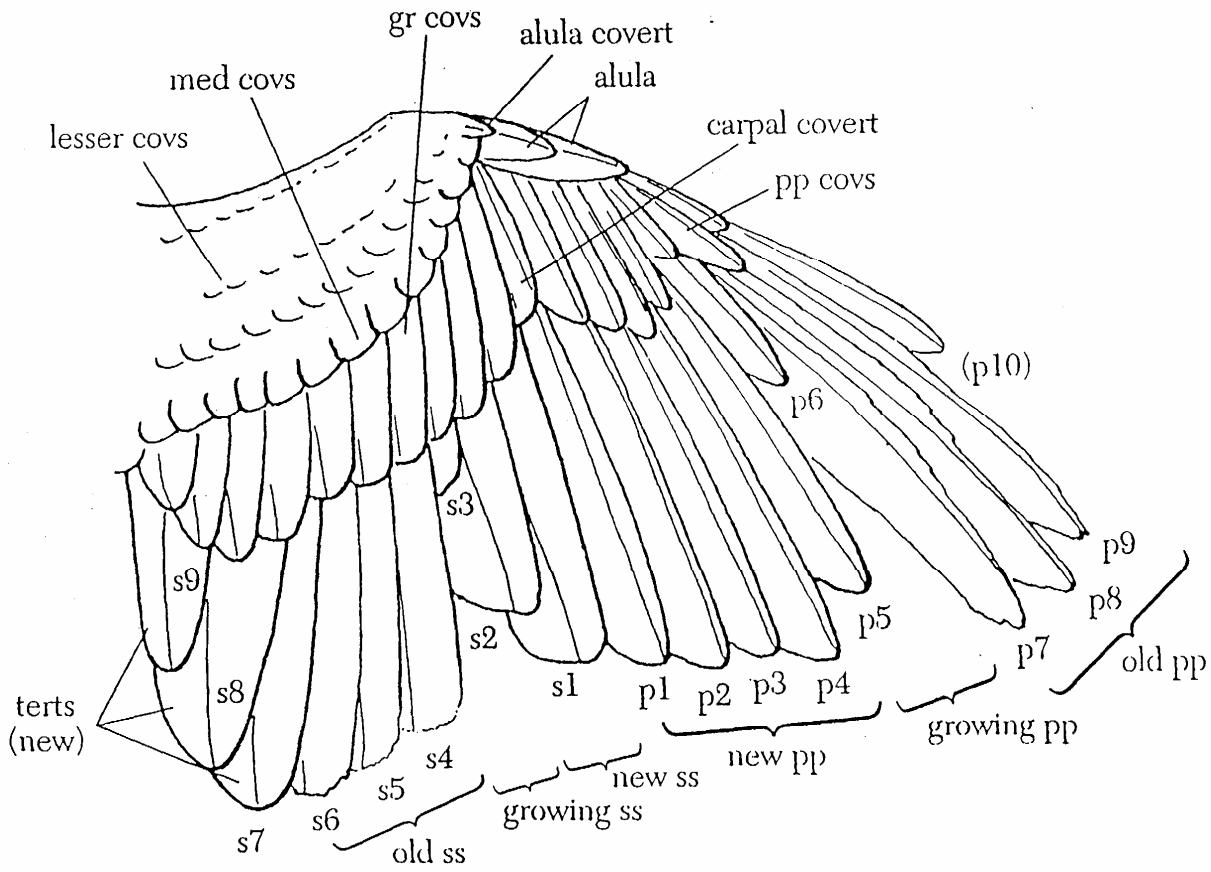


Diagram of a Bird's wing form Peter Pyle's Identification Guide to North American Birds

