AA MANUAL FOR BIRD BANDING & MIGRATION MONITORING

at

DELTA MARSH BIRD OBSERVATORY

&

WETLAND DISCOVERY CENTRE OAK HAMMOCK MARSH

Delta Marsh Bird Observatory
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by

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1 THE BANDER'S CODE OF ETHICS

1. Above all else, **banders are responsible for the safety and welfare of the birds they study**. This means that stress and the risk of injury or death must be minimised by:
   - handling each bird carefully, gently, quietly, and respectfully
   - capturing and processing only as many birds as can be safely handled
   - closing nets or traps when predators are in the area or when the weather is inclement
   - checking nets every 20 to 30 minutes (nets should NEVER be left unattended)
   - frequently assessing the condition of nets and adjusting or repairing them accordingly
   - properly closing the nets at the end of each banding day
   - using the correct band size and banding pliers for each bird
   - treating all bird injuries in the most humane way
   - resisting the temptation to band an injured bird, no matter how rare
   - thoroughly training assistants and supervising visitors

2. Banders must continually ensure their own work is beyond reproach by:
   - reassessing methods and approach whenever an injury or mortality occurs
   - accepting the authority and generally superior knowledge of the Bander-In-Charge
   - keeping one's mind open to techniques that might improve any aspect of the banding operation

3. Banders must offer honest and constructive assessment of other's work by:
   - publishing innovations in banding, capture and handling techniques
   - educating prospective banders and trainers
   - informing the Bander-In-Charge of any instances of mistreatment of birds
   - if there is no improvement, then file a report with the Banding Lab

4. Banders must ensure that data gathered are accurate and complete.

5. Banders must obtain permission to band on private property.

2 INTRODUCTION

The Delta Marsh Bird Observatory (DMBO) is part of a continent-wide network of stations, which was established to monitor the populations of migrating songbirds. It is a member of the Canadian Migration Monitoring Network (CMMN) and is the only station in Manitoba. As such, it plays a critical role in helping address the paucity of information regarding the status of songbird populations in the prairie provinces.

DMBO was located on the southern tip of Lake Manitoba on the edge of the Delta Marsh. Traditionally noted for its abundance of waterfowl, the Delta Marsh is also a primary stopover site for migrating songbirds. The narrow strip of trees growing on the sandy dune ridge between the lake and marsh provides a natural migration pathway, making the area an ideal place to situate a monitoring station. In addition, super-abundant food sources from the marsh and lake facilitate large numbers of migrating passerines to be funnelled through the narrow forest ridge.

DMBO's primary goal was to generate daily counts of migrant birds that can be used for long-term population monitoring.

Harry J. Enns Wetland Discovery Centre is an environmental education centre, established in 1993. In 2000, it created a banding program as part of an educational program promoting banding, conservation, wetlands and population monitoring to people of all ages. We encourage those who develop a keen interest to contact the Delta Marsh Bird Observatory. The banding is also a component of our environmental monitoring contributing to the Oak Hammock Marsh Conservation Centre Monitoring Plan.

In the spring of 2011, there was a massive flood in southern Manitoba that essentially washed away much of the beach ridge that DMBO banded on. It also flooded out all the accommodations and the banding station. DMBO looked for a new home for several years and finally in 2015 settled on the Oak Hammock Marsh Wildlife Management Area (WMA). The WMA is located 20 minutes north of Winnipeg and is provincially owned land. We have permission to be here if all buildings are moveable.

Both programs are now run at the same place. The Wetland Discovery Centre's focus is the educational portion and the DMBO is the scientific research and bander training portion.

For more information visit our website: http://dmbo.ca or email us at: info@dmbo.ca or deltamarshbirdobservatory@shaw.ca

2.1 Uses of migration data

Migration data are used for population monitoring and for a variety of other scientific studies. Banding allows us to gather information on the average survival and life expectancy of birds, the age at which breeding first occurs and the number of years of reproductive potential for each species. It also is a measure of the annual variation in numbers of adults and young birds, the ratios of males to females, and gives us insight into causes of avian mortality. Banding helps researchers map the location of breeding and wintering grounds and rest areas as well as the routes birds follow. Recovery of banded birds gives us information on the timing and duration of migration. It also helps us to determine which species are changing their migratory patterns. The banding data is sent to the Bird Banding Lab and the Estimated Totals data is sent to Birds Canada.

The following are brief descriptions of some uses for the data that collected:

1. The age and sex data obtained during banding to show dates of migration for each age and sex group within a species. Fall age ratios might also be useful in assessing trends in reproductive performance, although this has not yet been proven.

2. The recovery rate for banded songbirds is very low. For most species, less than 0.1% of all birds banded are ever recovered elsewhere. Large numbers must therefore be banded before there are enough recoveries to document where these birds breed, migrate and winter, and how long they live. Although these rather simple data are crucial to management and protection of birds, they are only known for barely a handful of non-game species.

3. Birds have high metabolic rates and must eat frequently to maintain health. Body weight is a good measure of a bird's condition and the amount of fat it has stored for a migratory flight. Banding data can be used to document weight changes according to season or to time of day and show how much weight birds gain while stopping over in an area during migration. A visual assessment of fat-loads can help explain patterns of weight change.

4. Banding data can be used for many other purposes, including: studies correlating migration to weather conditions; colour-banding in studies of behaviour and breeding biology of resident birds; studying patterns of moult; assessing and improving techniques for ageing and sexing; studying parasites and illnesses of birds; determining the degree of philopatry or 'site-faithfulness'; and providing information on their longevity.

5. Estimated totals (ETs) can provide a population index. The annual changes in these indices determine whether species are increasing or decreasing. These population indices are particularly important for many species of migrant songbirds that breed and winter in inaccessible areas where other kinds of censuses cannot readily be done.

2.2 Personnel

A minimum of two people is required to run the banding station, at least one of whom is well-trained in identification of birds by sight and in banding procedures. The most experienced employee or volunteer is designated as Bander-In-Charge (BIC). The Bander-In-Charge is responsible for overseeing field operations. The BIC also helps with training, logistics and maintenance, and generally ensures that the program is being conducted to the high standards outlined in the protocol. The BIC must also have a banding (sub) permit.

- BIC will have a plan for rescue should they have a vehicle break-down
- There will be a check-in/check-out protocol for the BIC to ensure safety
- BIC will provide an emergency contact

Volunteer assistants are an important component of our activities. Participation by volunteers, ranging from beginners to the highly experienced is strongly encouraged.

DMBO is run by a volunteer board of directors that meet once a year.

Day to day operations are overseen by Paula Grieef (grieef@dmbo.ca) and any issues can be brought to her.

2.3 Count Area/Site Map

Nets are set up in a small row of willows on the edge of a cattail/phragmites prairie marsh. There are some small grassland areas on one side of three nets. The trees include sandbar willow, pussy willow, yellow willow and red osier dogwood. Cattails and willows are cut back when overhanging nets but natural cycles of wet and dry keep the site more or less in a constant state. The grassy areas are mowed by Ducks Unlimited Canada as part of weed control.

The count area for incidental observations includes those birds seen or heard from within the boundaries of the count area (e.g. count the birds seen in the as far as you can see and identify but do it from the defined boundary of the station).

The station boundary for banding is the area that surrounds the nets shown in yellow in Figure 1.

Figure 1 Count Area.

3 PROTOCOLS FOR MIGRATION MONITORING AND BANDING

3.1 Migration Monitoring

The protocols for migration monitoring are standardized according to those of McCracken *et al.* (1993). This manual, although specifically written for site, is based mainly on that document, as well as that of Smith (1995).

3.1.1 Count area

The area considered as the count area surrounding the station is less than one square kilometre. The habitats within the count area include open water, prairie wetland, willow bluff (Peachleaf willow, Sandbar Willow, Pussy Willow), white top grass, phragmites and cattail wetlands. The observation area and the designated net-lanes are inside the count area (Figure 3).

3.1.2 Count period

The daily count period is limited to the standardized banding period (the first 6 hours of the morning starting 1/2 hour before sunrise). All birds banded and incidentally observed in the count area are included in the daily estimated totals.

Spring monitoring begins May 1 and continues until the first week of June. Fall monitoring begins the second week of July and continues through the end of September.

3.1.3 Daily Estimated Totals

Daily estimate totals (DET) incorporate all the birds banded (including retraps) and the daily observations.

The aim is to count as many of the birds present as possible from within the defined count area by counting all birds identified by sight or sound. No estimate is made of numbers of birds not actually seen or heard. For good estimation of large numbers (e.g., gull flocks), count birds in a section of the flock, then extrapolate by counting the number of similarly sized sections. Seek agreement among observers.

Count only those birds seen or heard from within the boundaries of the count area (e.g. count the birds seen in the as far as you can see and identify but do it from the defined boundary of the station). The general rule is: if you can see or hear it from the station, then it should be counted. This same rule applies for all observations that are being used to compile the DETs.

At least one person should be skilled at bird identification. If you cannot identify a species, do not guess. However, do try to identify it as closely as possible (e.g., warbler spp.). Write a note in the comment section of the log sheet if you feel you missed a large proportion of the birds because of exceptional circumstances (e.g., if they were flying over too high to identify accurately). Special care should be made to avoid birds that have been pushed ahead.

3.1.3.1 How to arrive at Daily Estimated Totals

1. On log sheets (Figure 2), enter the numbers of each species recorded as banded, as retrapped or observed.

2. To 'jog' the observers' memories, run down the list of species again, and ask if anyone has additional observations to add.

3. The DET is derived from data that appear in the columns of the log sheet (number banded, number retrapped & other observations). Inspect and add all these numbers together to best estimate the number of birds that were present in the area during the count period.

4. Reduce the total by eliminating probable duplicates (see below).

Some helpful hints for making observations:

- If one cuckoo was caught and two were seen together later, you might have reason to assume that one of the two birds was the same individual you caught. In that case, you should record one (not two) under observations, in addition to the one you caught. Likewise, if two people independently saw two cuckoos on the same day, in the same general area, you can probably safely assume that they were the same birds and record an observation of two (not four). Get a feel for who saw what, when and where, and the circumstances.

- If both Rose-breasted Grosbeaks you saw were females, and the one Mary saw was a male, then you can record an observation of 3. However, if the one Mary saw was a female, then you could assume that it was one of the birds you saw and therefore record the observation at 2.

- If you saw birds you could not identify, but could classify to group (e.g. warbler), you could try to assign them to actual species in the DETs, based on other data. For example, there were 12 unidentified warblers seen as incidental observations. Of 8 warblers banded, 6 were Bay-breasted Warblers and 2 were Blackpolls. The 12 unidentified could therefore be assumed to have been 3/4 Bay-breasted and could appear as such in the DETs. Again, use your judgement. If you banded only 2 warblers and one of them was a rarity, you obviously should not assume that half the unknowns from the incidental observations were the same rare species.

Daily Estimated Totals - OHM

DATE:

Code	Common Name	Band'd	R'trap	Obs.	DET	Code	Common Name	Band'd	R'trap	Obs.	DET
WEGR	Western Grebe					SBDO	Sh.-billed Dowitcher				
RNGR	Red-necked Grebe					LBDO	Lo.-billed Dowitcher				
HOGR	Horned Grebe					STSA	Stilt Sandpiper				
EAGR	Eared Grebe					PESA	Pectoral Sandpiper				
PBGR	Pied-blld Grebe					BASA	Baird's Sandpiper				
						LESA	Least Sandpiper				
HERG	Herring Gull					SESA	Semi. Sandpiper				
RBGU	Ring-billed Gull					SAND	Sanderling				
FRGU	Franklin's Gull					MAGO	Marbled Godwit				
gull sp	**Unident. Gull Spp.**					HUGO	Hudsonian Godwit				
						GRYE	Greater Yellowlegs				
CATE	Caspian Tern					LEYE	Lesser Yellowlegs				
FOTE	Forster's Tern					**YESP**	**Un. Yellowlegs Spp.**				
COTE	Common Tern					SOSA	Solitary Sandpiper				
BLTE	Black Tern					WILL	Willet				
tern sp	**Unident. Tern Spp.**					UPSA	Upland Sandpiper				
						SPSA	Spotted Sandpiper				
DCCO	Dbl.-crested Cormorant					BBPL	Black-bellied Plover				
AWPE	Amer. White Pelican					LEGP	Lesser Gldn-Plover				
COME	Common Merganser					KILL	Killdeer				
RBME	Red-brsted Merganser					SEPL	Semipalmated Plover				
						RUTU	Ruddy Turnstone				
MALL	Mallard					WHPH	Wilson's Phalarope				
ABDU	Amer. Black Duck					AMAV	American Avocet				
GADW	Gadwall					WISN	Wilson's Snipe				
AMWI	American Wigeon					**shorebd sp**	**Un. Shorebird Spp.**				
GWTE	Green-winged Teal										
BWTE	Blue-winged Teal					MODO	Mourning Dove				
NSHO	Northern Shoveler										
NOPI	Northern Pintail					NOHA	Northern Harrier				
WODU	Wood Duck					RTHA	Red-tailed Hawk				
REDH	Redhead					SWHA	Swainson's Hawk				
CANV	Canvasback					RLHA	Ro.-legged Hawk				
GRSC	Greater Scaup					**hawk sp**	**Unident. Hawk Spp.**				
LESC	Lesser Scaup					MERL	Merlin				
scaup sp	**Unident. Scaup Spp.**					AMKE	American Kestrel				
RNDU	Ring-necked Duck					**falcon sp**	**Unident. Falcon Spp.**				
COGO	Common Goldeneye					OSPR	Osprey				
BUFF	Bufflehead					PEFA	Peregrine Falcon				
RUDU	Ruddy Duck					BAEA	Bald Eagle				
duck sp	**Unident. Duck Spp.**										
SBGI	Snow Goose					SEOW	Short-eared Owl				
CACG	Cackling Goose					GHOW	Great-horned Owl				
CAGO	Canada Goose					SNOW	Snowy Owl				
TUSW	Tundra Swan										
						BEKI	Belted Kingfisher				
AMBI	American Bittern										
GBHE	Great Blue Heron					HAWO	Hairy Woodpecker				
GREG	Great Egret					DOWO	Downy Woodpecker				
BCNH	Bl.-crown. Night Heron					YBSA	Yel.-bellied Sapsucker				
						YSFL	Yel.-shafted Flicker				

Figure 2 Example of Daily Estimated Total sheet.

3.2 Banding

Mist netting follows a strict protocol. Nets are set up and opened 1/2 hour before sunrise and checked every 20 to 30 minutes for 6 hours thereafter. The net design (mesh=30mm, length=12m) and location are constant. Net hours are recorded for each net, including time of opening, time of closing and general weather conditions (Figure 4). Banding is conducted a minimum of 5 days a week.

If weather does not permit the nets to be opened, netting is delayed until the weather improves, or if not, cancelled for that day. Banding should start as early in the day as possible, as some species disappear after the first hour or so of light; others may not appear until later. There is often a mid-morning rush of migrants, so it is important to stay (weather permitting), even when there are few birds around.

