Vancouver Island University

Bird Monitoring and Banding Manual

Version 4

January 2024

Compiled and Revised by Eric Demers

VANCOUVER ISLAND
UNIVERSITY

Revisions to this Document

Version 4, January 2024

- Minor edits – updates, spelling, grammar, punctuation, and formatting.
- Update mist nest check timing to 30 minutes for owls (section 5.1.2).
- Holding Birds section was revised and other grips were added (section 6.1.3).
- Bander's Code of Ethics was revised based on North American Banding Council revision of March 2021 (Appendix I).

Version 3, August 2019

- Minor edits – spelling, grammar, punctuation, and formatting.
- "Feet-first" method of mist net extraction was added (section 5.1.3).
- Raptor extraction was added (section 5.1.3).
- A section on the use of ground traps was added (section 5.2).
- Description of band types was expanded, including lock-on bands (section 6.3).
- Revision of the methods to weigh birds to reflect method refinements implemented for this project (section 6.6).
- A section describing specific procedures use at the Buttertubs West Marsh Banding Station was added (section 11).
- Data sheets, reference sheets, and data scribing instructions were added as Appendices III-V.
- Bander Training Levels have been simplified (beginner, intermediate, advanced) to better reflect practice (Appendix VI).
- Photographs were added to illustrate the Buttertubs West Marsh Banding Station setup (Appendix VIII).

Version 2, August 2015

- Minor edits – spelling, grammar, punctuation, and formatting.
- Logo was updated (courtesy of Sarah Chalmers).
- Minor procedural clarifications.
- Methodology for nocturnal owl banding was added (section 5.2).
- Information about the potential hazards of large mammals (section 8.1).

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1. PREFACE

The purpose of this Bird Monitoring and Banding Manual is to provide the basic information to safely and effectively conduct bird banding at Vancouver Island University (VIU). It was compiled by Eric Demers, Ph.D., RPBio, based on numerous publications from various authorities. These include the North American Banding Council, the Canadian Bird Banding Office (Environment and Climate Change Canada), the US Bird Banding Laboratory (US Fish and Wildlife), protocols from other bird banding stations in Canada, and the Canadian Council on Animal Care. Relevant publications are listed in the REFERENCES section. All personnel involved in banding operations are required to become familiar with this document and with other referenced material as described in the TRAINING section.

Since this manual is intended to be a practical field manual, it emphasizes what procedures should be followed and how, and places little stress on why particular approaches have been chosen. The purposes of bird banding generally, and recommended methods of running a bird banding program, are explained in detail in Blancher et al. (1994) and Hussell and Ralph (1996). The procedures described in this manual are based on well-established standards that have been shown to result in safe and effective handling of birds, and to yield high-quality data about the studied birds. Some of the methods used may have been “borrowed” as refinements observed at other stations.

2. INTRODUCTION

The objectives of the bird monitoring and banding program at VIU are to:

1. obtain data on neotropical migrant and resident bird species, in a scientifically rigorous manner, in order to contribute to regional and continent-wide efforts to monitor changes in population levels of these species;
2. provide practical educational and training opportunities for VIU students, graduates, staff or community members, including through regular courses, directed studies or research project opportunities; and,
3. conduct public demonstrations where people of all ages can learn about bird identification, ecology, evolution, and conservation.

These goals are achieved by conducting bird banding operations. During each bird banding session, wild birds are captured using mist nets, extracted, identified to species, banded, measured, and released unharmed. All operations are conducted under permit and according to procedures prescribed by the Canadian Bird Banding Office of the Canadian Wildlife Service. More information about the VIU Bird Banding Project is available on the project website: http://wordpress.viu.ca/viubirdbanding/.

3. BANDING ETHICS

Bird banding is used around the world as a major research tool. When used properly and skillfully, it is both safe and effective. The safety of banding depends on the use of proper techniques and equipment and on the expertise, alertness, and thoughtfulness of the banders. The handling of birds is a privilege, not an inherent right. The bander's essential responsibility is to the bird. In no situation should data or personal pleasure be placed ahead of the health and welfare of the birds. Every bander must strive to minimize stress placed upon birds and be prepared to accept advice or innovation that may help to achieve this goal. Banders must ensure that their work is beyond reproach and assist fellow banders in maintaining the same high standards.

All banding at VIU follows the *Bander's Code of Ethics* (see **Appendix I**), which applies to every aspect of banding. Bird handling, extraction from mist nets and banding are extremely delicate processes that require lengthy training by experienced trainers. Therefore, anyone wanting to get hands-on experience will be required to follow the training procedures as described in the TRAINING section.

All banding activities at VIU are conducted according to the requirements set out by the Canadian Bird Banding Office. Banders should not consider that some injury or mortality is inevitable or acceptable in banding. Every injury or mortality must result in a reassessment of the banding operation, with appropriate action then applied to minimize the chance of repetition. Birds that are obviously stressed from cold or handling should be released immediately, even if unbanded, as extended periods of stress can lead to death. Likewise, nets should be shut if large volumes of birds are being captured that threaten the ability to extract and process birds in a safe and timely manner. Birds should not be held for more than one hour from time of extraction; those that have been waiting for processing longer than this should be released unbanded. It is essential that any casualties and/or injuries encountered be recorded as this is a requirement of any banding permit. Please refer to the BIRD WELFARE section for further details.

4. PERSONNEL

4.1. Banders

Banding operations are typically run by at least two people, one of whom must be a licensed bird bander who acts as Bander-in-Charge (BIC). In Canada, the Bird Banding Office (BBO) of Environment and Climate Change Canada issues scientific permits to capture and band migratory birds under the authority of the Migratory Birds Convention Act. Provincial permits are also required for the targeted banding of raptors (e.g., Northern Saw-whet Owl). The licensed BIC is responsible for the daily banding operation and to ensure that the welfare of every bird is always the top priority. In addition, the BIC oversees all volunteer banders and interactions with the public. Volunteer banders may be VIU students, graduates, staff, or members of the public engaged in approved banding activities or training.

4.2. Volunteer Responsibilities

The BIC will delegate responsibilities and tasks based upon the abilities and experience of all available personnel. Volunteers wishing not to participate in banding or mist net extraction can still help with observations, scribing or data entry. Only those individuals authorized by the BIC can extract or band birds. Inexperienced personnel must always be supervised by the BIC or by a person designated by the BIC during the extraction or banding process. Please refer to the TRAINING section for further details.

4.3. Visitors

Banding operations are run with an open-door policy but, whenever possible, visitors should provide advanced notice to the BIC before they show up. Visitors are welcome and encouraged to view banding operations. All visitors must be instructed not to touch any equipment or any birds, without consent from the BIC. No dogs or pets are allowed during any banding operations. Group visitation is discussed in the PUBLIC EDUCATION section.

5. BIRD CAPTURE

Biologists use a wide variety of devices to capture birds. The methods used as part of the bird monitoring and banding program at VIU include mist nets and ground traps.

5.1. Mist Netting

5.1.1. Net Specifications and Deployment

The typical mist nets used for bird capture are 12 m long by 2.6 m high panels, made of 75 denier / 2 ply black polyester yarn, with 30 mm mesh size (**Figure 1**). Horizontal trammel lines of thicker, stronger thread are woven through the mesh at the top and bottom of the net and at equal distances in between to form four trammel panels. Each trammel line ends in a loop designed to fit over a net pole. These nets are effective in capturing most passerines (e.g., flycatchers, thrushes, finches, sparrows, warblers, etc.), and near passerines (e.g., hummingbirds, woodpeckers). Nets with a larger mesh size (e.g., 60 mm) can be used to target larger species such as Northern Saw-whet Owls.