Figure 16. Coding of moult sequence for moult card

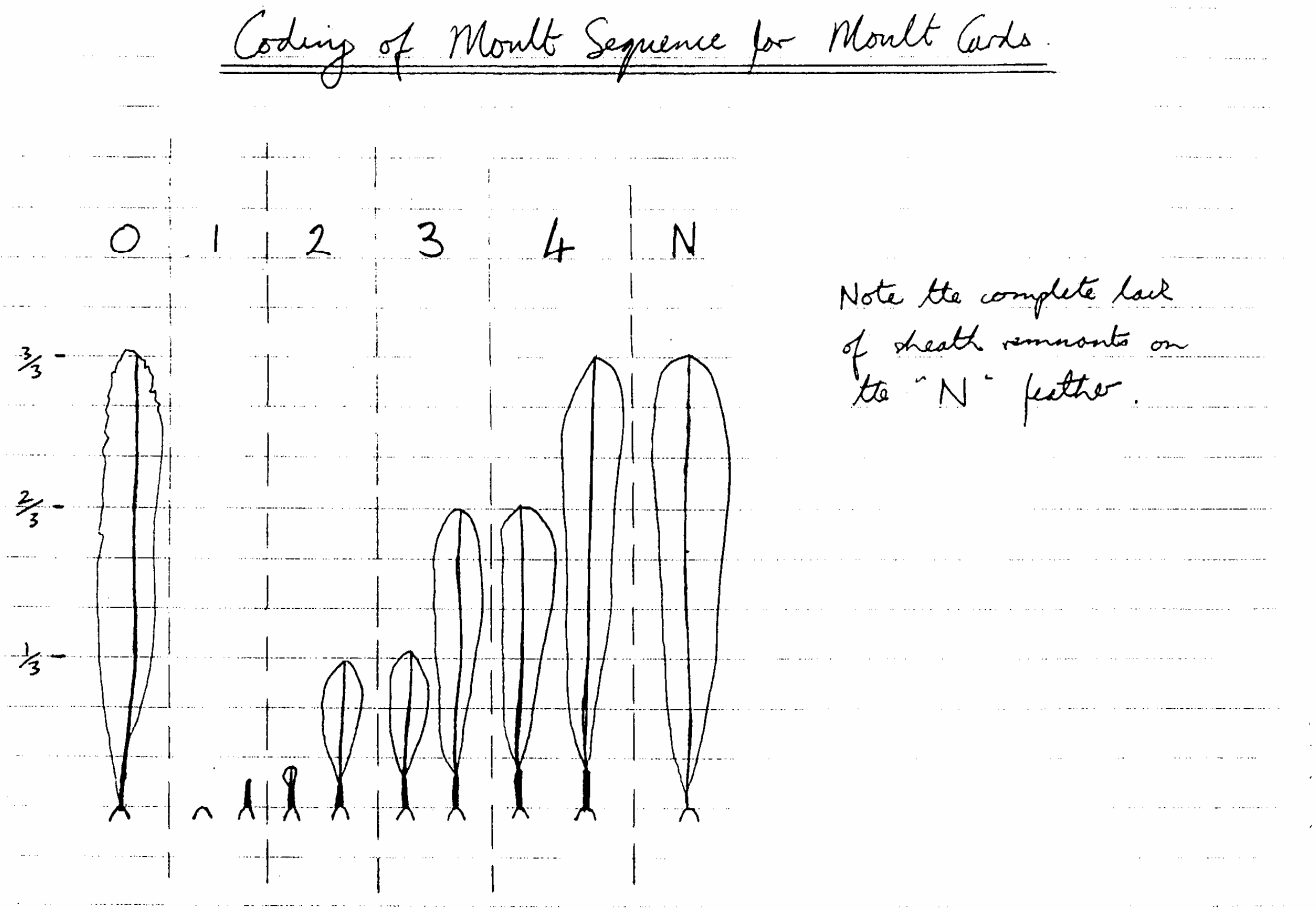
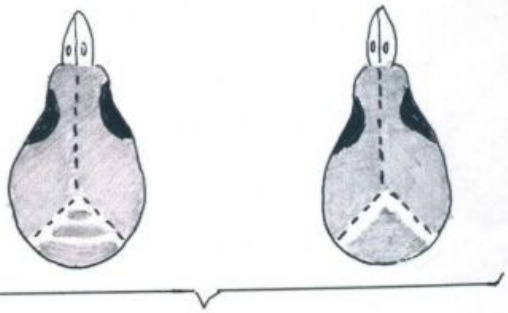


Figure 16b.

Figure 17.