The net lanes are near the Clubhouse, some parallel to the willows and others perpendicular to them. This ensures that birds moving in any direction could be caught. The net-lanes are numbered, and this number is recorded for each bird (see map, Figure 3). This ensures standardisation of net-lanes used and it provides data for other possible studies such as species habitat selection, habitat succession, etc. As well, if adverse conditions arise and nets must be shut down, or not opened, net-hours can be recorded for each net which provides information that can be used as correction factors when the data is compiled.

3.2.1 Mist Net Lane Coordinates

Net	End	Latitude	Longitude	Notes
0	Banding station	50.10.296	97.07.928	
1	West end	50.10.329	97.07.926	
1	East end	50.10.328	97.07.915	
2	North end	50.10.281	97.07.927	
2	South end	50.10.275	97.07.928	
3	West end	50.10.261	97.07.934	Spring, farther out
3	East end	50.10.262	97.07.925	Spring, farther out
3	West end	50.10.263	97.07.925	Fall, once dry can move into marsh
3	East end	50.10.264	97.07.915	Fall, once dry can move into marsh
4	North end	50.10.338	97.07.907	
4	South end	50.10.323	97.07.920	
5	North end	50.10.331	97.07.908	
5	South end	50.10.324	97.07.907	
6	North end	50.10.335	97.07.926	Not used anymore
6	South end	50.10.329	97.07.923	Not used anymore
7	North end	50.10.272	97.07.929	
7	South end	50.10.265	97.07.930	
8	West end	50.10.325	97.07.923	NSWO net only
8	East end	50.10.324	97.07.918	NSWO net only
9	North end	50.10.329	97.07.926	NSWO net only

9	South end	50.10.325	97.07.923	NSWO net only
10	North end	50.10.304	97.07.018	
10	South end	50.10.300	97.07.012	
11	West end	50.10.304	97.07.019	
11	East end	50.10.308	97.07.014	

3.3 Incidental Observations (non-standard observations)

Throughout the day, personnel should be looking for and recording birds in the station area apart from the ones captured in banding operations. It is important that the count whole area is considered. All volunteers can contribute to the observations and binoculars or scopes can be used.

Do not rely on mental notes for these other observations. Write them down in the field book provided. It should be clear that only “incidental observations” made within the count area and during the count period should be included in the DETs. Birds not observed in the count area should not be included in the DETs.

DETs should be compiled every day during the migration season after all other record-keeping for the day has been completed. All personnel should be present and try to arrive at a consensus. This activity also allows everyone to catch up on what was seen during the day.

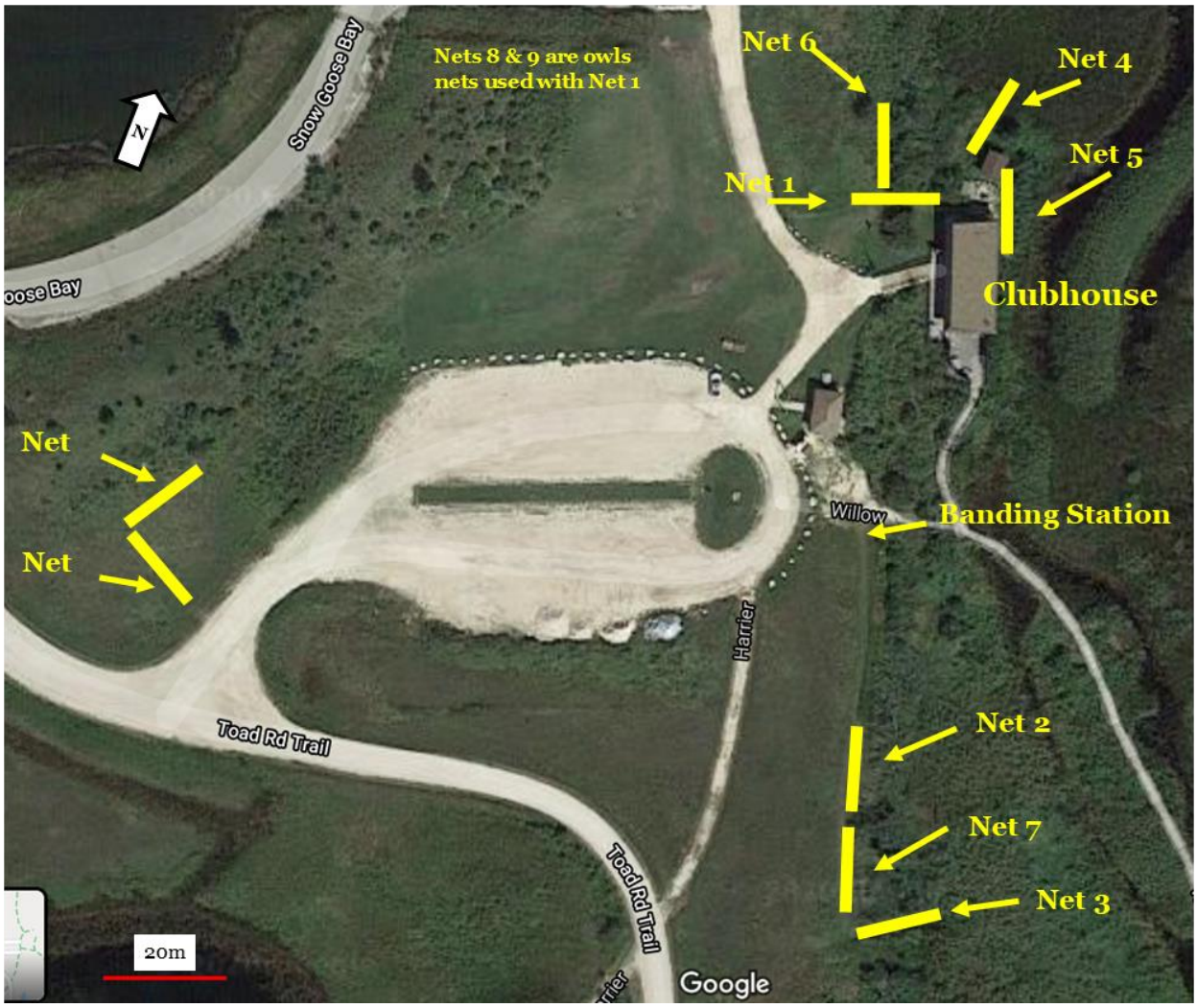

Figure 3 Mist net lane map.

3.4 Daily summary sheets

The data collected must be recorded carefully to be of any use. Completing the daily log sheets, is straightforward and an integral part of the day's activities. All data recorded must be as complete, accurate and legible as possible. An example of our daily summary sheet is shown in Figure 4. They are, for the most part, self-explanatory and should be filled out every day banding occurs.

3.4.1 Banders

Record names of personnel contributing to the day's banding.

3.4.2 Volunteers

Record names of volunteers contributing to the day's banding.

3.4.3 Visitors

Record names of all non-contributing personnel (e.g., casual or short-term visitors, non-birders, school groups, adult groups, etc.).

3.4.4 Weather

Record wind speed according to the Beaufort scale (Appendix 1), wind direction, cloud cover, temperature, and a general description of the weather at the beginning and end of each netting session.

3.4.5 Banding effort

Record the number of nets used and the number of hours of operation.

3.4.6 Narrative

Observations of other animals are to be noted in the narrative portion of the log sheets. The narrative should also note any extreme early or late records, notes on any colour-marked birds seen in the area, details concerning any bird mortality or injuries sustained during the banding operation, notes about maintenance, personnel switches, general highlights of the day, etc. Rare bird descriptions should be included. The narrative should include a general description of the kind of migration that occurred.

Daily Summary Sheet
Oak Hammock Marsh

<table>
<tr><td>Date

Banders</td><td>Weather
At opening:</td><td colspan="3">Precipitation:
Wind (beaufort, direction):
% cloud cover:
Temperature:
Other:</td></tr>
<tr><td>Volunteers</td><td>At closing:</td><td colspan="3">Precipitation:
Wind (beaufort, direction):
% cloud cover:
Temperature:
Other:</td></tr>
<tr><td rowspan="2">Visitors</td><td>Nets

1 (30mm – 12m)
2 (30mm – 12m)
3 (30mm – 12m)
4 (30mm – 12m)
5 (30mm – 12m)
6 (30mm – 12m)
7 (30mm – 12m)
8 (60mm – 12m)
9 (60mm – 12m)
10 (30mm – 12m)
11 (30mm – 12m)</td><td>Opened At:</td><td>Closed At:</td><td>Hours Opened:</td></tr>
<tr><td colspan="4">Narrative</td></tr>
<tr><td colspan="2">Summary
Number of Birds:
Number of Species:
Total Mist Net Hours:</td><td colspan="3">Signed by:</td></tr>
</table>

Figure 4 Example of daily summary sheet.

4 DATA MANAGEMENT

4.1 Mist net hours

Mist net hours are also computerised at the end of each day using a spreadsheet file. They are entered by day and by net number so that birds/mist net hour can be calculated. We can also trace net productivity this way.

4.2 Computerised banding schedules

The Canadian Wildlife Service (CWS) and the U.S. Fish & Wildlife Service require that banding records be submitted to them on special forms called Banding Schedules. Electronic submissions are acceptable. The 'Bandit' data entry program and manual has been developed by Bird Studies Canada and replaces both the 'Band Manager' and 'DBentry' programs used in the past. The data are entered after each banding period into the computer so that errors can be corrected while the day is still fresh in your memory. Be sure that at least 2 backup copies are made and stored away from the site.

4.3 Computerization of the DET data

Analysis of the DET data requires that they be computerized. All data are entered in the Canadian Migration Monitoring Network, Daily Estimated Totals Management Program. It is designed for the easy entry and management of Daily Estimated Totals data from bird observatories. It is not designed for the entry of specific banding information, but rather for the entry and management of totals for banding, retraps, observations, Daily Estimated Totals and several other categories for all bird species. It is also useful for the entry of some daily effort information including number of nets, volunteers etc.

4.4 Record of changes or major interruptions in standardized data collection

The table below alerts researchers to any anomalies in data collection that might affect their interpretation of data. Alerts should include any changes in standardized operations (such as coverage dates), notable interruptions in coverage (due to things like flooding or loss of key personnel), and any changes in habitat structure (short or long-term) that likely affect the species and numbers of birds captured. Whenever an alert is added to the table, change the date on cover page for 'latest revision,' and submit a copy of the table to Birds Canada along with year-end data submission.

Date	Description of change and justification (if applicable)
2011	Net 6 removed from array. This net had one end near the centre of Net 1 and extended perpendicularly to the north (see Figure 3).
2020	Program restricted by Covid-19 restrictions. Only 3-5 nets were run daily, and nets 4, 10 and 11 not used at all. No data collected that required blowing feathers on bellies of birds (fat, breeding condition).

5 BIRD BANDING

Procedures for capturing, banding and processing birds are described in the following sections. **There are several "Cardinal Rules". Of paramount importance is the bird's welfare and safety.** Always release a bird unbanded if you are the least bit unsure of its identity (or in your abilities to identify it correctly). We generally band all birds that are captured, with a few exceptions: unidentified species, sick/injured birds, Ruby-throated Hummingbirds, large hawks and owls.

The participants at any banding site must be especially concerned with good public relations for banding. Some members of the public might understandably regard a bird in a net, or bag in the hand with a certain amount of concern. Assure them that nets are checked regularly every 20 to 30 minutes. There is no reason why visitors cannot be shown birds in nets that are properly set, operated and tended, or be allowed to watch a competent and experienced bander remove and band the birds. A good banding operation is not a secretive affair. Trainees should not operate in the public eye until they have developed the necessary skills (see section 8).

Trainees must spend enough time with an experienced bander so that they will know exactly what to do when they begin to net without supervision. A brief training protocol is outlined in Appendix 2.

5.1 Mist nets

5.1.1 General Rules of mist netting

1. Birds are removed from nets and placed in soft, cloth bags for return to the banding lab. Avoid hanging bags of birds on trees (they are easy to forget) or leaving them on the ground (they may get stepped on) or in direct sunlight.

2. Note that when removing birds from nets, either the largest or smallest birds should be removed first, depending on which is in the fewest number. The larger birds are likely to injure the smaller. For example, if you have 6 grackles and 1 warbler, you should remove the warbler first. If you have 6 warblers and 1 grackle, you should remove the grackle first.

3. If you have to double-up birds in bags, put non-aggressive birds of the same species together. Do not double-up aggressive species like grosbeaks, jays, grackles, chickadees, woodpeckers, etc. Transfer the birds as soon as possible to individual bags. If for some reason, you must leave more than one bird in a bag, make sure that whoever is banding is aware of it.

4. Inspect and repair cloth bags often to make sure there are no holes or loose threads at the seams that can entangle the bird's feet. Make sure that the bags are routinely laundered on an as needed basis and keep the drawstrings knot-free. Bags are used only once and then laundered.

5. A bird should be returned to its point of capture and released if it is:
- an adult on a breeding territory,
- a female with a brood patch; or
- a dependent juvenile.

5.1.2 Description

Mist nets are large panels of fine black nylon, terylene, polyester or monofilament netting, of varying mesh sizes and lengths. They are strung between two or more poles placed in the ground. The poles are 3.2 m lengths of thin-walled steel electrical conduit. Running horizontally across the net at the top and bottom of the net and at three evenly spaced intervals are strong "shelf strings", which are stretched tautly between the two supporting poles. Loops at the ends of each string go around the poles. The net itself, which is difficult for birds to see, hangs loosely. When birds fly into the net, their weight forms a pocket in the net, and they become entrapped.

Different mesh sizes are used for different target groups of birds; the smaller the bird, the smaller the recommended mesh size. The standard nets we use are 12m in length, and 2.5m high with a 30mm mesh size.

5.1.3 Setting the nets

The nets should be set in the same location each year (see coordinates in section 3.2.1). In preparation for setting of the net, some vegetation will need to be trimmed because of new growth. Trim back the vegetation to form a 2 m wide corridor the length of the net. Also look up to make sure there are no over-hanging branches. We try not trim excessively, as trees are at a premium here at the marsh, but the nets should not snag on branches as this makes holes.

Placement of nets is easiest with two people. First, pound in a 125 cm length of rebar at one end of the net lane until about 40cm is left showing. The rebar should be pounded in at a 15-degree angle away from the net. Then, place the loops of one end of the net on to a net pole (with the white loop up) and push the pole onto the rebar until it is flush with the ground. Walk away from the pole until the net is taut, keeping it clear of vegetation and the ground.

Check that both ends of the net have the same shelf strings on top, and that the loops are in proper sequence. The top shelf string is usually identified by its white loop. On tethered nets, the top string is also doubled. Then pull the net taut and pound in a second piece of rebar at the appropriate place. Slide the net onto pole and the pole onto the rebar. Once the nets are in place, the poles should be pulled to a nearly vertical position. New nets are apt to stretch, particularly after a rain, so the poles will periodically need to be moved in order to keep the net taut.