Each net is strung between two poles anchored by guy-ropes, which hold it upright and taut. The trammel lines form pockets of netting. Birds fly into the net and usually drop into the pockets and become entangled. Nets are set so that the lowest trammel line is at knee height. Some adjustment may be required depending on landscape topography or to prevent birds captured in the lowest trammel panel from resting on the ground or in wet grass.

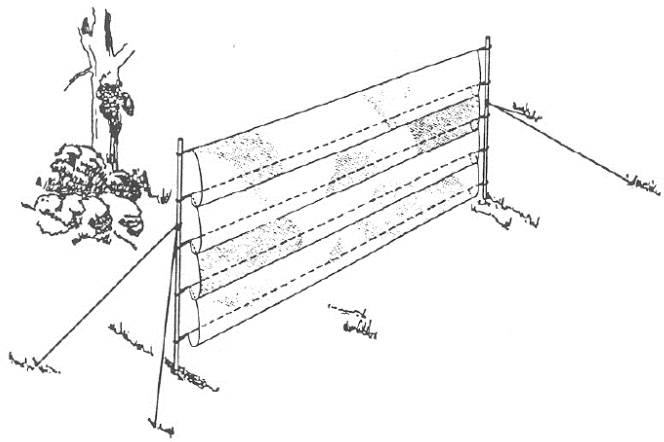

Figure 1. A mist net ready for operation (from NABC, 2001a).

The selection of suitable sites for mist nets must generally consider factors such as the likely movements of birds, vegetation structure and height, accessibility, proximity to a bird processing site, slope, type of ground surface, possible depth and type of water, wind exposure, and public access. If the site is in vegetation, a 1-m wide space must be cleared on each side and at each end of a net to allow proper access. Additional details on net deployment are available in the *North American Banders Study Guide* (NABC, 2001a).

5.1.2. Netting Operations

The use of mist nets requires certain favourable weather conditions. In general, nets are not operated under the following conditions:

- temperatures in direct sun above 25°C, as birds may become overheated or hyperthermic;
- temperatures below 0°C;
- snow or steady rain heavier than a light mist or drizzle; or,
- sustained strong winds or intermittent gusty winds that can potentially blow the nets into nearby vegetation.

On a typical day of songbird banding, 10-20 mist nets are operated from 30 minutes before sunrise and for a 6-hour period (i.e., until 5.5 hours after sunrise). Nets are checked at least every 15-20 minutes. Situations in which birds may be at greater risk of injury, such as with potential presence of predators or threat of rain, require that nets be checked more frequently, if not closed altogether. If bird capture volume is too high, or personnel availability too low, to maintain a 20-minute net check schedule, some nets should be closed until capture volume decreases or more personnel are available.

Mist-netting for owls is conducted at night, from 30 minutes after sunset and for a 6-hour period (i.e., until 6.5 hours after sunset). On a typical mist-netting night, up to 10 mist nets are used, representing a combination of mesh sizes (30 and 60 mm) to enhance capture probability. A subset of nets is set up in a triangle, square or line configuration around an automated audiolure system that

continuously broadcasts the breeding call of the Northern Saw-whet Owl. Nets are checked at least every 30 minutes.

Ideally, two or more experienced people check nets during each round, starting at opposite ends of the net circuit and always meeting somewhere along the way. This ensures that if one person encounters a lot of birds or a difficult extraction, help from another extractor is always on the way. Two-way radios should be used for effective communication between members of the banding team.

When checking nets, it is important to walk the full extent of every net and check each net carefully, paying special attention to the bottom shelf. Moving a trammel line can help reveal a bird caught at the opposite end of the net, when it agitates in response to the net movement. Even with nets set high off the ground, it is possible to pass by a bird lying still and hidden in grass. To avoid this, it is recommended to lift the bottom shelf of every net checked, and to keep the grass short under nets.

If nets will remain set up at the end of a banding session until the next banding day, then each net must be closed, furled tightly, and secured so that no bird is captured outside of banding operations.

5.1.3. Bird Extraction

Most birds that fly into a mist net do not struggle immediately. The bird may eventually begin to grasp with its feet and flutter its wings. In general, the longer a bird is left in a net, the harder it may be to get out. This is particularly true of a bird that can fit part of its body or the bend of the wing through the mesh.

When approaching a net to extract birds, it is important to always look down the length of the net to see if one bird appears to require more immediate attention (e.g., recently fledged birds, a bird caught by one leg or one wing, smaller birds, hummingbirds). These birds should always be extracted first, even if it means passing up “good” or easier birds.

Removing a bird is normally a one-person operation; two people handling one bird rarely enhances the operation (except for raptors or to assist upon request for a tricky extraction). Extraction generally consists in reversing the process of entry. Therefore, the first step in any extraction consists in figuring out from which side the bird entered the net. The bird is virtually always hanging in a pocket on the side opposite from where it entered. Because the tail is the last to enter, its position provides a clue about how the bird entered the net. The net must be lowered before attempting to extract any bird captured above shoulder height to improve visibility and avoid arms from tiring in the middle of extraction.

Various methods are used to remove birds from mist nets, although all extractors will be trained and encouraged to use the “body-grasp” method of extraction (Ralph, 2005). This method surpasses other methods in ease of learning, speed of extraction, and reduced injury rate. The body-grasp method involves slipping the fingers around the body of the bird, underneath the encumbering net, and then lifting the bird out of the enfolding layers of netting, focusing on the bird’s body, not on the tangle of netting that its feet may have made. Most extractions proceed in a “wing-head-wing” order, where one wing is extracted, then the head and then the other wings. When the net is freed from around the wings

and head, most birds actually “let go” of netting that may, at first glance, appear to be badly tangled around their feet and toes.

An alternate method for mist net extraction is the “feet-first” method. This method can be somewhat slower than the body-grasp method and, if done carelessly, can cause leg injury or wing strain. However, this method can be effective to extract species that grasp the net strongly and for which unentangling the feet first is necessary (e.g., chickadees, bushtits, wrens). For this method, the bird is held by the legs in the photographer's grip, with belly facing up (see HOLDING BIRDS). Netting is removed from the feet first, ensuring that no net loop remains on the upper legs. From there, the remaining netting is moved towards the head and extraction proceeds in a “wing-head-wing” order. Extractors who have demonstrated proper skills using the body-grasp method will then be shown how to use the feet-first method.

Once extracted, each bird is placed in a “bird bag” (23 cm x 30 cm lightweight cotton) closed with draw strings that are looped around the neck of the bag, while being transported back to the banding table or while waiting for processing (see BANDING PROCESS). Only clean bird bags should be used. Extractors should carry enough clean bags with them to accommodate the birds extracted on each net check round. Each net is numbered, and correspondingly numbered clothes pegs are attached to the guy-ropes. A numbered peg is attached to each bird bag to keep track of the capture net on data sheets.