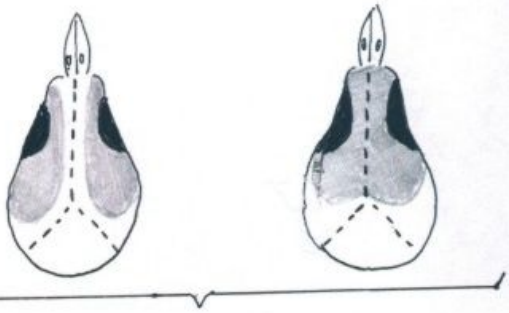
ABBREVIATIONS FOR AREAS OF MOULTING PLUMAGE NOTE: capital letters does not matter - just commas between each abbreviation		
B	=	Body
H	=	Head
1°	=	Primaries
2°	=	Secondaries
3° (not T)	=	Tertials
PC	=	Primary Coverts
GC	=	Greater Coverts
MC	=	Median Coverts
LC	=	Lesser Coverts
UpTC	=	Upper Tail Coverts
UnTC	=	Under Tail Coverts
UnWC	=	Under Wing Coverts
A	=	Alula
R	=	Rectrices (**tail**)
E	=	Moulting Everywhere; **MOULT CARD** should be done.
M.C.	=	There is a moult card for this bird
ADDITIONAL ABBREVIATIONS		
Exp Cul or **EC**	=	Exposed Culmen
1° Ext.	=	Primary Extension
Wg	=	Wing
T or tl	=	Tail (only for Tail measurement)
BD	=	Bill Depth
BN	=	Bill from Nares
BW	=	Bill Width at Nares
FF	=	flight feathers

0 = nothing

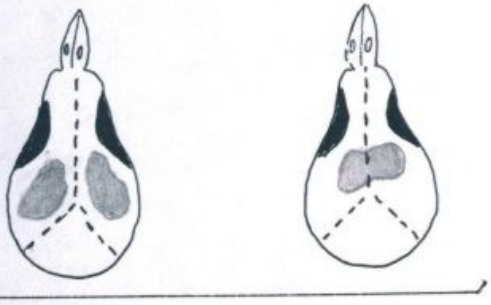


1 = trace, up to 5%

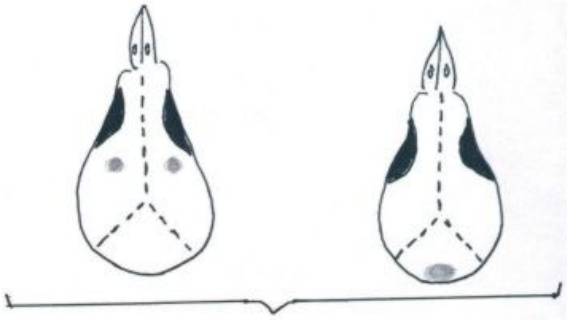
2 = full back triangle
less than 1/3



3 =1/2 (1/3 to 2/3)
back triangle fanning
up and out



4 = > 2/3 (67% to 94%)
two spots, one on each side of the cranium
or rarely one spot in center of skull



5 = 95% to 99%
one or two tiny
holes

6 = fully ossified

Figure 19.

NON-STANDARD BANDING (NSB)

Region: _____ Station: _____

Day		Month		Year		Species (Code)	Band Number	Location	Trap		Time Trapped				Total NSB to Date

Figure 20.

BANDING INJURY / CASUALTY REPORT FORM

Region: _____ Station: _____ Year:_____

Date DD/MM	**Species**	**Trap**	**Description of injury** (cause)	**Outcome / Treatment**

Appendix 1.

Priority Species (* species that we have banded more than 10 individuals in more than one season)

A. Species with <50% of North American (Canada and U.S. only) breeding range covered by BBS, and <60% of their winter range in U.S. and Canada.

Alder Flycatcher *
American Pipit
Blackpoll Warbler *
Grey-cheeked Thrush
Lincoln's Sparrow *
Magnolia Warbler *
Northern Waterthrush *
Savannah Sparrow *
Swainson's Thrush *
Orange-crowned Warbler *
Tennessee Warbler *
Wilson's Warbler *
Yellow-bellied Flycatcher
Yellow-bellied Sapsucker

B. Species with < 50% of North American breeding range covered by BBS, but 60% of winter range in U.S. and Canada.

American Tree Sparrow *
Audubon's Warbler*
Bohemian Waxwing
Boreal Chickadee
Boreal Owl
Common Redpoll
Dark-eyed Junco *
Fox Sparrow
Golden-crowned Sparrow
Harris' Sparrow
Hoary Redpoll
Lapland Longspur
Myrtle Warbler *
Northern Shrike
Pine Grosbeak
Ruby-crowned Kinglet *
Rusty Blackbird
Short-eared Owl
Snow Bunting
Swamp Sparrow
Varied Thrush
White-crowned Sparrow *
White-throated Sparrow*
White-winged Crossbill

C. Species with <60% of their Canadian and Alaskan breeding range (but 50% of North American range) covered by BBS, and <60% of their winter range in U.S. and Canada.