The nets are closed and taken down after each banding session/day. It may be useful to tape the loop ends with duct tape. This prevents the net from getting caught and tearing on the ends of the loops.

To set the nets push the loops apart on the pole to spread the net. You will need a stick to reach high enough to spread the upper panel. There are strings attaching the loops to each other vertically, and the loops should be spread almost as far apart as possible. The net should hang loosely, bagging slightly over each shelf string.

Ensure that the bottom of the net is high enough, so that birds hitting low in the net do not rest on the ground. If netted birds do touch the ground, they can get exceedingly wet and tangled on a dewy morning. They are also at risk from depredation. Test this distance by dropping a couple of bird bags into the lowest panel about mid-way along its length. Nets usually work best if the loops are not spread too far apart. However, this depends in part on wind direction and speed, and the species you are catching. A general rule of thumb is about 10cm of bag – test the amount of bag by tossing a bird bag into the panels. Too much bag and you sacrifice overall height and the birds will become entangled in the panel below (double netted). Too little bag will result in far fewer captures, since the birds are likely to bounce out.

Make sure that everyone at the site is aware of net status (which nets are open, and which are closed at any given time).

Nets can be safely used in moderate winds (use your judgement – due to their locations, nets are affected differently depending on the wind direction.) A little wind just means that you should give the nets more bag and check them more frequently. It is more apt to reduce the number of birds caught, especially if the wind is perpendicular to the net. Very strong winds may require some (or all) of the nets to be closed depending on their location.

Do not band if it is raining, very cold (below freezing or when your hands are too cold to band), exceedingly windy, or a combination of cool (**below 4°C**), cloudy, and/or windy, which together can create unsuitable conditions. Banding can continue if it is misty, spitting, or there has been heavy dew, providing the nets are checked very frequently.

Do not use nets that are exposed to the sun if the temperature rises **above 27°C** on calm (and especially humid) days, as it is too hot for the birds to be exposed to the heat. All nets should be closed in excessively hot weather. Nets should also be closed and remain so if there is a predator in the area. Most predators are persistent and tend to return. The net(s) can be reopened once the predator has left the area.

5.1.4 Checking the nets

Once set, nets must be checked frequently!! This usually means every 20 to 30 minutes. That is, the net round should begin no longer than 30 minutes after the start of the previous round. Check nets most frequently when the weather is hot, cold, damp or windy and when there are lots of birds.

We use carabiners of different colours to clip together the bird bags from each net, so it is easier to remember which bags came from which net. When you get back to the banding station you can easily hang the carabiner on the correct peg on the net board.

If you are catching more birds than you can process between checks, speed up the banding process by:

- Banding & recording only minimal data, i.e. species, age and sex (if possible) and only those data needed to determine age and sex

- Banding and species ID only (ring-and-fling). In exceptional cases, it may be necessary to simply extract the birds from the net and release them right away, unbanded (see section 5.2.11). Record the numbers of each species released. Use your best judgement. We are not trying to set records; the health and welfare of the birds are always of primary concern. Do not allow birds to remain in nets any longer than necessary, certainly not much more than half an hour.

5.1.5 Removing birds from nets

Removing birds from the net is an art and a science. It must be learned under the supervision of an experienced person. It should not usually take more than 5 minutes to remove a bird from the net. If it does, you should ask for help from a more experienced bander. Removing a bird from a net is normally a one-person proposition – two people trying to work together is seldom very successful. Visitors and other banders present should be kindly reminded, to keep their hands off the bird and net unless specifically called upon by the person removing the bird.

When removing a bird, it is best to visualise how it was caught and then imagine how you might reverse the process. With few exceptions, a bird is caught in a pocket formed in the netting between two shelf strings. As the net slows the momentum of the flying bird, the weight of the bird causes the bird and its pocket to come to rest below the lower of the two shelf-strings. In getting caught the bird normally gets entangled in five places: the head, the wings, and the feet. More rarely will a bird get tangled on the tongue (this creates a special problem, see further in this section).

The various extraction methodologies merely involve the sequence in which the five body parts (F-F-W-W-H) are disentangled. These include the “Feet First” (F-F-W-W-H), “Around the Clock” (F-W-H-W-F) and “Feet Last” (W-H-W-F-F) methods. Because of ease of learning, reduced injury to the birds and speed of removal, we prefer the “Feet Last” method. Body grasp is also easy on the bird and can be used for most birds with a little practice.

The first step is to determine from which side the bird entered the net; it is usually impossible to extract a bird from the opposite side. Once you are experienced you can usually tell from a distance by the way the bird hangs, but until then try reaching for the bird through a seam between the first shelf-string above the bird and the netting. If you cannot, you are on the wrong side of the net. Do not assume that because one bird is on one side of the net that they all are.

Once you have determined what side of the net has the bird, carefully look into the pocket and quickly assess the situation. If you are lucky the bird is simply "pocketed", and it can easily be removed by carefully slipping the first two fingers of the hand up the back of the bird and along the side of the neck. These are then brought together in front of the neck and the other fingers and thumb wrapped around the body to form the "banders grip". Carefully bring the bird out of the pocket ensuring that the feet are not entangled. Simple pocketing occurs most frequently with larger birds, so it is wise to remove large birds first before they escape.

Usually the bird is more tangled, and netting may seem to be everywhere! There is hope, however. With some manipulation you should be able to see a bare patch in the area between the legs. BEGIN HERE. If the tail is tangled, free it first, then work the netting up the body over the breast. If possible, hold the bird in the bander's grip, if not, slip your fingers up the back and gently hold the bird by pressing your thumb on its breast. Next lift the bird out of the pocket and away from net as far as the slack permits. This helps to pull the loose netting away from the bird and keeps the bird from grasping more netting with its feet.

Next come the wings. In most cases, the wings are freed by peeling the threads over the underside of the bend in the wing. Place the thumb under the threads and push upward while using the forefinger on the bend as a fulcrum to push downwards. Sometimes the wing tip is also caught in the mesh, remove this meshing before proceeding to the bend. As you free the wings, it may be necessary to shift your grip from one hand to the other. To free the head, it is best to twist your wrist so that the bird and your palm are facing down. Work the mesh from the nape forward. You may have to make several attempts at this before you are successful. Be careful of the eyes.

Last come the feet. If you are lucky the bird will simply let go. You may also be able to fool the bird into letting go by blowing on it. Most often, however, you will remove the mesh from the feet. This should be done in a gentle teasing motion in a direction parallel to the length of the leg. The metatarsal or "knee" joint should be held whilst doing this.

Circumstances dictate variations to the above procedure. It is often easiest to free the least tangled portions of the body and leave the most tangled to last. For example, it may be easiest to free the feet before freeing the other body parts (this is particularly true if there is netting above the metatarsal joint).

"Double pocketing" is a special problem where it is necessary to start on the side opposite to the entry of the bird and free the netting encompassing the original pocket before you can go back to the entry side of the net. Also, some birds especially wrens, pirouette in the net and cause difficulties. These can be solved by gently and carefully unwinding the bird and net.

Thrushes, blackbirds and a few other species have strongly arrowhead-shaped tongues that can often get netting caught up in them. Handle these birds gently; avoid pulling on the caught thread. "Tongued" birds can be freed by removing the netting from the rest of the bird first. When only the strands around the tongue remain, relieve tension on them as much as possible, and keep the bird's mouth open with your fingers, so it does not bite its tongue. A seam-pulling tool or some other pointed gadget (even a pencil) is handy for lifting loosened thread back and over the tongue fork.

In a pinch, you can cut a thread or two with small scissors (a knife pulls on the thread as it is cut and could hurt the bird). Holes in the net cause birds to become badly tangled, however, so you should avoid cutting as much as possible. Experienced people almost never need to do it. It is only used as a measure of last resort – seek assistance from more experienced banders if necessary. If you do cut any netting, be sure no pieces of mesh are left on the bird.

To reach birds caught at the top of a net, you may have to temporarily lower the top panel, by gently pulling the loop down the pole with a forked stick. Do not pull on the string itself, since it is delicate and will break. Be sure to reset the net afterwards. Banders quickly learn not to wear fancy jewellery or clothing with buttons. Buttons, especially on cuffs, easily get caught in the mesh. Not only can they easily tear the net; they are also a time-consuming nuisance to untangle. Velcro also tangles badly.

If the birds are exceedingly tangled, it usually means that the nets are improperly set or that you are not checking them frequently enough. While it is impossible to have 0% casualties, you must strive to have the lowest casualty rate possible.

Like the banding process itself, mist netting requires good eyesight, manual dexterity and the proper temperament. If you lack any of these qualities, or are uncomfortable extracting birds, we will find some other way for you to contribute to the banding operation.

5.1.6 Closing the nets

Close nets immediately if it starts to rain hard or if a prolonged rainstorm seems imminent (wet birds can die from exposure). Always close, furl and tie (optional) all nets at the end of each banding session/day. Before closing nets, clean out any leaves, insects, twigs, etc. If you do not, they become tangled, and the net is much harder to open the next time (be careful not to tear the net trying).

At the end of each banding session/day, take the nets down completely. To close the net, lower the top panel by reaching the top loop with a stick. Do not pull the loops down by the string; it will break. Slide the bag handle through all five end loops, remove the pole and loop the bag handle over your wrist. Put your other wrist through the other bag loop and then gently gather the net and put it in the bag with a hand over hand motion. Continue this for the entire net. When you reach the end of the net loop the free bag handle through the five end loops and remove the pole. Tie two knots with the bag handles to secure the net in the bag.

5.1.7 Maintaining the nets

Frequently check that the net is taut and clear of the ground, vegetation, and insects. Large insects like bumblebees and dragonflies are particularly hard on nets as they chew holes in the mesh. They are also usually impossible to untangle alive. Dragonflies can usually be pulled out without too much difficulty, but it is best to squash bees/wasps thoroughly, so that their body parts fall through the netting.

Make any repairs on nets quickly, before the damage gets worse. Holes can and should be repaired with a needle and heavy thread. Net repair is tedious but is easy and prolongs the life of a net. Burn any nets which become rotten and tear easily, or which have too many irreparable holes. When setting up nets each day, check to make sure that the netting is not caught up on the tethering knots of the top panel. Otherwise, the netting will get progressively more knotted up, reducing the size of the top panel and perhaps tearing the net. Keep net lanes trimmed of weeds and branches that can catch on the net, especially on windy days. Also, periodically "weed-wack" the new growth/grass under the nets as it may conceal birds and/or causes them to get wet with dew when caught in the bottom panel.

5.1.8 Recording Habitat

Mist net lanes and the vegetation surrounding them should be photographed twice a year, once in the spring (as leaf out has not yet occurred during most of spring banding) and once in the fall. The second week of May and the first week of August are the two weeks to do it. Stand at each end of each net and take a photo, ensure that it is a wide angle shot. Label each photograph with the net number, direction photo taken and date (e.g. Net1_east_May122020). These are all stored on the external drives that go with the computer.

Photos of the general count area should be taken as well as both these times (standing by net 10 looking towards the banding station, from Harrier trail looking east, from the banding station looking northwest and from the green space looking east are all good locations). These photos are intended to give a good snapshot of habitat around the nets. Label each photograph with the net number and the word Habitat, date (e.g. Net1_Habitat_May122020). These are all stored on the external drives that go with the computer.

5.2 Processing captured birds

During the banding operation, the following data must be recorded: band number, species, age, sex, location, date, wing chord, weight, fat condition, skull, cloacal protuberance, brood patch, time trapped, primary moult and net number. Brief notes on plumage aberrations, parasites, infections, wounds, etc. are also recorded.

5.2.1 Information gathered (Banding sheets)

This information is recorded for each bird on Banding sheets (see Figure 5 and Figure 6). **Use only pencils to record data and print everything legibly.**

Do not use ditto marks on the banding sheets when information is repeated on successive lines (they can be misinterpreted as "11"). Instead, denote repeated entries with a solid horizontal line. This greatly facilitates computer entry later. Write sevens as European sevens (7̶) with the bar as some written sevens can look like fours, nines or even ones.

Record lost or destroyed bands as “Band Lost” or “Band Destroyed” on the appropriate line for that band. The next data line must be filled out completely (e.g. re-enter the data as if you were starting a new sheet), with no ditto lines. This avoids confusion for those entering the data into the computer.

Note that the species’ four-letter codes used in the banding operation are not always the same as those conventionally used by birders, or in field guides. Only the codes provided by the Bird Banding Office are acceptable. It is important that all banders use the same codes (see Appendix 3). Banding log sheets are kept separate for each of the different band sizes. Retraps are also recorded separately on the Daily Retrap Sheet (see section 5.2.13).

Record the bander’s initials (in the notes column). This should be done for each new bander. When you start in the middle of a series, begin on the correct line for the first band number and make a note on the sheet that all band numbers prior to the first one used were **used previously**. There is room for 25 bands per sheet.

Banding data to be recorded for all birds banded and retrapped:

5.2.1.1 Disposition

Record the disposition as in the N.A. Bird Banding Manual.

Disposition code	Description
1	Banded
4	Destroyed
R	Recapture
F	Foreign recovery
8	Band lost

5.2.1.2 Band number

The complete band number (prefix and series) should be written in on the first line of each new page. After that only the last two numbers need to be entered.

5.2.1.3 Species

Use the current 4-letter species code for each bird banded. See Appendix 3.

5.2.1.4 Age

Give the age as determined by the ‘Identification Guide to North American Passerines’, (Pyle 1997).

Age Code	Description
0	Unknown

1	After hatch year (AHY)
2	Hatch year (HY)
4	Local (L)
5	Second year (SY)
6	After second year (ASY)
7	Third year (TY)
8	After third year (ATY)

5.2.1.5 How aged

How Aged Code	Description
EY	Eye colour
FB	Fault bar
FF	Flight feathers (remiges), condition
LP	Moult limit present
MB	Mouth/bill
MR	Actively-moulting remiges
NL	No moult limit
PC	Primary covert shape and/or wear
PL	Body plumage
SK	Skulling
TS	Tail shape and/or wear

5.2.1.6 How sexed

How Sexed Code	Description
BP	Brood patch
CL	Cloacal protuberance
EG	Egg in oviduct
EY	Eye colour
PL	Body plumage
TL	Tail length
WL	Wing length

5.2.1.7 Sex

Give the sex as determined by Pyle, (1997).

Sex Code	Description
0	Unknown (U)
4	Male (M)
5	Female (F)

5.2.1.8 Wing

Measure the wing chord of an unflattened wing from wrist to longest primary on folded wing held in natural position (see Figure 17).

5.2.1.9 Weight

Record the bird's weight to the nearest tenth of a gram.

5.2.1.10 Skull (SK)

Record the amount of ossification of the skull (see Figure 12).

Skull Code	Description
0	Unossified; none
1	Very back of skull; trace
2	<1/3 ossified
3	1/3 to 2/3 ossified
4	>2/3 ossified
5	Almost complete
6	Complete

5.2.1.11 Primary moult

Record the stages of moult for each of the primaries (see Figure 18).