A trained extractor should extract most birds in under 1 minute (often 15-30 seconds each). Occasional birds will be much more entangled in the nets, requiring more than the minimum amount of time to extract. Therefore, any extractor having difficulty extracting a bird should always ask for assistance from a more experienced extractor to avoid extending handling stress for that bird. As a last resort, it is acceptable to carefully cut one or a few strands of a net to free a bird that appears to be stressing rapidly. Any bird judged to have been through a stressful extraction and displaying signs of stress should be released immediately unbanded or taken to the BIC for further evaluation based on severity of stress. Please refer to VIU Standard Operating Procedure ACC SOP on Monitoring Stress and Injury in Birds during Bird Banding, which describes common signs of stress and the actions to be taken based on the severity of stress.

Banded birds that are recaptured within the same day are released immediately to avoid repeated processing. This is especially true for recently fledged birds (i.e., birds in full juvenal plumage and/or in active heavy moult) and nesting females. Band numbers can be written down or remembered for data records. Also, any bird not covered by the banding permit (e.g., gamebirds) must be released unbanded, although their capture should be recorded.

Although raptors are caught infrequently, they require special handling, and the BIC should be notified immediately. Most large-bodied raptors (e.g., Cooper’s Hawk) do not tend to remain in a net for long and may escape quickly. A trammel line can be raised to deepen the net pocket which contains the bird and help prevent its escape (this can also work for corvids or pigeons). It is impractical (and often ineffective) to use gloves for raptors. Although the bird may be hissing with a menacing beak, the talons must be held securely first because they represent the most risk to the extractor. The bird’s attention

should be diverted while the legs are grabbed. From this point on, the extractor must concentrate on not releasing, or even easing, the grip on the legs while the bird is freed from the net. Once out of the net, it is better to hold the bird and take it back to the banding table rather than putting the bird in a bag and having to grab the legs a second time. A bird bag may be placed on the bird's head if it is agitated. The BIC should be notified via radio anytime a raptor is caught.

5.2. Ground Traps

Ground traps can be an efficient means of catching some ground bird species (e.g., sparrows). Well-designed traps are usually safer and simpler to use than mist nets, but some factors must be considered to minimize bird stress and injury. Most traps are made from wire mesh (typically 1 cm x 1 cm mesh), and it is important to properly inspect each trap before use to ensure that there are no loose or sharp ends that could cause injury.

Ground traps are baited with seeds scattered in the center of the trap and lightly around the entrance funnels (see example of a ground trap in **Figure 2**). Birds enter through the entrance funnels and generally cannot escape. Ground traps should be checked regularly (e.g., every 15-20 minutes) to limit the time birds may struggle to escape and to reduce the risk of predation. Because the birds can feed while trapped, ground traps can be used on cold days, but they should be checked frequently.

Birds are extracted by means of a hinged door in the roof or side of the trap, while using the free hand to block the rest of the access doorway. Feet can also be placed to avoid birds escaping through the funnels. Birds are extracted by reaching in and grasping them in bander's grip (see HOLDING BIRDS) from the corners of the trap. Extraction should proceed quickly, yet gently enough to avoid chasing birds in the trap as this can result in birds scuffing their forehead or bill on the wire mesh. Once extracted, each bird is placed in a bird bag as described above.

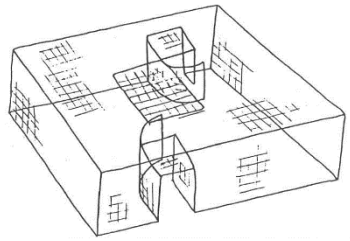

Figure 2. Example of a ground trap, showing two funnel entrances on the sides and the bander's access door on top (from NABC, 2001a).

Ground traps should not be used at banding sites where baiting is not desirable or permitted. At the end of banding activities, traps should be removed from the site or left with the access doorway secured open to allow birds to escape the trap when not in use.

6. BANDING PROCESS

Banding typically takes place at a banding table equipped with all the necessary banding tools, data sheets and reference guides. Ideally, there are two people involved in the banding process: a bander and a scribe. Although the bander handles the birds, the scribe has a very important job. Scribing data without error for dozens of birds in a day, often in the face of distractions of many kinds (e.g., multiple banders, visitors), can be a challenge. The scribe must ensure data are recorded accurately, otherwise their scientific value is compromised. Additional personnel may assist in banding or bird processing as directed by the BIC.

The banding process for most birds typically involves the following steps which are detailed further in the sections below:

- species identification;
- band application (if unbanded);
- age and sex determination;
- fat score;
- biometrics; and,
- photography (if applicable).

Birds that are already banded from a previous capture day (recaptures) are processed just like newly captured birds, except that no band is applied. Priority is given to small birds (because of their higher per gram metabolic demand compared to larger species), recaptures, recently fledged young, and nesting females. Recently fledged young should always be returned as soon as possible to the vicinity of the nets where they were extracted (especially if agitated adult birds were heard nearby during extraction). Although interesting scientifically, rare / uncommon birds should not be prioritized over birds those that require higher priority.

A skilled bander should be able to process a bird completely in about 1-2 minutes. In cases where more data must be collected, for photography or for training purposes, a bird can be handled for up to 5 minutes. However, the bander must continually monitor the condition of the bird by looking for signs of stress such as closed eyes or open gape, and promptly release any bird showing signs of stress. Please refer to VIU Standard Operating Procedure ACC SOP on Monitoring Stress and Injury in Birds during Bird Banding, which describes common signs of stress and the actions to be taken based on the severity of stress.

6.1. Holding Birds

The proper way to handle a bird is the safest way. To ensure the bird's safety during handling, it is crucial to use appropriate grips, as described below. Some birds will defecate, scratch, bite, and some can inflict a little pain or discomfort on the bander. In any case, frustrations should never be taken out on the bird. If a bird struggles free, it is crucial to resist the urge to reach for it; otherwise, there is a risk of pulling all tail feathers and injuring the bird. Birds are usually held in the non-dominant hand (e.g.,

right-handed banders hold birds in their left hand), leaving the dominant hand free to manipulate the banding equipment.

6.1.1. Bander's Grip

The "bander's grip" (**Figure 3a**) is the best and safest way to hold a small or medium-sized bird during the entire banding process. The bird is held with its neck in the gap between the forefinger and middle finger, and the wings are contained against the palm of the hand. Depending on the size of the bird and the bander's fingers, a bird may be held with its head closer to the base of the fingers (large birds) or near the fingertips (smaller birds). The remaining fingers and thumb are closed loosely around the bird's body, forming a "cage." This hold leaves the bird's legs free for banding. With this grip, most measurements can be made by simply lifting the thumb away from the bird's body. Placing the tibiotarsi (shin bones) between the ring finger and pinky can also prevent the bird from struggling with its feet. Never use the bander's grip for raptors because this grip does not allow securing of the legs and talons.