American Redstart *
Bank Swallow
Barn Swallow
Black-and-white Warbler
Brewer's Sparrow
Chipping Sparrow *
Clay-colored Sparrow
Cliff Swallow
Common Nighthawk
Common Yellowthroat *
Dusky Flycatcher *
Eastern Kingbird
Hammond's Flycatcher *
Least Flycatcher *
MacGillivrary's Warbler *
Olive-sided Flycatcher
Ovenbird
Red-eyed Vireo
Rufous Hummingbird
Say's Phoebe
Solitary Vireo*
Townsend's Warbler *
Tree Swallow
Violet-green Swallow
Warbling Vireo *
Western Tanager *
Western-Wood-Pewee*
Yellow Warbler *
Yellow-headed Blackbird

D. Species with <60% of their Canadian and Alaskan breeding range (but >50% of North American range) covered by BBS, but > 60% of their winter range in U.S. and Canada (includes some irruptive species and irregular migrants).

American Crow
American Robin *
Belted Kingfisher
Black-capped Chickadee *
Brewer's Blackbird
Brown Creeper
Cedar Waxwing*
Downy Woodpecker*
European Starling
Golden-crowned Kinglet *
Gray-crowned Rosy-Finch
Hairy Woodpecker
Hermit Thrush *
Horned Lark
Northern Flicker
Northern Saw-whet Owl*
Pine Siskin *
Purple Finch
Red-breasted Nuthatch*
Red-breasted Sapsucker
Red--winged Blackbird
Song Sparrow *
Townsend's Solitaire
Vesper Sparrow
Winter Wren

E. Species with >60% of both their Canadian and North American breeding range covered by BBS, and <60% of their winter range in U.S. and Canada.

Calliope Hummingbird	Northern Rough-winged Swallow
House Wren	Western Flycatcher

F. Species with >60% of both their Canadian and North American breeding range covered by BBS, and>60% of their winter range in U.S. and Canada.

Brown-headed Cowbird	Evening Grosbeak	Red-naped Sapsucker

Appendix 2
UTM readings of Mugaha Marsh Banding Station net lanes taken using NAD 83
UTM Zone:10U

	Easting	Northing	Net lanes	Easting	Northing
# 1	**486584**	**6139083**	**# 17**	**486792**	**6138902**
Corner of # 1 & # 2	**486584**	**6139073**		**486797**	**6138914**
# 2	**486597**	**6139073**	**# 18**	**486607**	**6139151**
# 3	**486561**	**6139089**		**486612**	**6139159**
Corner of # 3 & # 4	**486553**	**6139081**	**# 19**	**486837**	**6138868**
# 4	**486537**	**6139078**	**Corner of # 19 & # 20**	**486845**	**6138877**
# 5	**486616**	**6139189**	**#20**	**486854**	**6138885**
Corner of # 5 & # 6	**486526**	**6139192**	**#21**	**486825**	**6138877**
# 6	**486636**	**6139198**	**Corner of # 21 & # 22**	**486831**	**6138889**
# 7	**486617**	**6139249**	**# 22**	**486836**	**6138903**
	486622	**6139254**	**# 23**	**486640**	**6139127**
# 8	**486639**	**6139254**	**Corner of # 23 & # 24**	**486652**	**6139134**
	486640	**6139267**	**# 24**	**486654**	**6139148**
# 9	**486634**	**6139098**	**Corner of # 25 & # 26**	**486529**	**6139113**
	486629	**6139110**	**Corner of # 25 & # 27**	**486541**	**6139117**
# 10	**486641**	**6139121**	**# 26**	**486516**	**6139104**
	486640	**6139133**	**# 27**	**486553**	**6139117**
# 11	**486604**	**6139058**	**# 28**	**486893**	**6138861**
	486598	**6139049**		**486881**	**6138857**
# 12	**486732**	**6138974**	**# 29**		
	486740	**6138984**			
# 13	**486713**	**6138909**	**# 30**		
Corner of # 13 & # 14	**486722**	**6138902**			
# 14	**486719**	**6138889**	**# 31**		
# 15	**486747**	**6138857**			
Corner of # 15 & # 16	**486758**	**6138851**			
# 16	**486754**	**6138841**			

Appendix 3 **Bander's Report Card**[1]

Not all categories need to be checked (initialled) for a banding permit. However, some categories are fundamental and need to be assessed for all prospective banders. These are identified by an asterisk. Items with double asterisks are essential elements for prospective Master Permittees.