Primary Moult Code	Description
0	Worn
1	Missing, pin or <1/3 grown
2	1/3 grown
3	2/3 grown
4	Almost fully grown

5	Fresh, fully grown

5.2.1.12 Fat (FT)

Record the amount of fat in the furcular cavity (see Figure 16).

Furcular Fat Code	Description
0	None
1	Trace amount
2	Pit <1/3 full; light
3	Pit 1/3 to 2/3 full; half
4	Pit 2/3 to almost full; filled
5	Pit more than full; bulging
6	Pit bulging greatly, fat over breast

5.2.1.13 Cloacal protuberance (CP)

Record the stage of the ‘CP’ (see Figure 15).

CP Code	Description
0	None
1	Small, somewhat enlarged
2	Medium; cylindrical
3	Large; bulbous

5.2.1.14 /Brood patch (BP)

Record the stage of the ‘BP’ (see Figure 14).

BP Code	Description
0	None
1	Smooth; feathers gone; dark red
2	Vascularized; wrinkles, some fluid
3	Heavy; thickly wrinkled, much fluid
4	Wrinkled; dry, no fluid

5.2.1.15 Time

Record the time of the net check on the 24-hour clock.

5.2.1.16 Trap

Record the number of the net from which the bird came. We use carabiners of different colours to clip together the bird bags from each net.

5.2.1.17 Notes

Record any unusual occurrences, markings, parasites, etc.

*Bill and tail measurements are only taken if needed to identify the species.

Banding Data Sheet – Oak Hammock Marsh

Band size: **Bander:**

D	Band Number	Sp. Code	Age	How	Sex	How	Wing	Wgt.	SK	Primary Moult 1	2	3	4	5	6	7	8	9	10	11	FT	CP	BP	Time	Trap #	Notes
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Figure 5 Example of Banding Data Sheet

Banding Data Sheet – Oak Hammock Marsh

Band size: OA **Bander:**

D	Band Number	Sp. Code	Age How	Sex How	Wing	Wgt.	S K	Primary Moult 1 2 3 4 5 6 7 8 9 10 11	F T	C P	B P	Time	Trap #	Notes
	2570-05416	TEWA	2 PL	O PL	62	8.7		5				945	1	Aug 14'20 MS
	7	TEWA	1 PL	M PL	59	7.9		5 3 0				1015	1	"
	8	TEWA	2 PL	O PL	64	9.0		5				1015	1	"
	9	TEWA	1 PL	M PL	65	10.8		5 1 1 0				1015	1	"
	30	TEWA	2 PL	O PL	62	9.2		5				1015	1	"
	31	TEWA	2 PL	O PL	65	9.0		5				1015	1	"
	32	TEWA	2 PL	O PL	61	8.1		5				1015	1	"
	33	TEWA	2 PL	O PL	68	9.3		5				1015	1	"
	34	TEWA	2 PL	O PL	60	8.5		5				1015	1	"
	35	TEWA	2 PL	O PL	61	9.4		5				950	1	Aug 16'20 MS
	36	TEWA	2 PL	O PL	66	8.8		5				1020	5	"
	37	TEWA	2 PL	O PL	61	9.3		5				1020	5	"
	38	TEWA	2 PL	O PL	60	8.7		5				1020	5	"
	39	TEWA	0 PL	O PL	64	7.9		5				650	1	Aug. 17/20 MS
	40	TRFL	2 PL	O PL	66	12.4		5				650	5	
	41	TEWA	0 PL	O PL	62	8.5		5				720	1	
	42	TEWA	1 PL	♀ PL	60	10.1		5 1 1 0				830	3	
	43	TEWA	2 PL	O PL	67	9.5		5				930	3	
	44	TEWA	0 PL	O PL	61	8.4		5				950	7	
	45	TEWA	0 PL	O PL	66	9.0		5				950	7	
	46	TEWA	2 PL	O PL	61	8.4		5				950	7	
	47	TEWA	2 PL	O PL	61	8.1		5				950	1	
	48	TEWA	2 PL	O PL	65	9.2		5				1050	5	
	49	TEWA	2 PL	O PL	63	9.3		5				1050	5	
	50	TEWA	2 PL	O PL	62	8.5		5				625	1	Aug 19 MS

Figure 6 Example of Completed Banding Data Sheet

5.2.2 Bird handling

There are two important considerations when handling birds. **First and foremost is the bird's safety**. Of secondary importance is your safety. Nearly all birds bite and scratch, but only a few (e.g. raptors and grosbeaks) can inflict any real pain or injury.

The best way to hold a bird is to put its head between the first two fingers of your hand, and lightly grasp the body with the other fingers and your thumb, the **bander's grip** (Figure 7). The bird's back lies against your palm. Close your two fingers (lightly!) around the neck to prevent the bird pulling its head between your fingers. Your palm restrains the wings and the legs are accessible for banding. If you are right-handed, learn to hold the bird in your left hand, so you can band, measure and write with your right hand. If left-handed, do the reverse. You can restrain a small bird very effectively by using this very gentle grip.

If a bird struggles loose from your grip, it is much better to let it go than to grab for it. What you get is usually the tail that pulls out easily. Also, the chances of injuring the bird by a sudden grasp are great. Try to refrain from the instinctive desire to seize to bird.

A bird may be held by its legs, in what we call the **photographer's grip** (Figure 8). In this grip, the legs are held between the first and second fingers as close to the body as possible, so no injury occurs. The third and fourth fingers may be used to restrain the wings, so no injury occurs when the bird flaps. Legs are very fragile, and they can break easily if the bird is not held properly. Make sure that everyone is taught the proper grips. You may need to practice passing birds back and forth between to volunteers to become comfortable with both grips.

There are special handling methods used for raptors. Perhaps the safest is to hold them by the legs in an **ice-cream cone grip** (Figure 9). In this grip, the legs are fully extended along the tail. A hawk or owl has practically no ability to grasp when its legs are fully extended. The lower part of the bird (lower part of wings and body, the upper part of the tail, and the legs) are clenched in your fist – as if you were holding an ice-cream cone. The feet and talons safely protrude away from your hand. And the bird cannot flap and injure itself. With raptors, it is important to control their talons; their bite is usually not of much consequence (except for falcons which have a 'tooth').

Hummingbirds must be handled with particular care and should be held using the **pencil grip** – as if its little body were a pencil, its bill the lead. **Never** hold them by their legs. Also, their body feathers pull out very easily. Because of the risks involved and the need for special bands, we release hummingbirds as they are extracted from the net.

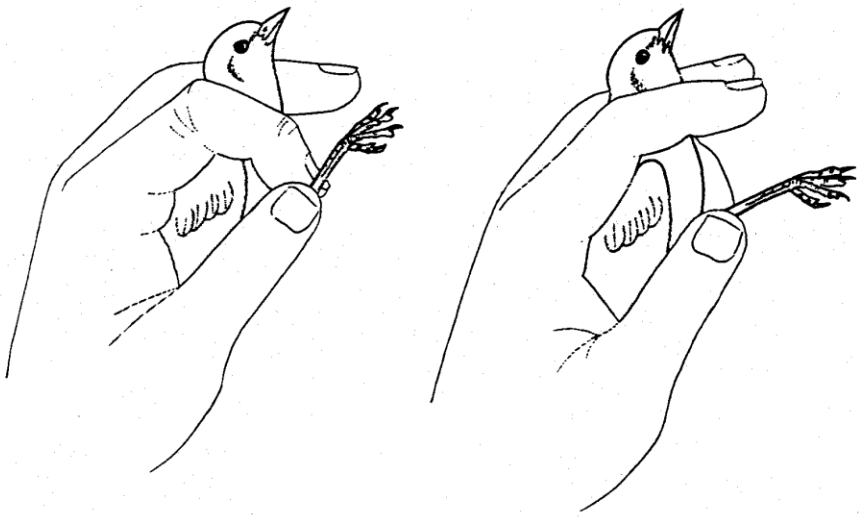

Figure 7 Bander's Grip, showing how the tarsal joint is held (from Lowe 1989).

Figure 8 Photographer's Grip (from McCracken et al. 1999).

Figure 9 Ice-cream cone grip (from McCracken et al. 1999).

5.2.3 Banding

You must be fully acquainted with the banding sheets before banding a bird. Know how to fill the sheets out correctly and neatly. Know how to use the age/sex keys from Pyle (1997). Know the acceptable codes for each item on the sheet.

Assuming you have mastered 'scribing', your first step is to identify the bird. **If you are not 100% sure what it is, let it go, unbanded!** Identification guides are available on site.

To determine the appropriate band size for the species, refer to the master code sheet (Appendix 3). If a choice is given between two band sizes, use a leg gauge to determine the most appropriate size. You should routinely use a gauge for blackbirds and hawks even though their sizes are listed, since their leg sizes are highly variable.

Then, take the next band of the correct size from the string and READ ITS NUMBER OUT LOUD to the scribe to be sure it corresponds to the next number on the record sheet. Birds are occasionally let go without a band, without the bander realising, and this check for band number on the record sheet is important in preventing chaos in the records. Also, sometimes the bands are out of sequence or missing from the string.

To open the band, place it completely over the posts on the banding pliers, with the seam along the axis of the pliers. Carefully, open the band evenly and just wide enough to comfortably slip over the bird's leg.

Place the band in the correct hole in the banding pliers. Pliers vary in the number of holes and therefore the band sizes that each will accommodate. For example: for some pliers size 0A, 0 and 1 fit in the first hole on the smallest pair of pliers; size 1B and 1A fit in the second hole and the third hole fits size 2. The next size of pliers accommodates sizes 3, 3A, 3B and 4.

All birds should be banded on the right leg. Grasp the bird's 'knee' firmly between your thumb and forefinger, ensuring that the leg is well supported in case the bird struggles while you are applying the band. Gently close the band around the bird's right leg, watching to make sure that it does not pinch the leg or overlap. Rotate the band 90 degrees and close it further. Rotate and pinch it again hard if necessary. Both ends of the closed band should abut, with very little or no gap between them. Among other things, gaps result in birds getting excessively tangled the next time they venture into a net.

Now that the bird has been safely banded, you can set the pliers down gently (so that the little post does not break) and quietly (so that the bird is not frightened by sharp noises). The entire banding operation should be a gentle and quiet process. It should also proceed quickly and efficiently.

5.2.4 Ageing

Never record age or sex of a bird unless you are sure of your determination. When in doubt, use 'unknown' (U) age or sex, and record what you think the correct age or sex is under Notes. Naturally, there should be no U-aged birds in the spring (since they are all at least AHY).

Pyle (Identification guide to North American birds, Part 1. 1997) is the primary age/sex reference used at the station. Note that the age 'answers' are often paired (e.g. HY/SY). The slash (/) merely represents the new calendar year. Choose the correct code depending on whether the season is post-breeding (e.g. fall), or in the next year and before breeding (e.g. spring). A bird of the year that is banded on 31 December might be aged correctly as HY. If it is banded on 1 January, however, it becomes a SY (i.e. it is in its second calendar year). Similarly, a bird that is aged as U in December automatically becomes AHY in January (see Figure 10).

It is important to note that Pyle (1997) represents major progress in our understanding of the moults, ageing and sexing of North American birds since the first edition (Pyle et al. 1987) was published. Bar graphs for each species have been added to:

- Present information on the degree to which users can reliably age and sex birds throughout the year, and
- Represent the age and sex codes currently accepted by the Canadian Wildlife Service (CWS) and Bird Banding Laboratory (BBL). Techniques for ageing and sexing are dealt with in the introductory sections of Pyle (1997) and are required reading.

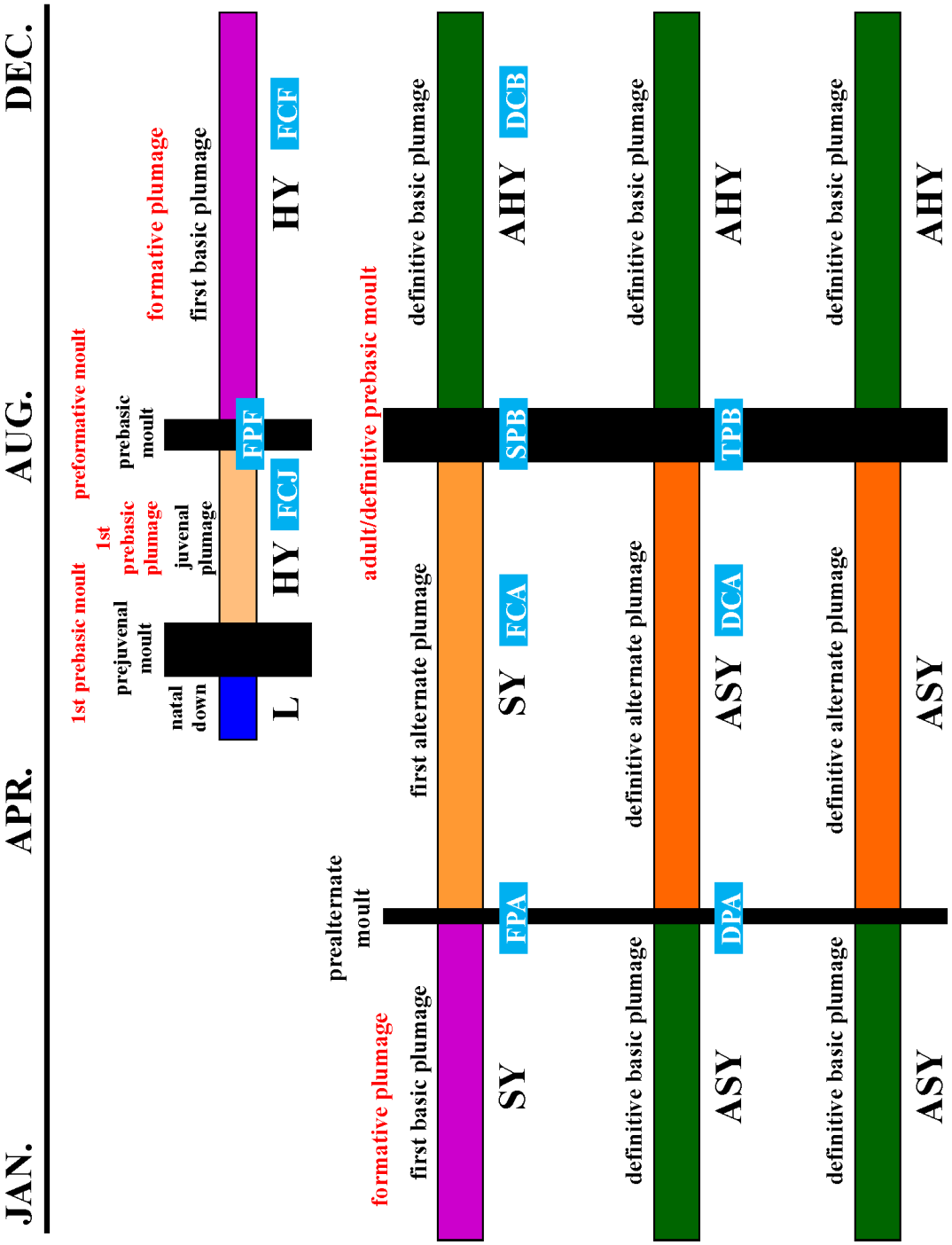

Figure 10 Moult/Age Class Chart (from McCracken et al. 1999).