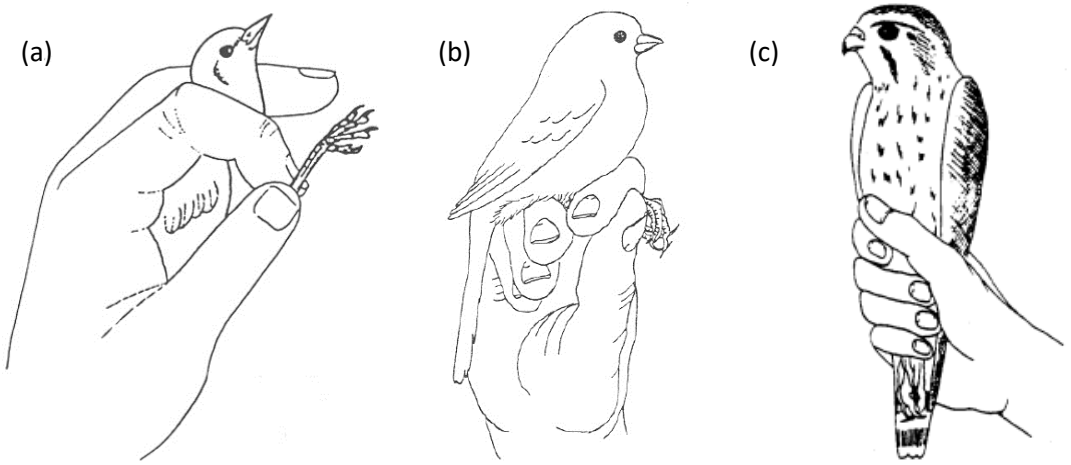

Figure 3. (a) Bander's grip; (b) photographer's grip; (c) ice cream cone grip (from NABC, 2001a).

6.1.2. Photographer's Grip

The "photographer's grip" (**Figure 3b**) maximizes the amount of plumage in view, and it is used primarily to view of features not visible in the bander's grip (e.g., back) or for photography. It is also used to transfer a bird from one bander to another. For this hold, the bird's legs are held in a "scissor" grip, as near to the body as possible, between the forefinger and middle finger, and the bird's tibiometatarsi (foot bone) are held between the thumb and forefinger. The bird will be able to flap its wings, but it should not be able to rock back and forth or from side to side. The free hand can be placed over the bird's back to keep its wings from flapping until ready for photography or to transfer to another bander. Birds should not be held in this grip for longer than necessary because they will be using additional energy trying to escape or strain the wing or leg muscles. Never hold a bird only by the lower

part of its legs (i.e., near the toes). Swallows and other birds with extremely short tarsi (e.g., swift, kingfisher) should never be held in photographer's grip.

6.1.3. Other Grips

In some cases, a larger bird (e.g., raptor, flicker, corvid) may require holding in the "ice cream cone grip" or the "reverse grip". The ice cream cone grip may be used for larger birds which cannot be held securely in the photographer's grip. For this grip, the legs are fully extended down the tail, and the lower part of the bird (the upper part of the legs and tail, the lower part of the wings and body) is clenched in a fist as if holding an ice cream cone (**Figure 3c**). For the reverse grip, the bird is held with the tail facing away from the bander with the hand and fingers wrapping around the bird's midsection and legs, and the bird is cradled on the bander's forearm. The thumb and fingers can be placed in such a way to isolate the legs for banding. The BIC should be consulted on the proper grip for each species handled.

6.2. Bird Retrieval and Identification

Upon selecting a bag with a bird ready to be processed, the bander will usually weigh the bird before removing it from the bag (see BIOMETRICS). The bander then unties the bag strings and reaches in with his/her non-dominant hand. The other hand should be used to squeeze the bag around the wrist to remove any possible escape space for the bird. Without peeking into the bag, the bander must feel the bird's body and grasp it in bander's grip. Birds should not be removed from bird bags in any other grip. The bander should avoid squeezing the bird against the bag, the banding table or his/her body. Birds should not be chased in the bag for an extended time; a more experienced bander may need to remove a hard to grip bird for a trainee.

Once retrieved from the bag, the bander should first verify if the bird is already banded. If a band is already present (i.e., recapture), the band number must be read to the scribe to record on the recapture data sheet (see RECORD KEEPING). The band number should be read forward and backward with confirmation from the scribe to ensure it is correctly recorded. The band should be checked for proper closure and fit and adjusted if necessary. Any concern with band fit should be referred to the BIC.

Proper identification of any bird to be banded is essential. Only individuals of known species can be banded; unidentified species must be released unbanded. Identification should always be confirmed with the BIC, unless the bander is experienced identifying all potential captured species. Birds in the hand can be surprisingly challenging to identify without the benefit of habitat, behaviour, and vocalization. Banders must be familiar with the *Identification Guide to North American Birds, Part I* by (Pyle, 1997). Field guides by Sibley (2016) and the National Geographic Society (2011) are also very useful references.

6.3. Band Selection and Application

During banding, uniquely numbered (typically 9 digits) lightweight aluminum bands are placed on the leg of the bird, which allow tracking of individual birds throughout their lifetime. In North America,

all bands are obtained from the US Fish and Wildlife Bird Banding Laboratory (through the Canadian Bird Banding Office), and they can only be ordered by a licensed bander.

Bands come in various sizes designated by a number or a number-letter combination, ranging from 0A (smallest) to 9C (largest). Like shoe size, this number is for identification only; the actual size of the band is measured by its inside diameter. Selection of band size is determined by the size of the bird's leg (the tibiometatarsus for most birds). Generally, a band is said to be a good fit if, when closed properly, it can rotate and slide freely up and down the tarsus without slipping over the ankle joint or down over the bird's toes. Recommended band sizes are provided in Pyle (1997) and online on the Bird Banding Laboratory website. If in doubt, a leg gauge can be used to determine the proper band size for a given individual. For some species, band size should always be determined with a leg gauge due to variation in leg size (e.g., raptors).

Band sizes 0A, 0, 1, 1B, 1A, 1D and 2 (in increasing order of size) are the most frequently used for songbird banding. Note that the fourth digit of the band number is the same as the band size (e.g., band number 197**2**-15643 is a size 2 band). Because raptors may be capable of removing standard bands, they are banded with special "lock-on" bands that have a special crimping flange to lock the band onto the bird's leg. Lock-on bands may require two people for application (one of whom is the BIC): one person to hold the bird and one person to apply and close the band.

Prior to banding, the band number must be read to the scribe to ensure that it is recorded properly, that it is the correct band size and band number in sequence, and that it is legible (see RECORD KEEPING). While holding a bird in the bander's grip, the bander can use his/her dominant hand to handle the banding pliers and the fingers of the hand that holds the bird can be used to manipulate the band. All bands are supplied closed and must first be opened. Banding pliers usually have a split pin, which is used for opening the band (**Figure 4a**). A pair of banding pliers has holes in its jaws that fit one or more standard band sizes. Use of the proper pliers' hole is important to avoid overlapping the band and crushing the bird's leg (refer to the *Species Reference Sheet* for the proper pliers' hole to use for the common band sizes; **Appendix IV**).

The band is placed over the pin, with the seam of the band oriented exactly toward the tip of the pliers so that, when the pliers are opened, the band opens evenly. This evenness is important to ensure that the band can be closed evenly. The band should be opened just enough to fit over the bird's leg. When the pliers are used to close a band placed in the right-sized hole, the band will close properly without overlapping or leaving a gap between the ends of the band (**Figure 4b**). The bird's "ankle" can be held with thumb and forefinger to immobilize the leg and expose the tarsus (see **Figure 3a**). Once closed (first crimp), the band is rotated 90° and pinched again (second crimp) in the appropriate hole of the pliers to provide complete and tight closure (**Figure 4b**). Once installed, the band number must be confirmed with the scribe to ensure that it is recorded properly, it is legible, and that the bird is not inadvertently released unbanded. Bands can be placed right side up or upside down, unless there's a specific need to read band numbers with binoculars or for larger band sizes (i.e., size 3 or higher).