	The trainee can . . .	Required Items	Trainer's Initial
	BACKGROUND MATERIAL		
1.	Understand the ethics of banding birds	*	
2.	Understand how banding fits into scientific studies	*	
	CHECKLIST OF PRACTICAL SKILLS		
1.	**PROCESSING**		
1.1	Identification and handling		
1.1.1	Recognize all target species and release a bird unbanded if identification cannot be made with 100% certainty	*	
1.1.2	Appreciate the importance of minimizing handling time while not compromising safety	*	
1.1.3	Use the bander's grip on a variety of species	*	
1.1.4	Use the photographer's grip safely	*	
1.1.5	Use the "ice cream cone" grip safely	*	
1.1.6	Transfer a bird from hand to hand safely	*	
1.1.7	Open a bird's bill reliably	*	
1.1.8	Handle a variety of awkward species	*	
1.1.9	Release a variety of species correctly	*	
1.1.10	Effectively deals with escaped birds in an enclosed space	*	
1.2	Banding		
1.2.1	Select correct band size	*	
1.2.2	Read band numbers correctly	*	
1.2.3	Apply a band correctly	*	
1.2.4	Correctly apply a lock-on band (if appropriate)		
1.2.5	Correctly apply a colour band (if appropriate)		
1.2.6	Recognize when and how to correct an improperly applied band	*	
1.2.7	Know when and how to remove a band safely	*	
1.3	Storing/carrying birds		
1.3.1	Use the appropriate method of storage for particular species	*	
1.3.2	Place birds in bags and carry and hang them correctly	*	
1.3.3	Recommend when bags/boxes need cleaning	*	
1.4	Field data collection		
1.4.1	Record data clearly, legibly and accurately on field sheets	*	
1.4.2	Recognize and take description of and/or photograph rarities or unusual birds	*	
1.4.3	Maintain complete and accurate daily logs	*	
1.5	Biometrics		
1.5.1	Use and accurately read measuring devices (wing rule, balances, callipers, dividers)	*	
1.5.2	Correctly and accurately measure anatomical features	*	

[1] from the Canadian Bander's Study Guide

	The trainee can …	Required Items	Bander's Initials
1.5.3	Assess simple wing formulae		
1.5.4	Assess and record moult accurately on a moult card		
1.5.5	Accurately score fat deposits		
1.6	Ageing and sexing		
1.6.1	Correctly use guides for ageing and sexing	*	
1.6.2	Accurately score skull ossification		
1.6.3	Correctly use other characteristics for age determination		
1.6.4	Understand and assign correct age codes	*	
1.6.5	Correctly use color, size, brood patch, and cloacal protuberance for sex determination	*	
2.	**SPECIAL AUTHORIZATION FOR MIST NETTING**		
2.1	Erecting, opening and closing nets		
2.1.1	Choose an appropriate netting site and appropriate net		
2.1.2	Correctly set up nets unaided		
2.1.3	Properly furl and unfurl nets		
2.1.4	Take in and store nets and associated equipment properly		
2.2	Operation and Extraction		
2.2.1	Judge how many nets to safely use and checks them frequently and carefully		
2.2.2	Demonstrate an astute, accommodating approach to extraction		
2.2.3	Extract a variety of species quickly and safely		
2.2.4	Deal proficiently with tricky situations		
2.2.5	Recognize/maintain nets that are in poor condition		
3.	**TRAPS**		
3.1	Has knowledge of range of traps and their target species		
3.2	Operate traps properly and safely		
4.	**NESTLINGS**		
4.1	Follow species and date/age guidelines in Banding Manual		
4.2	Approach nests responsibly and remove, handle, band and Replace nestlings safely		
5.	**ETHICS AND INJURIES**		
5.1	Know and practise the Bander's Code of Ethics	*	
5.2	Show excellent awareness of injury prevention	*	
5.3	Show familiarity with the most common injuries and their causes	*	
5.4	Demonstrate ability to treat minor injuries	*	
5.5	Recognize and demonstrate the necessity of euthanasia	*	
5.6	Assess whether a specimen is worth preserving	*	
5.7	Record details of all injuries and casualities	*	
6	**HEALTH AND SAFETY OF BANDERS**		
6.1	Demonstrate a responsible attitude towards potential injury from birds	*	
6.2	Demonstrate a responsible attitude towards physical hazards in the banding area	*	