Ageing is most often done by looking at feather shape and wear of the rectrices and primary coverts and by looking for moult limits in the lesser, middle and greater coverts. Hatch year birds grow feathers very quickly and produce pointy (tapered) poor quality feathers that wear quickly. Adults undergoing a moult produce feathers that are square (truncate) and high quality and wear more slowly (Figure 11).

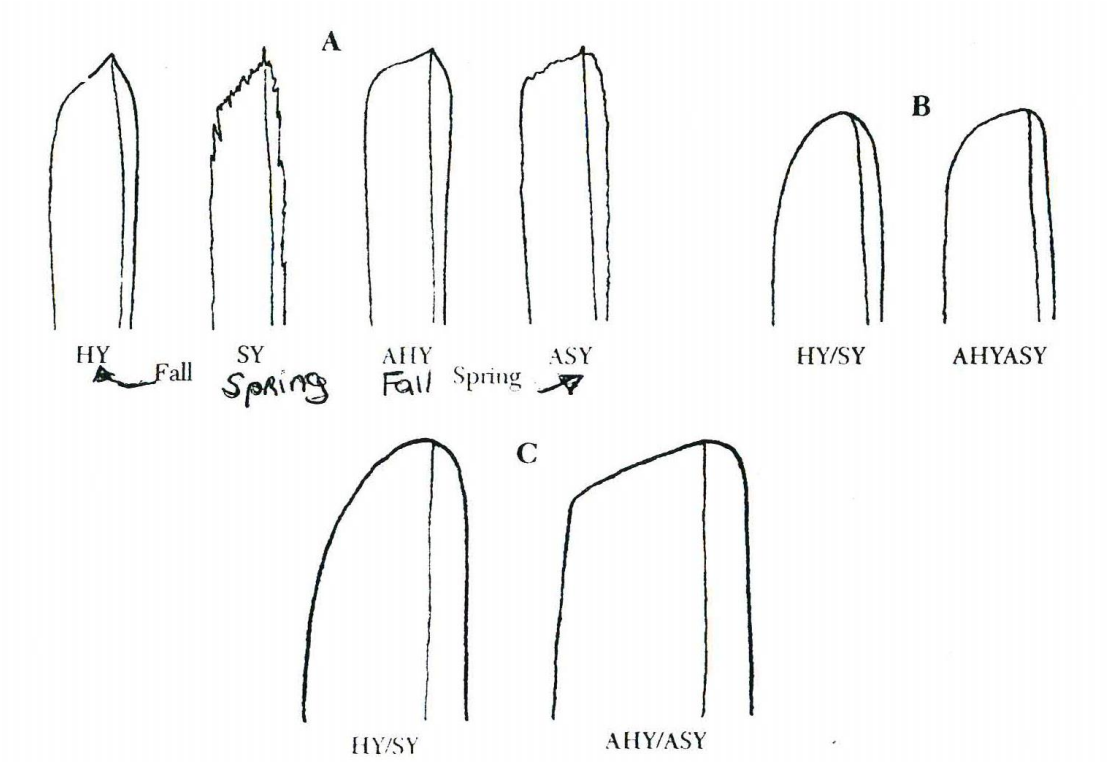

Figure 11 Feather shape and wear by age (Pyle 1997).

Ageing a bird can also be done by degree of skull ossification. It takes a bit of practice and is now rarely needed. An experienced person should show you how and check your age determination for each bird until you are completely trained. The basis for skulling is as follows. Young birds have one layer of bone in the skull. As they get older, a second layer grows beneath the first, and small pillars of bone connecting the two layers appear as small white dots. The second layer of bone grows gradually in a pattern that leaves two gradually decreasing "windows" until ossification is complete (Figure 12).

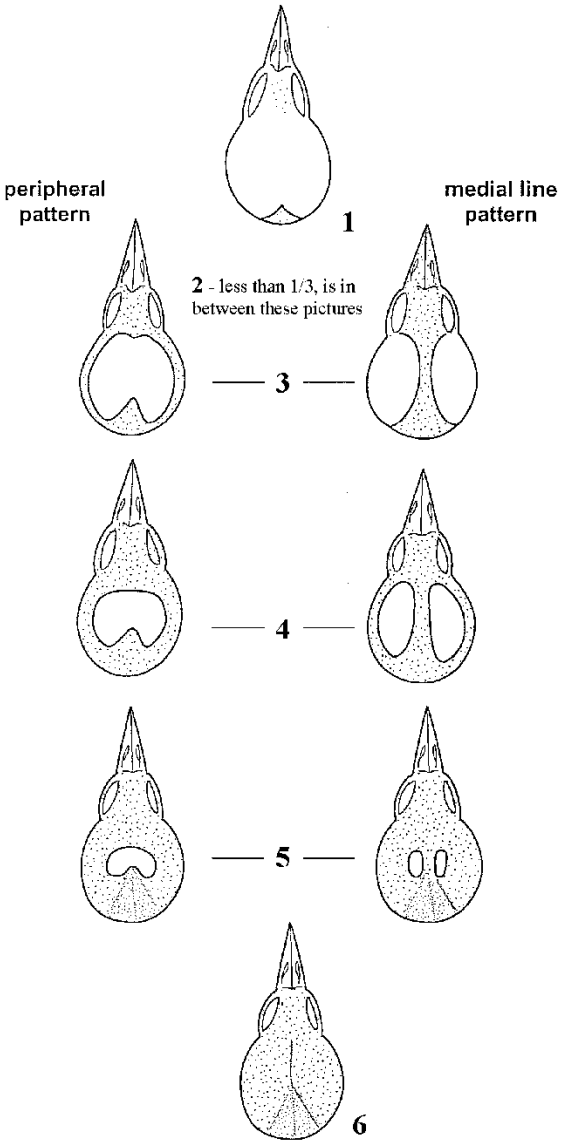

Figure 12 Two common sequence patterns of skull pneumatization (after Pyle 1997).

To look at the skull, lightly wet the feathers at the back of the head. Push the feathers aside to leave a clear patch of skin (see Figure 13). Under bright but suffused light conditions (daylight or an electric lamp), look through the skin to the skull. Move the skin around (it is loose and moves over the skull) – sideways and back and forth to search for white dots and/or pinkish 'windows' of unossified material that contrast with the whitish ossified bone. Most birds in fall are immature and are easiest to identify by looking for the edge of the 'window' (dots on one side and clear pink skull on the other). In most species, the last place to ossify is the top-centre of the skull. Smooth the feathers back down on the bird's crown after you have skulled it.

Skulling is done routinely from mid-June to 31 December but check the various references to see how late in fall that skulling is reliable, as it varies between species. Birds with completely ossified skulls cannot be reliably aged after certain dates and they should go down as 'U'. However, the skulling practice must continue beyond the skull-completion dates, since there will still be many birds with incompletely ossified skulls which can be reliably aged as HY. Also, some species (e.g. thrushes and swallows) can often be reliably aged by skulling into the spring.

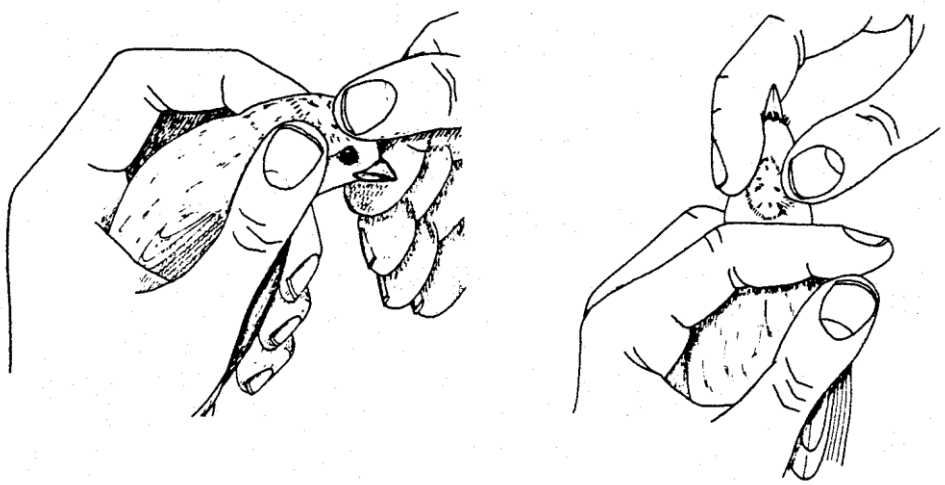

Figure 13 Two good holds for skulling (Pyle 1997)

5.2.5 Sexing

Two other techniques that give beginning banders difficulty are sexing by brood patch (BP) and cloacal protuberance (CP). Note that these techniques only work if one or the other character is present. Absence of a brood patch or a cloacal protuberance does not give you any definitive information about a bird's gender.

If the bird has a brood patch, the skin on the belly will be completely bare of feathers, and the skin will often appear wrinkled and/or heavily vascularized (Figure 14). This technique is not useful for separating the sexes of grebes, most shorebirds, most rails, all pigeons, all cuckoos, and all woodpeckers. In these groups, both sexes incubate and have a brood patch. Many birds, especially recently fledged young, have reduced feathering on the belly and this should not be mistaken for a BP. In general, only locally resident birds in the breeding season will have a BP. Hence, most birds undergoing migration cannot be sexed by this method.

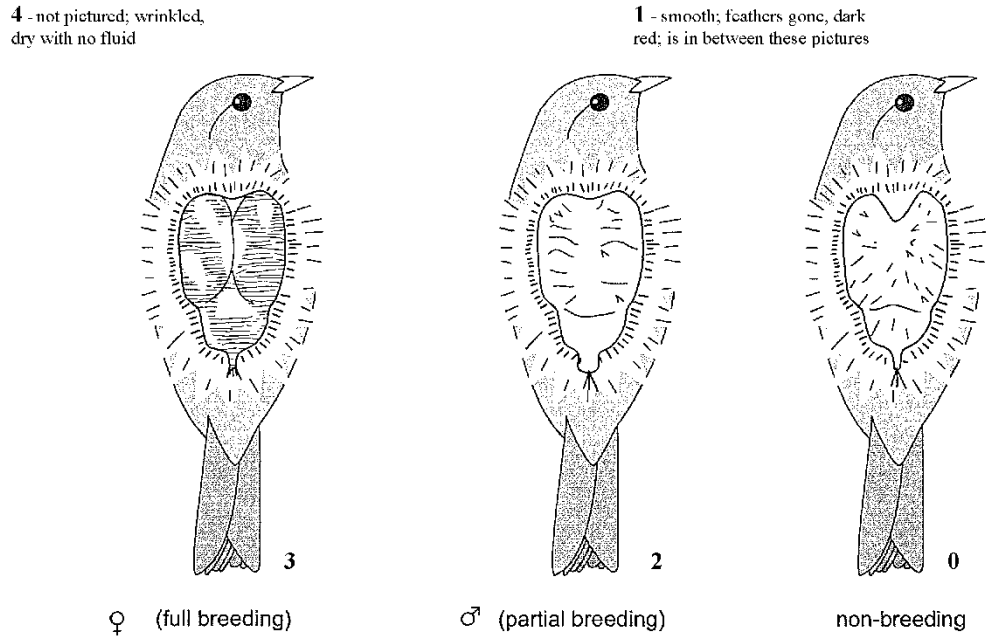

Figure 14 Brood patches at different stages of development (after Pyle 1997).

In breeding males of some passerines, the cloaca becomes swollen and protrudes posteriorly, forming a bulbous protuberance (Figure 15). A CP is present only in males that are sexually active; it is not often seen on birds that do not breed locally (e.g. migrant birds). Also, some females, while in the egg-laying period, appear to have a cloacal protuberance, but at that time they also have an incubation patch and the cloacal protuberance will not be very large (Figure 15).

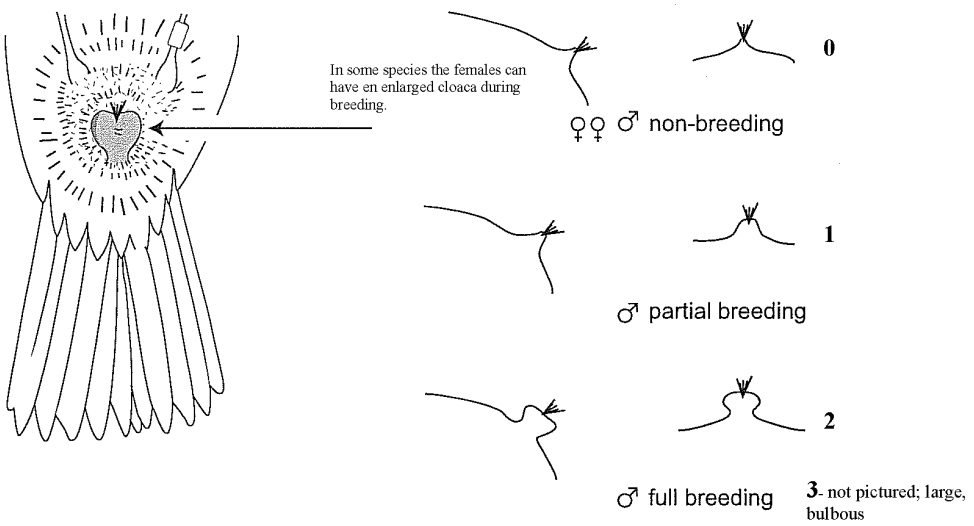

Figure 15 Cloacal protuberance in a breeding and non-breeding male (after Pyle 1997).

5.2.6 Measuring fat

The amount of fat on a bird can be used as a measure of a bird's condition. During migration, bird physiology changes markedly, such that birds develop hyperphagia and put on tremendous quantities of fat. Fat is the fuel required to sustain migratory flight. A visual assessment of fat can indicate whether a bird has just completed a migratory flight (little or no fat) or is about to depart on one (large amount of fat). Measuring fat is also useful for gauging the condition of sick or injured birds.

Once you get the hang of it, measuring fat is an easy procedure. After banding, hold the bird in the customary grip and part the feathers over the hollow of the breastbone (the furculum), by blowing on them. As you blow, the feathers will part along their natural tracts. You should not blow so hard as to make you faint from hyperventilation! Look at the amount of fat deposited beneath the skin. The fat deposits show up as distinct yellowish or orangish patches, contrasting with the red muscular areas. Consult the fat-scoring chart (Figure 16).