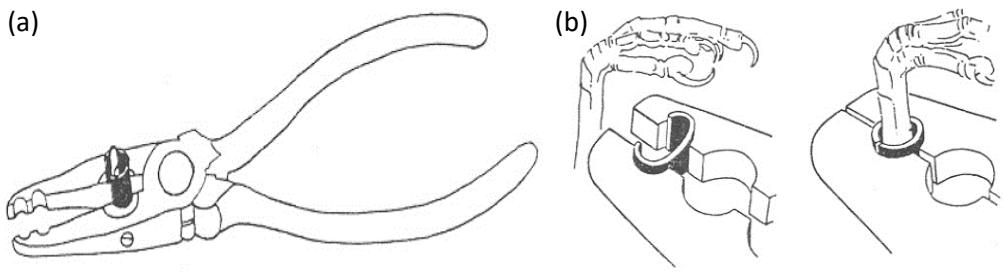

Figure 4. (a) Banding pliers, showing holes in the jaw and the split pin opening a band; (b) applying and closing a band, including the 90° band rotation (from NABC, 2001a).

Bands that are too loose, too tight or worn down need to be removed. Removing a band can be difficult, especially if it is tight against the leg. Band removal should always be performed by the BIC with assistance of another volunteer. Refer to **Appendix II** for details on band removal methods.

6.4. Age and Sex Determination

Age and sex determination are the most technically challenging parts of the banding process, which require expertise and skill usually gained over many years of study and field experience. The procedures used are outlined in *The North American Banders Study Guide* (NABC, 2001a) and *The North American Banders' Manual for Banding Passerines and Near Passerines* (NABC, 2001b). In addition, the technical information for individual species is provided in Pyle (1997). All banders who want to advance their skills must become familiar with these important references.

Many criteria can be used to determine the age of birds. In general, feather shape, colour and condition are used to determine a bird's age with a basic understanding of the bird's moult strategy (**Figure 5**). In contrast to old feathers, new feathers appear smoother, with more colour and sheen. Abrasion wears away the outer edges of older feathers, which is most noticeable on the tips of flight feathers and tail feathers. Other criteria used in age determination include eye colour, pattern of skull ossification and the presence of breeding characteristics (see below).

A bird is aged according to the number of calendar years it has survived. A bird in its first calendar year is designated a hatch year (HY) bird until 31 December of that year. On 1 January of the next calendar year, the bird is in its second calendar year (SY) even though it may be only 6 to 7 months old. Birds of most species can only be aged precisely during their first and second calendar years. In this case, a bird may be aged after hatch year (AHY) in its second or more calendar year, after second year (ASY) in its third or more calendar year, etc. Therefore, an ASY bird may be any age greater than calendar age 2.

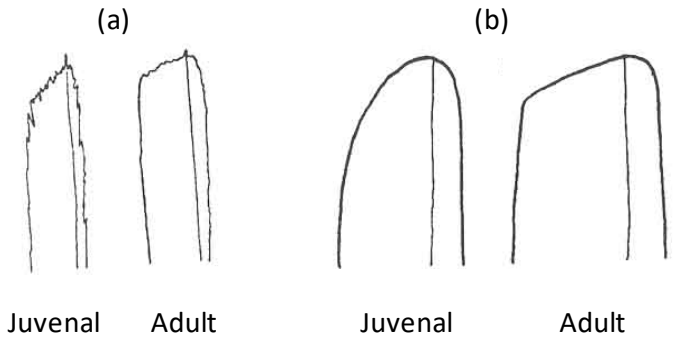

Figure 5. The wear and shape of the tail feathers by age. (a) Juvenal feathers typically become more abraded than adult feathers; (b) the "corner" effect on adult feathers is absent or reduced in juvenal feathers (from NABC, 2001b).

Sex determination can be simplified in species that take on different plumages for each sex (sexually dichromatic). However, some species do not display any sex difference in plumage (sexually monochromatic), or the differences are not apparent during their early age or at all times of the year. Therefore, other characteristics must also be used to determine sex.

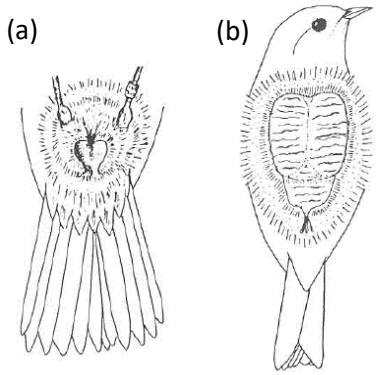

Figure 6. (a) A cloacal protuberance in a male; (b) a brood patch in a female (from NABC, 2001b).

The best method for determining the sex of birds during the breeding season is by the presence of the cloacal protuberance in males or the brood patch in females (**Figure 6**). All species develop at least one of these characteristics, at least partially, and most are reliably sexed by them during the spring and summer months. External cloacal protuberances are developed by males to store sperm and to assist with copulation. Brood patches are developed by females to transfer body heat to eggs or young. The bander blows the feathers apart in the vent or belly region to view the cloacal protuberance or brood

patch, respectively. The size of the cloacal protuberance and extent of development of the brood patch are scored and recorded. Other criteria used in sex determination include eye colour and wing length.

6.5. Fat Score

Birds store fat as a readily accessible source of energy, especially during migration. Birds that have little or no fat during migration probably have just arrived and will need to spend a few days replenishing their stores. Birds with large amounts of fat are probably ready to depart on the next phase of their journey. Fat content is a good general indicator of the condition of a migrating bird.

Birds store fat in the furcular hollow (or "furculum" where the throat joins the body), lower abdomen, and sides of the body beneath the ribs and underneath the wings (**Figure 7a**). Fat deposits can be examined by blowing apart the body feathers. When present, fat deposits are visible through the skin, which appear as yellowish or orangish masses contrasting with the burgundy-coloured muscular areas. The relative amount of fat in the furcular hollow and on the bird's body is recorded on a scale from 0 (no fat) to 7 (heavy) (**Figure 7b**).

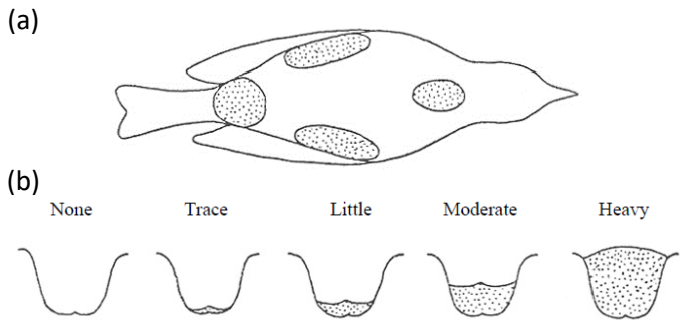

Figure 7. (a) Location of visible fat deposits on birds; (b) representation of increasing fat in the furculum (neck hollow) (from NABC, 2001a).