	The trainee can …	Required Items	Bander's Initials
7	**DATA Management**		
7.1	Proof and correct banding sheets	**	
7.2	Complete banding schedules properly and unassisted	**	
7.3	Handle other paperwork correctly and promptly	**	
8	**PUBLIC RELATIONS**		
8.1	Communicate effectively with the public about banding	*	
8.2	Communicate effectively using banding data (reports, articles, etc.)	**	
9.	**OTHER SPECIAL AUTHORIZATIONS**		
9.1	Demonstrate proficiency in the following special authorizations (specify):		
10.	**FINAL GRADING**		
10.1	Ethics	*	
10.2	Processing	*	
10.3	Special Authorization for Mist netting		
10.4	Traps		
10.5	Nestlings		
10.6	Injuries to Birds	*	
10.7	Health and Safety of Banders	*	
10.8	Record Keeping	**	
10.9	Public Relations	*	
10.10	Other Special Authorizations (specify):		

TRAINER'S RECOMMENDATIONS

I _____ (name of trainer) have trained and witnessed _____ (name of trainee) and am satisfied that all necessary training has been successfully completed and that he/she qualifies for a:

Subpermit ☐

Master permit ☐

to band the following species groups:

waterfowl ☐
seabirds ☐
shorebirds ☐
raptors ☐
landbirds ☐

with the following authorizations:

to use mist nets ☐

to use cannon nets ☐

to use chemicals ☐

to use colour marking ☐

to use radio transmitters ☐

to band endangered species ☐

to take blood samples ☐

Signed:_____(trainer) Dated:_____

Permit #_____

Special Species or Trapping Restrictions (please list):

_____

_____

_____

_____

Other Comments:

_____

_____

_____

_____

Appendix 4 How ETs were done in previous years

Comments from former banders at Mackenzie with respect to their procedures and the utility of Estimated Totals (ET).

From Paul Prior – bander in fall 1998
"I'm gonna have to dig out some of my notes from Mackenzie since I cannot recall the precise methodology used. I should imagine that I carried over a fairly similar method to that which we'd been using at Long Point. However, there would have been some superficial differences based on the somewhat different migrant profile of the area. At Long Point I always felt much more justified in extrapolating migrant numbers passing through the area because it was always very evident when a prolonged diurnal movement was occurring. The separation of birds that are simply milling about along the lakeshore at Mugaha and those that are heading determinedly south is somewhat difficult and so my final ET for any given species was probably closer to what the tally of observations was on paper (hopefully, the log sheets will bear this out, ETs would move further away from the paper-total of observations etc. only in instances when there was evidence of waves of migrants passing through the area, something that is always easier to determine for aerial migrants as opposed to bush-borne migrants)."

From Jim Tuck – Bander 1 week in spring 1998
"When I did ET, I usually totaled banded, census, and observed birds for the day. The exceptions were:

1) when it was fairly obvious that census and observed were the same birds (for instance census 2 GBHE and observed 6 GBHE, then ET = 6 GBHE);
2) uncommon species on slow days, where banded birds and census or observed birds were probably the same; and
3) busy days when no census was done and there were obviously lots of a species around and observations were casual at best, then there was just a ballpark estimate (for instance RWBL on some spring days)."

From Kevin Hannah – Bander Fall 1995, Fall 1996 and August 1997
"As for the ET, they are quite subjective and do require some basic guidelines. Firstly, treat all banded and recaptured birds as unique and obvious). Also, any rare birds in the area that habitually use the same perch (I'm thinking about Olive-sided Flycatcher for instance, hawking dragonflies from the large pines above the banding tent) can be considered a known resident bird. Any other birds in other areas of the site would be treated as unique individuals. In this regard, the ET require at a minimum a daily census during peak movement in the morning. This will help to estimate the numbers of birds moving through. An important point to consider is, if you don't see birds, you can't count them. For instance, if you see a flock of 6 Redstarts flying through at 9:00 a.m. and a flock of 6 flying through at 11:00 a.m., you can't assume the flow is constant (unless you are constantly observing and catching Redstarts all morning). The more time spent outside the tent the more people observing, the more accurate your ET. I also tried to census at midday and in the early evening to help with the determination of the et. Many birds will continue to move in the warmer afternoon and several will start to move in the early evening as well. Obviously, one of the greatest drawbacks about the ET are that it is impossible to standardize this data. On days when you are extremely busy with birds in the nets, I can guarantee that the ET is severly underestimated. The only option for creating a standardized dataset for all sites across the country would be to have a separate migration counter. Observatories such as Thunder Cape and Whitefish Point also have (a) counter(s) that is on constant watch for migrants. This person generally watches for the entire standardized period and generally can get a good handle on movement. Otherwise, I think the value of ET as a tool in determining migrant numbers is questionable!"