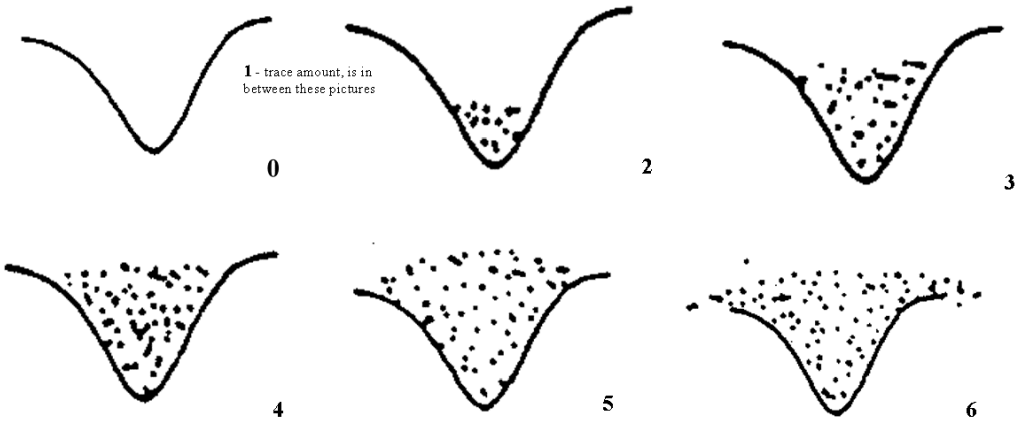

Figure 16 Furcular fat scores (after Smith 1995).

5.2.7 Measuring wing chord

Wing chord is important in:

- making sure you have identified the bird correctly,
- in analysis of weights, where wing chord can be used to 'correct' for the bird's fat-free body weight, and
- in separating the sexes of some species.

Measure the right wing (if you are right-handed, and holding the bird in your left hand), from the 'shoulder' to the tip of the longest primary, with the wing held in a natural position (Figure 17). If you can tilt the ruler to a 45-degree angle to the plane of the wing, so much the better, since this keeps the feathers off the ruler and reduces friction and increases accuracy.

Do not flatten the wing! All wing measurements done in North America are based on the natural arc of the unflattened wing. This is an important note to European banders, who are accustomed to measuring the flattened wing.

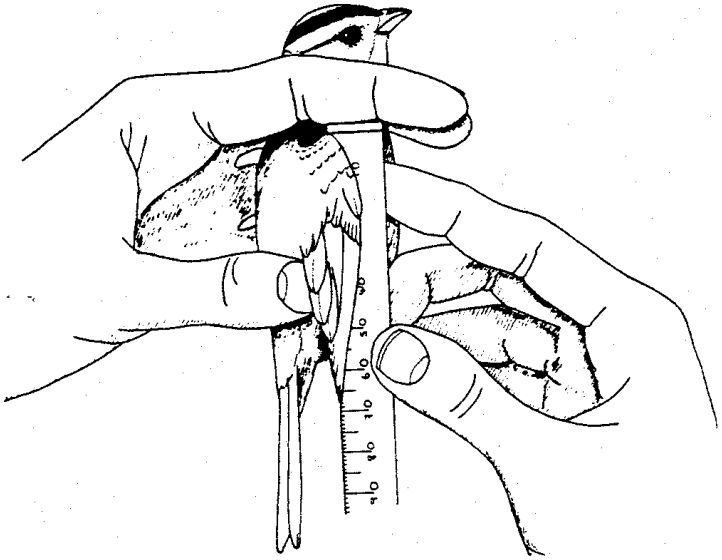

Figure 17. Measuring wing chord (Pyle 1997).

5.2.8 Measuring weight

We weigh all birds in small, open-ended envelopes on an electronic scale. Pesola scales are at times too slow in a large-scale banding operation, but are a good backup, especially if the electronic scale is not working. Birds are weighed with the band on. At the start of each day, make sure that the envelopes are clean and that the scale is tared.

Place the bird in the envelope head first, making sure the feet are tucked in. Weigh to the nearest 0.1-gram. Some species (especially cavity nesters) are prone to escaping from the envelopes, so keep an eye on them and do the weighing as quickly as possible.

It is best to weigh the bird as the last step in the banding process so you can release the bird directly from the envelope. Release the bird by hand. Do not try to remove a ‘stuck’ bird from the envelope by pulling on its tail; you will wind up with a handful of tail feathers. Such birds can be gently shaken down far enough for you to get a bit of a grip on them. If a bird escapes before being weighed, make a note of that in the Notes column of the banding sheet.

5.2.9 Moult

Moult is generally confined to two times of the year; the prealternate moult occurs just before the breeding season when the bird moults into its alternate breeding plumage. The prebasic moult occurs after the breeding season, though non-breeders may moult during the breeding season. All North American passerines have a prebasic moult, but only about half have a prealternate moult. Species that don't have a prealternate moult acquire alternate plumage through wearing away of the tips of body feathers.

Depending on the species, the prebasic moult occurs sometime between May and December, but usually between July and September. At this time, the adults of most passerine species have a complete moult, meaning that all flight and body feathers are replaced. Hence, for many species, a bird captured in mid summer that is undergoing a complete moult is almost certainly an adult. On the other hand, the juveniles of most species have an incomplete moult in which replaced feathers include only body feathers, lesser and middle coverts and none, some or all the greater coverts. They do not moult their flight feathers or tail feathers. Young birds can be aged by the degree of contrast present between the juvenal feathers and the more recently replaced adult type feathers (see section 5.2.1.5)

Conventionally, the primaries are numbered in ascending order, beginning with the innermost feather, in accordance with the sequence in which the feathers are normally replaced. Likewise, secondaries are numbered in ascending order, beginning with the outermost secondary and proceeding towards the body. Tertials are numbered as part of the secondary row, because these feathers are morphologically of the same origin (see Figure 18).

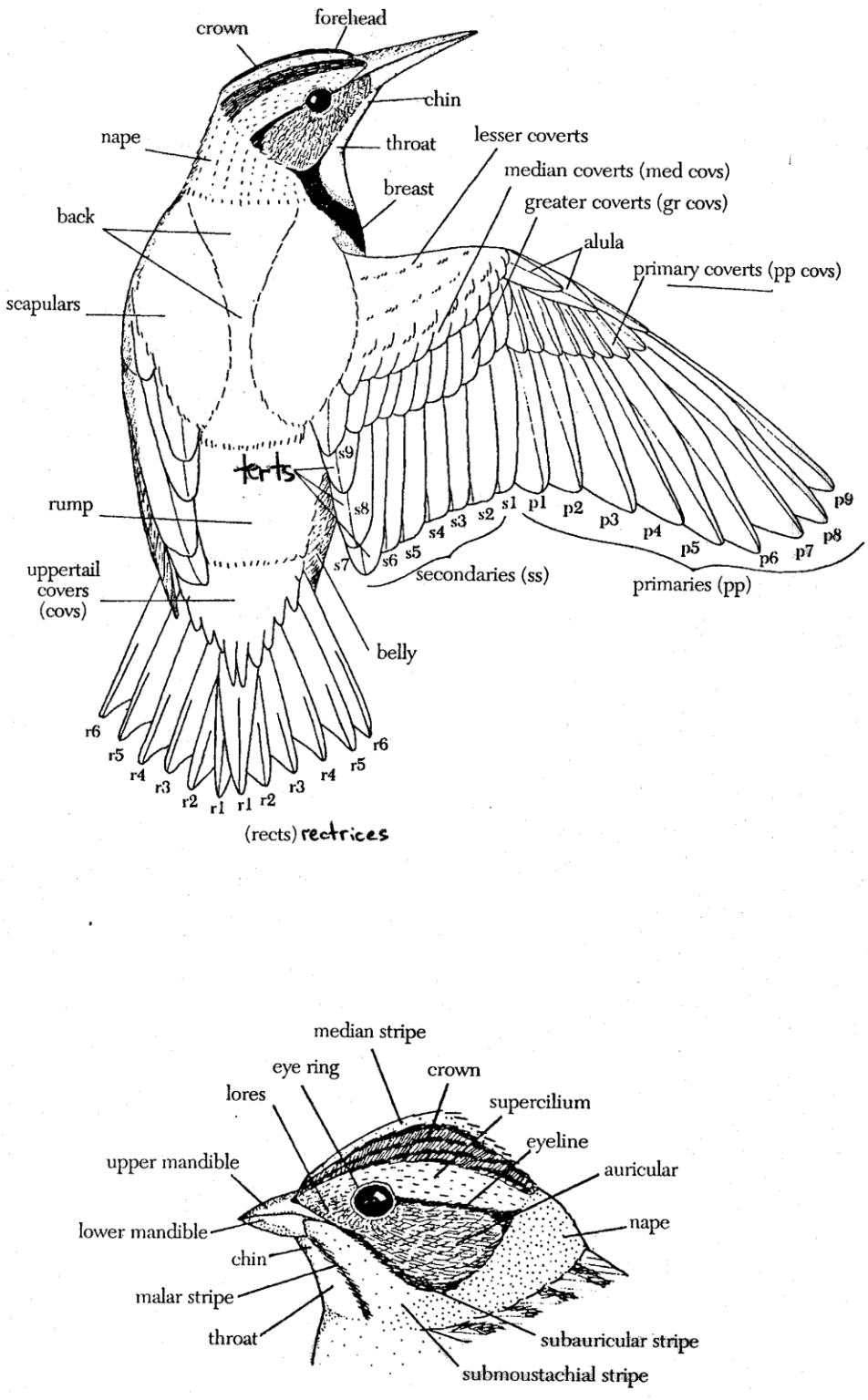

Figure 18 Bird Topography

5.2.10 Release

As a rule, birds should be released unbanded if they have been waiting to be banded for longer than one hour. The time really depends on the temperature and on other conditions. For example, if it is very cold outside, birds should be released as quickly as possible to allow them maximum time to feed. In any case, it is important to keep track of time. The following birds should be banded as soon as possible and must be released at their point of capture: adults caught while on a breeding territory, females with a brood patch, and dependant juveniles. Band and release family groups together. To avoid shock in hummingbirds, release them immediately at the net site.

For release, waterfowl can be grasped by both hands and thrown upwards, into the wind and towards water. Most shorebirds should be taken near the water's edge and released by lowering them to ground level. When your grip is loosened, the bird should walk away by itself.

Raptors should be held in the Ice-cream Cone Grip. While facing into the wind and away from nearby obstacles, the bird may be gently but firmly thrown upwards and away from you. Any large bird with long wings and short legs may be released this way. Owl at night should be simply placed in a safe, dark spot; when their eyes readjust to the dark, they'll fly away.

Passerines should never be thrown into the air or released high above the ground since the bird may be unable to fly properly due to cold, stress or wing-strain. If it appears to have 'wing strain', retrieve it and treat it as described in section 6.3. When releasing a small bird, it is often best to hold it in the bander's grip, crouch down low and simply open your hand palm upwards. If it appears "hypnotised", blowing on it should send it on its way. Make sure the bird flies away safely. Also, avoid releasing birds after dark (except owls), since they may have difficulty in finding a safe roosting place.

5.2.11 Modified and Rapid Release Protocols

The information gathered is ultimately dependant on the number of birds to be handled. The welfare of the birds is more important than gathering data. Under normal circumstances information to be gathered is outlined in section 5.2. In the event of a persistent backlog, the **Modified Release Protocol** should be instituted. If birds are coming in at 50 birds or more per hour, a backlog is likely to develop and persist. In that event, record only those data as required by the Banding Office: species, age, sex and only those data needed to determine age or sex. For example, wing measurements need only be taken if it would help in sexing the bird; there is no need to measure the wing of a bird that is obviously male.

If the backlog grows larger or if you are swamped with a wave of birds, you should let the birds go at the nets, unbanded. This is called the **Rapid Release Protocol**. While you release the birds, have an assistant record this information: date, net number, time, species plus age (how) and sex (how) if possible. This information should be filled into the Rapid Release Form (Figure 19). If it looks like the wave has subsided, you might want to save the last 20 birds for banding. The use of these protocols requires sound judgement - try to anticipate how many birds you might have by scouting the nets before changing protocols.

Rapid Release Form – Oak Hammock Marsh

Date:

Net #	Time	Species	Age/How	Sex/How		Net #	Time	Species	Age/How	Sex/How

Figure 19 Rapid Release Form (after Smith 1995).

5.2.12 Band removal

Overlapped bands (or ones that are not completely closed) can eventually injure the bird. Removing bands is a difficult and hazardous procedure – despite all care, it can easily result in a broken leg. In general, remove a band only if it is likely to injure the birds (e.g. if it will not comfortably slide up and down the leg without pinching it). The Cardinal Rule in band removal is to ensure that all leverage is applied to the band and none to the bird’s leg.

If the band is loose fitting, it should be removed with a pair of specially made band-removal pliers (‘circlips’). Carefully, insert the tips of the circlips through the band, so that the tips are equidistant between the seam. Make sure that the leg is well supported. Gently open the pliers (and the band). If the band is too tight to allow direct use of the removal pliers, it can be removed by using two strands of wire (that the bands come on). Gently insert both wires, on opposite sides between the band and leg, again so that they are equidistant from the seam. Do not cut the leg in the process. Twist the wires to form two loops; these must be tight. Again, supporting the leg is critical to success. Wrap the loops around something solid like a couple of pens or a pair of band-removal pliers (so you do not cut your hands on the wires as you pull). Now, pull both wires loops simultaneously and carefully open the band (see Figure 20). Once the band is loosened, you may decide to either continue using the wires, or switch directly to the pliers. Use the wire removal method only as a last resort, however, as it can easily result in a broken leg, despite all care. On very tight-fitting bands, you can frequently pry the band open a little by carefully twisting the tip of a pen knife blade.

If you band a bird with the wrong band size, it too, may have to be removed. A band that is too tight will chafe the leg, whereas one that is too loose will slip down over the foot. If neither of these is a problem, it is safer to leave the band on. In the latter event, you must make a note in the Notes section of the banding sheet. (e.g. “wrong band used in error, but it fit OK”, or “large/small leg hence this band size”).

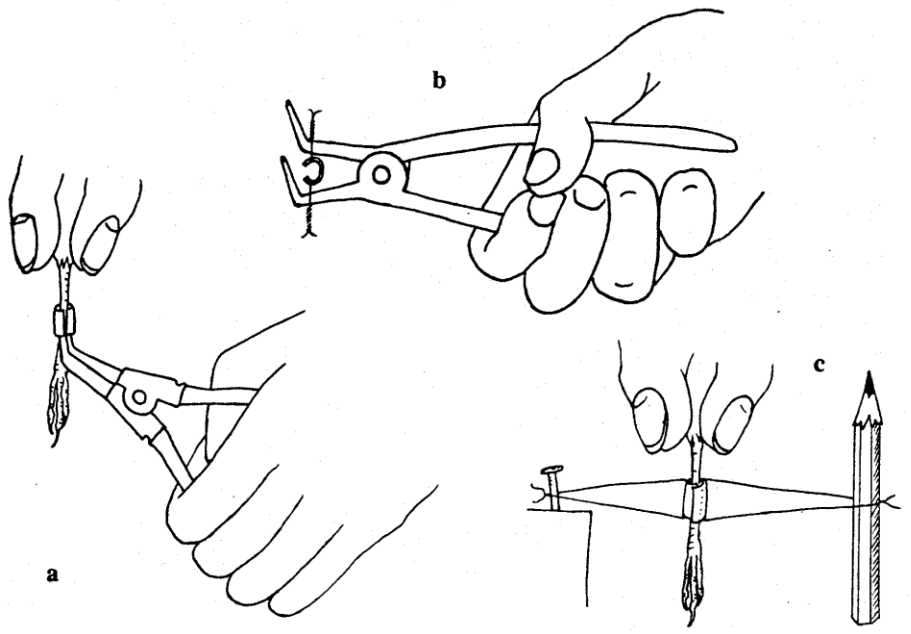

Figure 20 Removing a band with two pieces of wire. McCracken et al. (1993)

5.2.13 Processing retrapped birds

Retrapped birds fall into one of two categories: recaptures and foreign recoveries. A ‘recapture’ indicates a bird that was banded at the same site but on a different day. A ‘foreign recovery’ refers to a bird that was banded elsewhere and recovered at our site. All cases are treated the same and are placed on a ‘Daily Retrap’ page.