6.6. Biometrics

Many measurements are taken which are used in identification, age/sex determination, and to assess the bird condition, including wing length, tail length, and weight. Wing length is measured (to the nearest 1 mm) as the wing chord or unflattened wing length (**Figure 8a**) using a ruler with a perpendicular metal stop fixed at one end. The wing should be as close to a natural resting position as possible, ensuring that all flight feathers lie in their natural alignment. Tail length is measured (to the nearest 1 mm) as the distance between the tip of the longest tail feather and the point at which they protrude from the skin (**Figure 8b**). A ruler is inserted between the two central tail feathers and the end is pushed firmly against the feather roots (i.e., the point of insertion of the feathers).

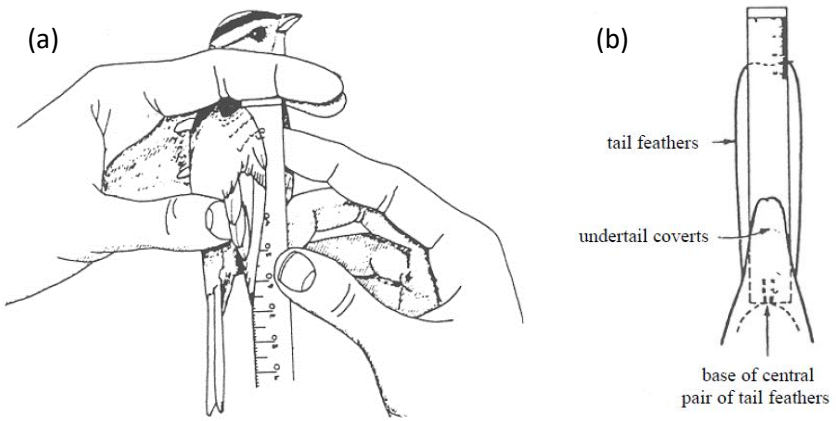

Figure 8. (a) Measuring wing length; (b) measuring tail length (from NABC, 2001a).

Body weight (to the nearest 0.1 g) can be quickly and accurately measured with an electronic scale. Birds are normally weighed at the beginning of the banding process, before retrieval from the bag. The bag with the bird within is placed in a weigh vessel on the scale, and the scale is zeroed (tared). The bird is then retrieved from the bag, and the bag is returned into the weigh vessel. The bird's weight is displayed on the scale as a negative number (the absolute value displayed is the weight sought). For birds that were not placed in a bag (e.g., large birds, raptors) or in cases where the weight was not taken at the beginning of the banding procedure (i.e., forgotten), the bird can be weighed with a properly sized weighing tube. In this case, the tube is placed on the scale, the scale is zeroed, and the bird is gently lowered in the tube headfirst by holding the feet in photographer's grip. Whenever possible, birds should be weighed using the first method as it reduces the extra step needed with the weighing tube.

Other measurements that may be taken for some birds include length of specific flight feathers, bill depth, width or length, or tarsus length.

6.7. Releasing Birds

Birds should not be thrown into the air (except raptors) or released high above the ground, as they may be unable to fly properly due to disorientation or wing strain. It is best to hold the bird in the bander's grip and to simply place it onto the palm of the other hand at table height. This height is suitable to observe the bird as it flies away. Avoid releasing the bird directly on the ground as some species tend to run away into nearby brush, which does not allow observation of proper flight. A gentle nudge may aid departure.

Raptors should be released while facing into the wind and away from nearby obstacles (e.g., trees or shelter). The bird in ice cream cone grip may be gently but firmly thrown upwards and away from you (the feet are released last). Owls at night should be placed in a safe, dark spot where their eyes can readjust to the dark before flying away.

6.8. Record Keeping

The primary reason for banding birds is to collect useful, reliable data, and to store these data in a manner that makes them readily accessible for analysis. Success of the banding and recovery reporting system depends on international cooperation among the Banding Offices, all banders, researchers, and the public. Therefore, the banding operation must keep careful track of all birds banded and recaptured.

At the time of banding, each bird's band number, species, age, sex, wing and tail length, fat score, weight, date and time captured and released, capture method and number of the capture gear / net, names of bander and scribe, and any relevant comments must be recorded. The following information must also be recorded for the day's operation:

- location of the banding operation;
- number of nets used;
- hours of operation for each net;
- weather conditions (air temperature, cloud cover, precipitation, wind direction and speed at net opening and closing);
- names of personnel and visitors; and,
- a summary of the day's activities, including a tally, and details of any unusual events, injury, or casualties.

The banding data sheet, reference sheets and daily log sheets are included in **Appendices III**-**V**, along with general instructions for data entry.

7. BIRD WELFARE

A "casualty" is defined here as any debilitating injury or death. Such casualties are rare in any good banding operation, but birds can be injured or die even in the most careful banding operation. While the goal is zero casualties, the risk can never be completely eliminated, if only because predation is always a risk. Although they are rare, every casualty must be judged not only as an unfortunate and deeply regrettable accident, but also as an important learning experience. Banding casualties are usually caused by predators, bander inexperience, bad practice, or faulty equipment. A combination of common sense, forethought and awareness minimizes the risk of casualties. *The North American Banders Study Guide* (NABC, 2001a) provides a detailed review of the causes of injury and death.

A review of mist netting by 22 banding organizations in the United States and Canada reported average rates of injury and mortality of 0.59% (1 in 169) and 0.23% (1 in 435), respectively (Spotswood et al., 2011). Therefore, casualty rates must be monitored and should ideally be maintained well below these values.

All personnel involved in banding operations are required to become familiar with and abide by the following VIU Standard Operating Procedures (SOP):

- VIU ACC SOP on *Monitoring Stress and Injury in Birds during Bird Banding*.
- VIU ACC SOP on *Euthanasia of Birds during Bird Banding*.

All stressed birds and casualties (injury or death) must be reported to the BIC immediately. The BIC is responsible for making all decisions in the case of injury or fatalities. If an incident occurs, immediate action must be taken to prevent further casualties and an examination of the banding operation is required to reduce the chances of such events reoccurring. All casualties must also be recorded, including the date, species, net or location found, and any other pertinent information such as the circumstances surrounding the incident and what course of action was taken.

"Orphaned" birds should be left alone, unless they are faced with imminent threat. Parents will care for many birds on the ground, so unless it is clear that a young bird is abandoned, its chances are better if left alone. Fledglings may be carefully placed in a shrub 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.

8. PERSONNEL INJURIES AND DISEASES

8.1. Physical Risks

Banders should always strive to minimize physical hazards around the project area. At all times, steps should be taken to minimize tripping hazards. Logs and branches should be cleared off paths around the netting area, and stumps cut down to ground level.

Most songbirds are quite harmless, except for shrikes and raptors, which can draw blood with their sharp talons and hooked bill. Large-billed seedeaters (e.g., grosbeaks) can inflict painful bites, although they rarely draw blood. One way to reduce their mobility is to use the "straitjacket" grip. This is a variation on the standard bander's grip in which the head is held nearer the tips of the first and second fingers, which are then straightened somewhat.

Several species, such as jays, starlings, most blackbirds, and woodpeckers, have strong toes and sharp claws. Banding many of these can take its toll on banders' hands. Scratches can be lessened by using another variation on the bander's grip in which legs are immobilized between the third and fourth fingers for most of the banding operation.

Depending on the location of banding operations, large mammals (e.g., bear, cougar, wolf, deer) may be present in the banding area. Participants should be knowledgeable about the proper safety procedures to adopt if these animals are encountered (see http://wildsafebc.com). When encountered, these animals usually retreat quickly. The presence of any large mammal should be communicated to the BIC and all personnel via radio to alert everyone of its presence. If practical, net checks should be performed in pairs if these animals are suspected of being present in the banding area. No food or waste should be left in the banding area.

8.2. Diseases and Disorders

Birds may suffer from various infections. Most of these, fortunately, are peculiar to birds, but some may be shared with other animals, including humans. Banders contracting curious symptoms are strongly advised to seek medical attention immediately and to inform their doctor of their contact with wild birds. As a general precaution, regular hand washing with alcohol, hand sanitizer or soap is recommended, especially before drinking or eating. Never place bird bags in the mouth and avoid inhaling dust from bird bags, which should be washed or cleaned out regularly. At the end of each banding session, all used bird bags must be inverted, shaken, and stored separately from clean bags.

Salmonellosis is a bacterial infection, common in mammals and birds. In humans, it is most likely to be contracted from the feces of birds that frequent garbage dumps, feed lots and bird feeders. Because it is commonly found in dead birds that are simply “found dead,” personal hygiene is especially important after handling dead birds. Symptoms are acute enteritis and diarrhea.

The risk to humans associated with infectious viral diseases such as avian pox, avian flu and West Nile Virus is low, but again personal hygiene and frequent hand washing is warranted. It is important to avoid ingesting, inhaling, or getting excrements, bird blood or other body fluids in contact with open cuts and scratches. Along with these precautions, it is important to reduce transmission of infectious diseases from one bird to another by not bringing captured birds into contact with other birds’ excretions. Therefore, frequent washing of hands, equipment and bird bags is recommended.

Rabies is potentially communicable, not via birds, but from bats. Although bats are not typically caught in mist nets used during the day, they can be captured during nocturnal owl banding. Any bat captured in a mist net must be extracted carefully, ideally while wearing cut-resistant gloves (e.g., Kevlar gloves). Any bander suffering a bite from a bat must seek immediate medical treatment even if immunized.

Banders should be aware of toxic plants occurring in their banding area (e.g., giant hogweed, stinging nettle, poison ivy, etc.). Strong-footed species such as blackbirds and jays that have been foraging in patches of these plants can cause irritation if the skin is punctured by their claws, allowing the toxin to penetrate under the skin. Prevention is effected by care during handling and by frequent hand washing using soap. Additional information about toxic plants can be obtained from E-Flora BC (http://www.geog.ubc.ca/biodiversity/eflora) and published plant guides. The BIC will notify personnel about toxic and other hazardous plants in the project area.

9. TRAINING

Bird banding is both a delicate art and a precise science. It should come as no surprise that it requires not only sensitivity and knowledge, but also extensive training. This is in the interest of the birds’ safety and in the interest of gathering accurate and useful information. Removing birds from a mist net is mostly a matter of common sense and logic, but it only comes with much experience. Net

extraction must be learned under the supervision of an experienced person. Applying a band on a bird can be learned quickly but obtaining meaningful and accurate age and sex data from all banded birds requires extensive knowledge acquired by handling thousands of birds at all times of the year. Therefore, no one should expect to become an expert bird bander after just a few banding days.

Individuals who are new to bird bandings (students or other volunteers), with little or no training elsewhere, must be approved for training by the BIC. Trainees will be required to read this manual and the North American Banding Council study guides (NABC, 2001a, b), the Introduction pages of Pyle (1997), and any other assigned readings. In addition, trainees will be required to receive animal ethics training as recommended by the VIU Animal Care Committee.

Trainees should be aware that training may be discontinued for persons who demonstrate poor dexterity, eyesight or aptitude for extraction or banding, poor judgement, or any reason at the discretion of the BIC.

A structured, graduated training program is followed for volunteers who want to assist in banding operations. Details are provided in **Appendices VI** and **VII**.

10. PUBLIC EDUCATION

Formal banding demonstrations are typically scheduled well in advance. Only well-trained, experienced banders should give the demonstrations. Trainees can scribe and generally help out until they are sufficiently adept at the entire process. Visitors are not permitted to handle the birds and should be discouraged from touching them. Occasionally and with approval from the BIC, visitors may release birds that have been placed on their open hand. Photography of birds in the hand is acceptable, but it should be kept as brief as possible and avoid the use of flash photography.

11. BUTTERTUBS WEST MARSH BANDING STATION

The main activity of the bird monitoring and banding program at VIU is the operation of a banding station at Buttertubs West Marsh in Nanaimo. This section highlights details of the banding operations which are specific to this project location. All other procedures of the banding program at the Buttertubs West Marsh banding station are as described in other sections of this manual.

11.1. Introduction

In the summer of 2012, the City of Nanaimo and Ducks Unlimited Canada jointly acquired the 27-hectare Buttertubs West Marsh property. This property is located west of the Buttertubs Marsh Conservation Area and east of the Nanaimo Parkway (**Figure 9**), and it encompasses a mixture of ecosystem types, including marsh and shallow water, riparian areas, upland forest, and old-field habitats. Altogether, the Buttertubs West Marsh and adjacent Buttertubs Marsh represent approximately 53 hectares of productive parkland habitat with significant ecological value in an

otherwise fragmented urban landscape (Lepczyk and Warren, 2012). These green spaces can provide important breeding, stopover, and wintering habitats for various bird species (NABCI, 2012). Vancouver Island University (VIU) has operated a bird monitoring and banding project at Buttertubs West Marsh since 2013, in partnership with the City of Nanaimo, Ducks Unlimited Canada, and The Nature Trust of BC.

11.2. Mist Net Distribution and Station Layout

Each year between March and October, 20 mist nets (12 m x 2.6 m; 30-mm mesh size) are installed for use at Buttertubs West Marsh. The location of these nets is stratified among the habitat types present at the site (**Figure 10**). Ten nets (nets no. 1-10) are located in old-field habitat dominated by open expanses of reed canarygrass (*Phalaris arundinacea*) and shrub / tree patches consisting mainly of hardhack (*Spiraea douglasii*) and willows (*Salix* sp.). Five nets (nets no. 11-15) are located in upland forest habitat consisting of Douglas fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), English oak (*Quercus robur*), and a shrubby understory consisting of thimbleberry (*Rubus parviflorus*), salmonberry (*R. spectabilis*), ocean spray (*Holodiscus discolor*), hardhack, and Himalayan blackberry (*R. armeniacus*). Five nets (nets no. R1-R5) are located in riparian habitat along the Millstone River consisting of Nootka rose (*Rosa nutkana*), English hawthorn (*Crataegus monogyna*), Red osier dogwood (*Cornus sericea*), hardhack, and Himalayan blackberry.