Even when a captured bird is already banded, always bring it in to be processed. Foreign recoveries are extremely rare, and you cannot afford to miss them.

Check the Daily Retrap page and the Banding sheets for the day to see if the bird has already been handled once that day. If so, it can be released directly. If it is new, fill in the Daily Retrap page (see Figure 21).

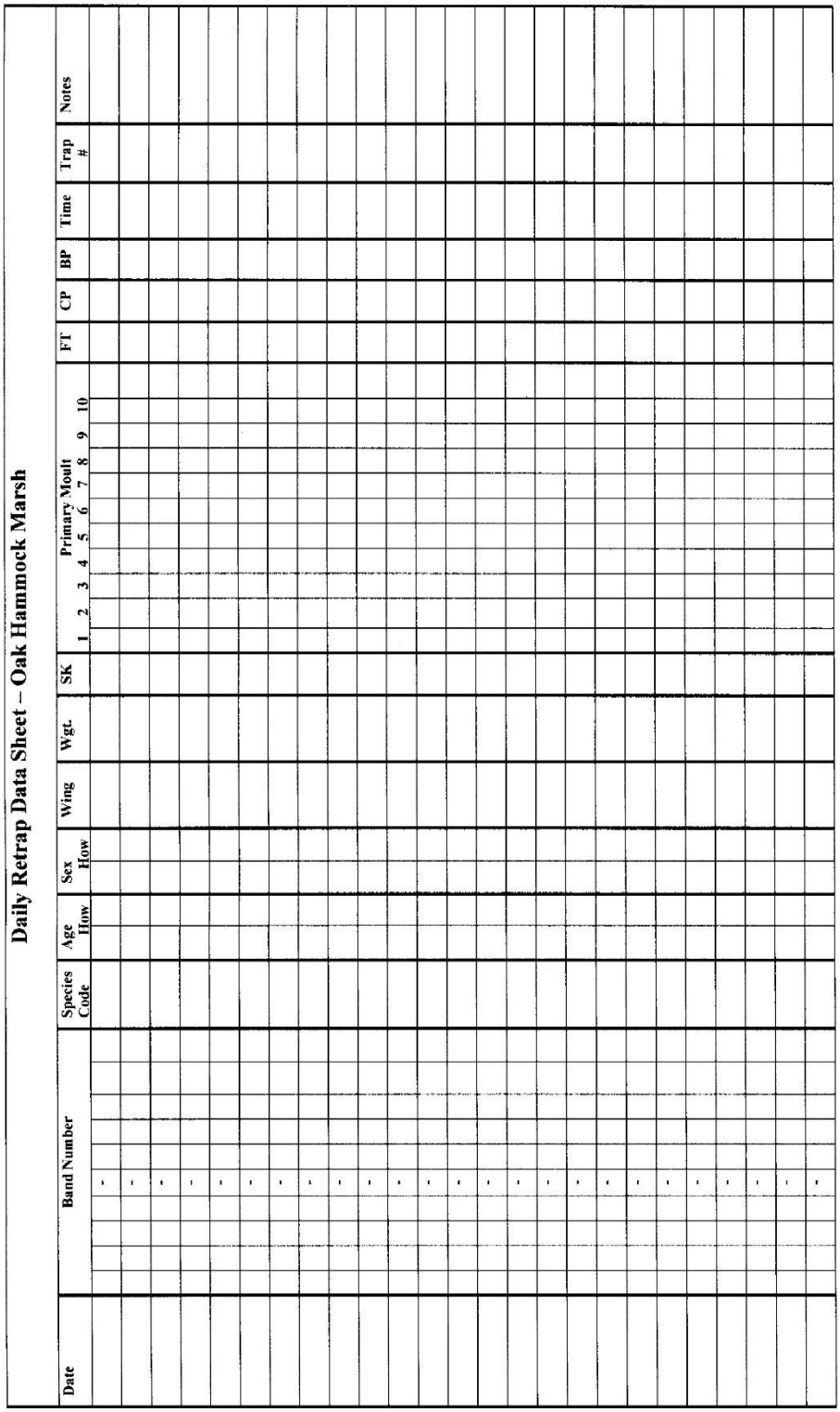

Figure 21 Daily Retrap Data Sheet.

5.2.14 Recoveries

Foreign recoveries are among the most exciting events of banding. These can be birds that were banded at your site but were recovered somewhere else later. Or they may have been banded elsewhere and recovered by you.

Members of the public often bring in dead, banded birds or report them to us. Get all the pertinent details of these recoveries (species, age, sex, band number, when and where the bird was found, how it died, and the name and address of the person who reported it). Whenever possible, double-check the band number. All recoveries must be submitted to CWS or USFWS. Bands can be reported using a website: www.pwrc.usgs.gov/BBL/bblretrv/. The same information is needed when reporting a banded bird using this website.

6 INJURIES AND THEIR CAUSES

For any of the injuries listed in this section or any deaths (section 7) an **Incident Report Form** should be filled out (see Figure 22). Incident rates should **never exceed 0.5%** of birds banded. If it does, you need to evaluate the banding operation and look for possible causes that can be corrected.

6.1 Minor Cuts and Scrapes

Small cuts may bleed profusely for a little while (as with humans), despite their non-severe nature. Although cuts and scrapes are not life threatening, it is your responsibility to ensure that birds are treated as humanely as possible.

1. Cut Legs

Small cuts to legs (usually thighs and toes) can result from rough handling or inattentiveness during mist net extractions. Banders should be careful.

2. Feather Bases

As with legs, this is the result of rough handling or inattentiveness during net extraction. Recently fledged juveniles and moulting birds are especially vulnerable because the bases of their incoming feathers are soft and blood-filled. The netting is apt to get tangles around these incoming feather shafts and unless you are careful, it is easy to break the shaft.

3. Tongues

Birds sometimes get “tongued” in mist nets. Some species (e.g. thrushes) are more prone than others to being tongued. Providing that a seam-ripper or twig is used to free the loops of netting, no damage usually results. Extra caution must be taken to safely remove the bird.

6.2 Problems with Legs

Very rarely, a bird will be found with a broken leg in a net. This is usually caused by some external force being applied to the net, effectively stressing the leg at the wrong angle until it breaks. The external force can originate from high wind or from another (usually larger) bird that is caught in the same panel of the net. Less often, it is a result of a banded bird being hung up by its band in a net due to a mist net strand slipping under the band (make sure bands are closed properly). Broken legs can also occur during mist net extraction if the tarsi are held too low; these occurrences are inexcusable. If you get a small bird with a broken leg, it is often most humane to quickly snip off the leg at the break with a pair of scissors, rather than just let the leg dangle. Put antiseptic on the stub and let the bird go unbanded.

Leg dislocation is rare, but some species (e.g. White-throated Sparrow) seem more prone than others do. Straightening the leg and popping the joint back into its socket can quickly treat most dislocations.

Legs can be crushed if an incorrect (small) band size is used or if the bander has failed to notice that the band is starting to overlap during band closure. Choose the band size carefully and if in doubt use a leg gauge. Do not guess.

6.3 Wing Strain

Occasionally, on release, some small birds (up to thrush size) appear to be incapable of flight, preferring to flutter along the ground. Such symptoms are commonly referred to as "wing strain". The condition is the result of a slight muscular strain or bruise. It is probably caused while the bird is in the net when one wing is free but the other is tangled and exerting a lot of pressure against the net. It can also occur during the extraction process. These birds should be held in a quiet, warm (very warm), dark place (often more than an hour) before being released. The condition is seldom fatal, and nearly always corrects itself quickly. Nevertheless, if a banding operation is experiencing any more than 0.05% incidence of wing strain, the cause should be investigated, one of the banders may be too rough in his/her net extractions.

6.4 Stunning

Stunning can happen when a bird escapes in a banding lab and hits the window. The bird can be kept in a warm (very warm), dark, quiet place for a few hours and periodically monitor its condition.

6.5 Shock and Torpor

Very small birds (hummingbirds, kinglets and sometimes warblers) occasionally appear to go into a state of shock, especially if they are over handled. It is usually a temporary phenomenon.

There are some tell-tale signs that should alert you that a bird may be in distress: opening and closing the bill (panting), gaping, closing eyes, lying limply, and fluffing up feathers. Birds showing any of these signs should be handled as little as possible, assessed as to their capacity for flight and released immediately if flight is likely. Often, the bird will surprise you and fly away normally. If flight is judged unlikely, then distressed birds should be put in a warm, dark quiet place and periodically checked. As a rule, for songbirds, if recovery is going to occur, it usually happens spontaneously within an hour.

6.6 Tail Loss and Feather Damage

As part of a bird's strategy to avoid depredation, tail feathers are not firmly anchored. Not surprisingly, tail loss is probably the most common kind of injury. It usually happens when you try to grab at an escaping bird, although it can also occur when placing birds in bags. It places additional energetic stress on a bird and is easily minimised with careful handling.

Frayed and broken feathers are other kinds of feather damage that can occur and need to be minimised with careful handling. Also be aware that the natural oils on your hands can gum up feathers. Keep your hands clean and dry. Never handle birds if you have applied mosquito repellent to your hands. It may be toxic and is highly corrosive.

6.7 Some Further Notes

"Orphaned" birds should simply be left alone, unless they are faced with imminent destruction. Parents will care for many birds on the ground, so unless you are sure a young bird is abandoned, its chances are better if left alone. Fledglings may be carefully placed in a tree to get them beyond the reach of predators. Contrary to popular lore, the parents cannot "smell" human scent and will not desert a bird that has been handled by humans.

When you come across a sick or injured bird, evaluate its condition and determine a likely prognosis. Is it likely to die? Is it just stunned or suffering wing strain? Is a limb broken? There are no easy decisions to make about what steps should be taken. Decisions to euthanize a bird are always difficult, but it should be kept in mind that euthanization is often the most humane thing to do, especially when dealing with hopelessly mutilated birds. Also bear in mind that most birds brought into rehabilitation centres will be euthanized anyway if they cannot be released back into the wild.

The best methods of euthanization are to suddenly snap the neck or to depress the sternum (on smaller birds). The latter is really a combination of squeezing from the sides and pressing downwards. This prevents breathing and stops the heartbeat and is quite humane.

If a limb is broken and the bird is sufficiently large and healthy, the bird can be brought to a bird rehabilitation clinic. But call them first. Here in Manitoba the organisation is called Wildlife Haven and can be reached at 204-878-3740.

Injured or sick birds should never be banded, unless the injury is old and healed. Note any such injuries as Notes on the banding sheets.

7 CAUSES OF DEATH

7.1 Strangling

It is extremely rare for a bird caught in a well-set net in good condition to get strangled. Generally, it only happens if the bird's head and neck are somehow pulled taut by the netting. The likelihood increases when the net has many holes or if the mesh size is incorrect. It is also increased by large catches at one time, when a heavy bird is captured under a smaller one, when the bag setting is too generous, or in conditions that are too windy. Pay attention to birds captured and not seen in the bottom panel, check the entire length and height of the net. Strangling could also occur as a result of rough handling during extraction, which is totally inexcusable.

7.2 Predators

Banders must be continually on the lookout for avian predators. Should the presence of one be noticed, nets should be checked more frequently, but failing that, nets should be closed. If present, hawks and owls will gladly try to help themselves of the free lunch of birds caught in mist nets. Other species may be equally dangerous – you should watch out for jays, magpies, and even grackles. If a predator learns what mist nets can provide, there may be no alternative but to close the net.

Several mammals can prey upon birds in nets and traps (e.g. fox, weasel, mink, ground squirrels, raccoon, skunk, and deer). If a problem occurs, increase the frequency of net checks, raise the net or nets may need to be closed. Frogs can also kill birds and should be monitored closely.

7.3 Haemorrhage

Birds have higher blood pressures than mammals. Extreme nervous excitement induced by excessive handling may be enough to produce haemorrhaging. It is extremely rare in a banding operation, it may be manifested as traces of blood seen in the mouth or as a slight wheezing, which is an indication of a lung haemorrhage. If symptoms are detected, handling must cease immediately and the bird put in a sheltered, secure place, where it can calm down and depart at leisure. This may only take a few minutes. If a bird has not left within half an hour, the bird should be taken to a rehabilitation centre, if possible. It may also be left for one more half-hour period.

7.4 Heat Exhaustion/Heat Stress (hyperthermia)

In certain instances, small birds can overheat in mist nets and bird bags. This is easily avoided with forethought and alertness. Don't open nets in direct afternoon sunlight on hot days. If you must, check the nets every 10 minutes and remove birds as soon after capture as possible, band them quickly or not at all. Keep bags of birds out of the sun.

7.5 Cold Exhaustion/Cold Stress (hypothermia)

Birds are prone to cold exhaustion/stress if they have little or no fat. Fat is a bird's metabolic fuel, and metabolic needs are heightened in cold weather. Even on cool days, early morning captures of small birds with no fat should be monitored closely. As with heat exhaustion/stress be prepared to close nets, release birds waiting to be processed, or reduce the processing time if exhaustion/stress start becoming apparent.

All birds with wet or even damp feathers are prone to cold exhaustion/stress at any time. For this reason, mist netting in rain or even a heavy mist is unacceptable. Following overnight dew, nets should be shaken as dry as possible before starting to capture. If a bird gets wet, keep it in a warm, dry place until dry.

7.6 Natural Causes

Just occasionally, a bird is found dead in a net that was recently checked or in a bird bag that was not held too long before processing. There is no sign of injury or any indication of what may have been the cause of death. Birds have short lifespans, and for sites banding thousands of birds annually, it is entirely possible that one occasionally dies from natural causes or old age. However, mysterious deaths should be extremely rare (1 in 10,000).

Incident Report Form – Oak Hammock Marsh

D	Band Number	Sp. Code	Age How	Sex How	Wing	Wgt.	S K	Primary Moult 1 2 3 4 5 6 7 8 9 10 11	F T	C P	B P	Time	Trap #	Date

Notes:

D	Band Number	Sp. Code	Age How	Sex How	Wing	Wgt.	S K	Primary Moult 1 2 3 4 5 6 7 8 9 10 11	F T	C P	B P	Time	Trap #	Date

Notes:

D	Band Number	Sp. Code	Age How	Sex How	Wing	Wgt.	S K	Primary Moult 1 2 3 4 5 6 7 8 9 10 11	F T	C P	B P	Time	Trap #	Date

Notes:

D	Band Number	Sp. Code	Age How	Sex How	Wing	Wgt.	S K	Primary Moult 1 2 3 4 5 6 7 8 9 10 11	F T	C P	B P	Time	Trap #	Date

Notes:

D	Band Number	Sp. Code	Age How	Sex How	Wing	Wgt.	S K	Primary Moult 1 2 3 4 5 6 7 8 9 10 11	F T	C P	B P	Time	Trap #	Date

Notes:

Figure 22 Incident Reporting Form.

8 VISITORS AND PUBLIC RELATIONS

Our banding program is geared to involve the public and we have many visitors. We hope to educate the public about birds and conservation. However, problems can arise if the operation is in any way sloppy. This is of course unacceptable.

The safety of the birds is the number one concern and should never be compromised. Injuries and mortalities must be kept to a minimum in any banding but even more so in public surroundings. Any hint of injury creates enormous public relation difficulties.

Errors in data recording also increase with increased number of visitors and special care must be taken to record the information accurately.

8.1 Banding Demonstrations for the General Public

Only well-trained, experienced banders should give the demonstrations. The demonstrator runs through the process slowly at first, describing everything that is going on as it is being done, as well as interesting facts about the bird itself. The bird's safety should always be foremost. If you think that the demonstration is eating into time normally devoted to a net check, get someone to do a quick net run.

Never let visitors handle or touch birds, though they can photograph them while you hold them, providing it is done quickly and doesn't get out of control. Visitors may be able to release birds under strict supervision.

When at a net, the most experienced person acts as the leader, does most of the talking and does most of the bird extractions. Another person generally helps, often bringing up the rear to make sure no one trails behind, gets themselves caught in the net, tries to take a bird out on their own, wonders off, pokes at birds in the nets, etc. While the leader is stopped for a while at a net, the other person should check the other nets to make sure there are no problems (we may send a person ahead to the first net before the group shows up). Any difficulties should be relayed quietly to the leader who might choose to avoid a net. If the other person can extract difficult birds quickly before reporting back to the leader, then so much the better.

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APPENDIX 1 The Beaufort wind scale.

Force No.	Description	Signs	K.P.H.	M.P.H.
0	Calm	Smoke rises	0-2	0-1
1	Light air	Smoke drifts but no wind-vane movement	3-5	1-3
2	Slight breeze	Wind felt on face; leaves rustle	6-11	3-7
3	Gentle breeze	Leaves and small twigs in constant motion, wind extends a light flag	12-20	7-12
4	Moderate breeze	Dust and loose paper are raised; small branches are moved	21-29	12-18
5	Fresh breeze	Small trees in leaf begin to sway	30-39	18-24
6	Strong breeze	Large branches in motion; whistling in wires	40-50	24-31
7	High wind	Whole tree in motion	51-61	31-38

APPENDIX 2 Bander training protocol

We have a training protocol and general rules of operation. Casual visitors are never permitted to extract birds from mist-nets, hold birds, or band them, without the express consent from the person in charge.

New volunteers, regardless of experience, must be checked out and if necessary, receive proper training. All of a novice's activities should be closely supervised by an experienced bander/trainer. They are not permitted to hold, band, or extract birds without first being acquainted with the site's training protocol. The following step-wise training procedure should be used as a guide only and each person will be different.

1. Read over the entire Banding Manual thoroughly.

2. Practice the techniques learned on dead birds (if possible).

3. Learn to "scribe".

4. Learn the basics of how to set nets properly and how to close them properly.

5. Watch an experienced bander extract and band a variety of birds. Continue to scribe. Practice opening and closing some practice bands...and reading them. If your eye-sight or coordination is bad, perhaps you should consider acting primarily as a scribe. Bird banding requires good hand/eye coordination and eyesight.

6. If you and the trainer feel comfortable, you should handle (not band) a few "large" birds (band size 1B or larger only). You should master the all-important standard "banders grip" before attempting any banding.

7. Band large birds (band size 1B or larger) and age, sex, and measure them (supervised).

8. Extract large birds (1B or larger) from mist nets (supervised).

9. Handling and banding small birds (band size 0-1). Throughout, keep in mind that birds are fragile and that they should be handled carefully and with respect.

10. Begin extracting small birds from mist nets (with supervision of course).

11. Within a month or two, you will have become a reasonably skilled bird bander. Until then, however, you must still be accompanied until your trainer feels confident in your abilities. Even when soloing, you must seek and get help from more experienced banders whenever you run into difficulties. Some people are natural-born bird-banders and others are "all thumbs". If you happen to fall into the latter category, please be satisfied at learning at a slow pace, or even with helping mostly as a scribe. Few people can learn the gentle art of bird-banding in a week.

APPENDIX 3 Master code sheets for band sizes and species codes

SPECIES	CODE	BAND SIZE	NO. OF PRIMARIES	F WING/M WING	PAGE
Sharp-shinned Hawk	SSHA	M: 2, 3 F: 3B, 3A, 3	11, 11th spurious		
Mourning Dove	MODO	3A, 3B	11, 11th spurious	131-133/155-159	48
Black-billed Cuckoo	BBCU	2, 3	10 full	145-147/133-136	55
Yellow-bellied Sapsucker	YBSA	1B, 1A	10, 10th spurious	110-111/129-130	179
Downy Woodpecker	DOWO	1B, 1	10, 10th spurious	84-85/114-115	189
Hairy Woodpecker	HAWO	1D, 2, 1A	10, 10th spurious	107-109/137-138	191
Yellow-shafted Flicker*	YSFL	3, 3B	10, 10th spurious	138-139/176-177	202
Olive-sided Flycatcher	OSFL	1B, 1, 1C	10 full	96-102/111-117	214
Eastern Wood-Pewee	EAWP	0A, 0, 1C, 1	10 full	75-77/87-90	218
Yellow-bellied Flycatcher	YBFL	0, 0A	10 full	60-61/70-72	222
Traill's Flycatcher	TRFL	0A, 0	10 full	66-67/75-77	224
Least Flycatcher	LEFL	0A, 0	10 full	56-59/64-67	230
Eastern Phoebe	EAPH	0, 1C, 1	10 full	76-78/90-91	240
Great Crested Flycatcher	GCFL	1A, 1B	10 full	91-96/105-109	248
Western Kingbird	WEKI	1A, 1B	10 full	112-119/129-135	261
Eastern Kingbird	EAKI	1B	10 full	106-112/121-128	263
Purple Martin	PUMA	1D, 1A, 2	9 visible	137-138/151-152	321
Tree Swallow*	TRES	1, 0, 1C	9 visible	106-109/123-125	322
Northern Rough-winged Swallow*	NRWS	0, 1C, 1, 0A	9 visible	100-104/113-118	325
Bank Swallow*	BANS	0, 1C, 1, 0A	9 visible	94/106	327
Cliff Swallow	CLSW	1, 1C	9 visible	96-98/115-117	331
Barn Swallow*	BARS	1, 0, 1C	9 visible	113-114/124-127	328
Blue Jay	BLJA	2, 3, 2A	10, 10th spurious	115-116/140-148	297
Black-billed Magpie	BBMA	4, 3A, 3B	10, 10th spurious	177-190/210-216	307
Black-capped Chickadee	BCCH	0, 0A, 1C, 1	10, 10th spurious	57/72-73	334
Boreal Chickadee	BOCH	0, 0A, 1C, 1	10, 10th spurious	52-57/70-71	340
Red-breasted Nuthatch	RBNU	0, 1C, 1	10, 10th spurious	60-63/71-73	351
White-breasted Nuthatch	WBNU	1B, 1, 1C	10, 10th spurious	80-81/95-96	352
Brown Creeper	BRCR	0A, 0	9 full	57-58/68-69	357
House Wren	HOWR	0, 0A, 1C, 1	10, 10th spurious	46-47/54-55	365
Winter Wren	WIWR	0A, 0	10, 10th spurious	44-45/50-51	366
Sedge Wren	SEWR	0A, 0	10, 10th spurious	40-41/47-48	368
Marsh Wren	MAWR	1C, 1, 0	10, 10th spurious	47-52/54-55	369
Golden-crowned Kinglet	GCKI	0A	10, 10th spurious	49-51/60-62	374
Ruby-crowned Kinglet	RCKI	0A	10, 10th spurious	50-52/60-63	376
Veery	VEER	1B	10, 10th spurious	89-90/104-106	392
Gray-cheeked Thrush	GCTH	1B	10, 10th spurious	93-95/107-109	394
Swainson's Thrush	SWTH	1B	10, 10th spurious	87-90/101-104	397

SPECIES	CODE	BAND SIZE	NO. OF PRIMARIES	F WING/M WING	PAGE
Hermit Thrush	HETH	1B, 1	10, 10th spurious	78-80/104-110	399
American Robin	AMRO	2	10, 10th spurious	115-118/141-145	403
Gray Catbird	GRCA	1A	10, 10th spurious	81-84/90-97	408
Brown Thrasher	BRTH	2, 3	10, 10th spurious	94-97/115-117	411
Bohemian Waxwing	BOWA	1A	9 visible	109-110/120-121	435
Cedar Waxwing*	CEDW	1B	9 visible	88-89/100	437
Blue-headed Vireo	BHVI	1C, 1, 0	10, 10th spurious	69/77-78	281
Warbling Vireo	WAVI	0, 1C, 1	10, 10th spurious	62-63/74-75	285
Philadelphia Vireo	PHVI	0, 0A	10 full	61-62/69-70	287
Red-eyed Vireo	REVI	1C, 1, 0	10 full	72-74/83-85	288
Golden-winged Warbler	GWWA	0A, 0	9 full	54-56/64-67	446
Tennessee Warbler	TEWA	0A, 0	9 full	58-61/65-68	447
Orange-crowned Warbler	OCWA	0, 0A	9 full	51-54/65-66	448
Nashville Warbler	NAWA	0A, 0	9 full	52-54/64-66	450
Yellow Warbler	YEWA	0, 0A, 1C, 1	9 full	55-57/65-68	459
Chestnut-sided Warbler	CSWA	0A, 0	9 full	56-58/66-68	462
Magnolia Warbler	MAWA	0A, 0	9 full	53-54/62-64	464
Cape May Warbler	CMWA	0, 0A, 1C, 1	9 full	61-63/71-72	466
Black-throated Blue Warbler	BTBW	0A, 0	9 full	58-60/64-68	468
Myrtle Warbler	MYWA	0, 1C, 0A, 1	9 full	68-70/79-83	470
Black-throated Green Warbler*	BTNW	0A, 0	9 full	52-56/65-68	477
Blackburnian Warbler*	BLBW	0, 0A	9 full	63-64/72-73	480
Western Palm Warbler	WPWA	0, 0A	9 full	57-60/65-67	488
Bay-breasted Warbler	BBWA	0, 1C, 0A, 1	9 full	67-69/75-78	490
Blackpoll Warbler*	BLPW	0, 1C, 0A, 1	9 full	67-70/76-78	491
Black-and-white Warbler	BAWW	0, 0A, 1C, 1	9 full	59-62/70-74	495
American Redstart	AMRE	0A, 0	9 full	55-57/67-69	496
Ovenbird	OVEN	1C, 1, 0	9 full	67-69/79-81	501
Northern Waterthrush	NOWA	1, 0, 1C	9 full	67-70/79-82	502
Connecticut Warbler*	CONW	1, 0, 1C	9 full	63-64/74-75	505
Mourning Warbler	MOWA	0, 0A, 1, 1C	9 full	54-56/64-65	506
Common Yellowthroat	COYE	0, 1C, 0A, 1	9 full	48-50/57-59	510
Wilson's Warbler	WIWA	0A, 0	9 full	46-49/59-62	515
Canada Warbler	CAWA	0, 0A	9 full	57-60/68-70	517
Rose-breasted Grosbeak	RBGR	1A, 2	9 full	90-92/106-111	609
American Tree Sparrow	ATSP	1, 0, 1C	9 full	67-69/81-82	549
Chipping Sparrow	CHSP	0, 0A, 1C, 1	9 full	62-63/75-77	550
Clay-colored Sparrow	CCSP	0, 0A, 1C, 1	9 full	56-58/63-67	552
Vesper Sparrow	VESP	1B, 1, 1C	9 full	72-73/85-87	558
Savannah Sparrow*	SAVS	1, 1C, 0	9 full	50-61/78-81	565
Le Conte's Sparrow	LCSP	1, 1C, 0	9 full	48-49/55-56	571
Nelson's Sparrow	NESP	1, 1B, 1C	9 full	52-53/61-62	574
Fox Sparrow	FOSP	1A, 1B	9 full	73-75/88-92	577
Song Sparrow	SOSP	1B, 1, 1C	9 full	Too much variation	579
Lincoln's Sparrow	LISP	1, 0, 1C	9 full	54-55/66-69	584

SPECIES	CODE	BAND SIZE	NO. OF PRIMARIES	F WING/M WING	PAGE
Swamp Sparrow	SWSP	1, 1C, 0	9 full	52-54/64-65	585
White-throated Sparrow	WTSP	1B	9 full	64-68/73-78	587
White-crowned Sparrow	WCSP	1B	9 full	63-66/81-85	589
Harris's Sparrow	HASP	1A	9 full	76-81/86-91	588
Slate-coloured Junco	SCJU	0, 1C, 1	9 full	72-74/80-83	593
Red-winged Blackbird	RWBL	M: 2, 1D F: 1A, 1D	9 full	88-101/112-135	626
Yellow-headed Blackbird	YHBL	M: 2, 3, 1D F: 1A, 1D, 2	9 full	105-125/126-150	636
Rusty Blackbird	RUBL	2, 1D	9 full	101-111/113-123	637
Brewer's Blackbird	BRBL	2, 1D	9 full	111-120/127-137	638
Common Grackle	COGR	M: 3, 3B F: 3, 2A	9 full	115-127/136-150	639
Brown-headed Cowbird	BHCO	M: 1A, 1D, 2, 1B F: 1B, 1A, 1D	9 full	85-95/105-118	646
Orchard Oriole	OROR	1B	9 full	69-72/80-83	648
Baltimore Oriole	BAOR	1A, 1B, 1D	9 full	83-88/95-100	656
Purple Finch	PUFI	1, 1C, 1B	10, 10th spurious	71-73/84-87	668
Common Redpoll	CORE	0, 0A	10, 10th spurious	67/83-84	677
Hoary Redpoll	HORE	0, 0A	10, 10th spurious	Too much variation	679
Pine Siskin	PISI	0, 0A	10, 10th spurious	66-68/76-77	680
American Goldfinch	AMGO	0, 0A, 1C, 1	10, 10th spurious	63-65/70-79	686
House Sparrow	HOSP	1B, 1	10, 10th spurious	67-70/82-85	690

(* species with irregular codes)

NOTES