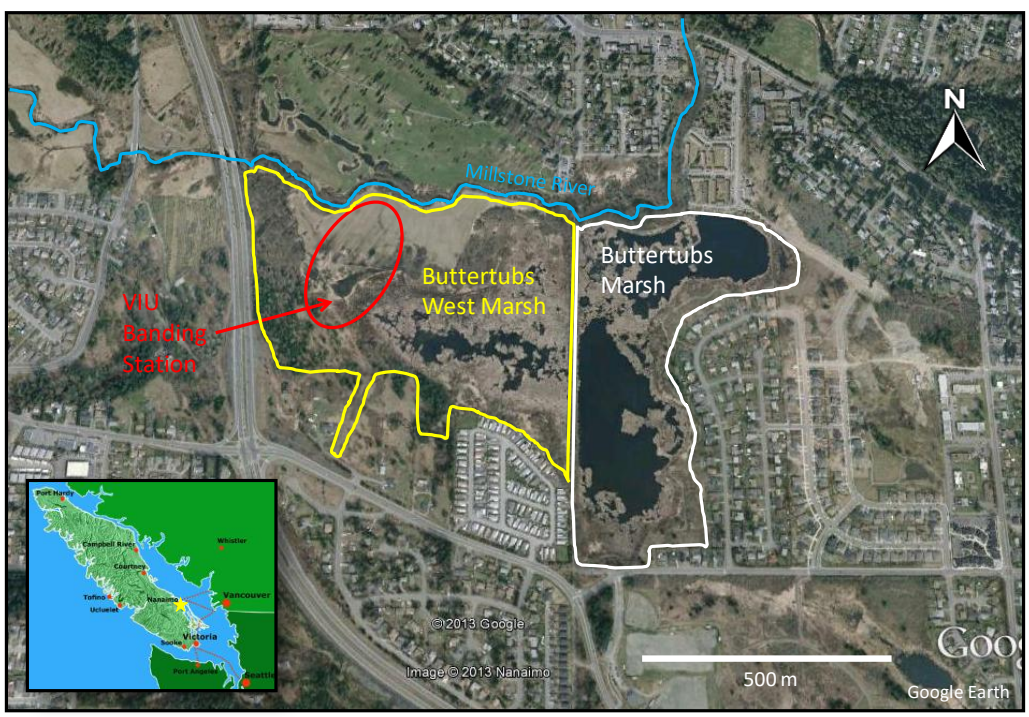

Figure 9. Aerial photograph of Buttertubs West Marsh in Nanaimo, BC, including the location of the Vancouver Island University (VIU) bird banding station.

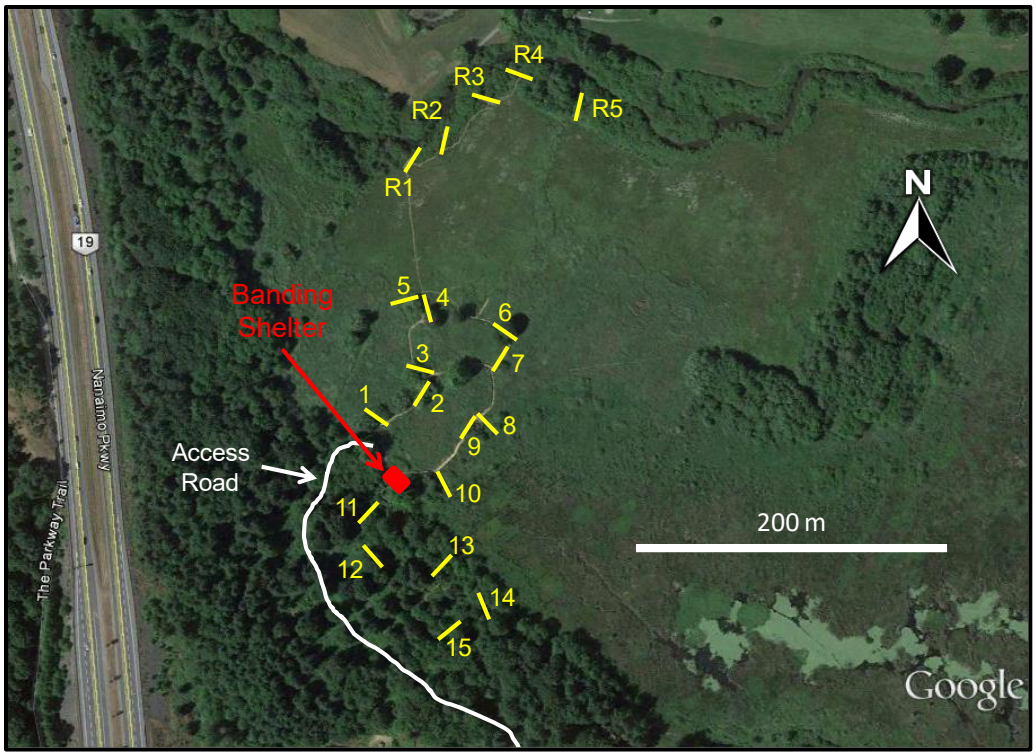

Figure 10. Locations of mist nets and banding shelter used for bird banding at Buttertubs West Marsh.

Bird banding activities at Buttertubs West Marsh are centred at a banding shelter where captured birds are processed (**Figure 10**). The shelter includes a table, chairs, a rope line with hooks to hold birds in bags prior to processing, and space to leave personal effects. From the shelter, nets are distributed into an "inner loop" (nets 1-10), an "outer loop" (nets R1-R5, also called the "riparian nets"), and the "forest" (nets 11-15). During net checks, extractors are usually deployed in opposite directions along the loops. This approach ensures that all nets get checked in a timely manner, especially if one extractor is slowed down by a complicated extraction or a high number of captured birds. After returning from a net round, a timer is set to signal the time for the next net check (10-15 minutes, or less in cold weather operation below 10°C). **Appendix VIII** includes photographs that show the banding shelter and mist net setup at Buttertubs West Marsh.

11.3. Mist Net Setup and Operation

Each mist net is set up and operated as described in Section 5.1.1, with some modifications specific to this project. Along with the guy wires which hold up the net poles, an additional "pulley" rope is installed at each end to facilitate raising and lowering the net like a flag on a flagpole. Each pulley rope is looped through an eyebolt at the top of the net pole, and the upper three trammel lines of the net are attached to the pulley rope using shower curtain clips. The net is raised by pulling the pulley rope until the top trammel line reaches the top of the pole. The bottom trammel line is lowered to just above knee height. Trammel lines should be spaced at roughly equal distance from each other. Net tension can be

adjusted by raising the guy wire knot on one of the net poles to avoid sagging. To close the net, the upper trammel lines are lowered using the pulley rope and the bottom trammel line is raised so that all trammel lines are now located at the guy wire knot.

At the end of a banding day, all nets must be closed and furled tightly to ensure no bird is captured until the next banding day. To furl a net, the top trammel line is raised, and the remaining closed trammel lines and panels are then furled into the top trammel panel with quick rolling strokes, while simultaneously lowering the top trammel line once all trammel panels have been furled into the top trammel panel. Approximately 30 cm of netting at the end of each net should be secured with clothes pegs to remove any drooping netting. The net is then rolled while standing approximately mid-length along the net, and it is secured with a rope attached to nearby vegetation and a slipknot. A clothes peg should be placed near the rope attachment. A furled net should have no drooping netting that could inadvertently result in a bird getting entangled while flying near or standing on it. **Appendix VIII** includes photographs that show a net furled and secured.

Each net comes with a “net tag” labelled with the net number which is used to keep track of the status of each net (i.e., open or closed). Upon opening a net, the tag is clipped to the upper trammel line loop and raised along with the net. When a net is closed and furled, the net tag is removed and returned to the banding shelter. Net tags must never be removed from nets that are not completely furled. At the end of the banding day, all net tags must be returned to the banding shelter to confirm that all nets have been furled.

11.4. Incidental Observations

During bird banding days, all birds detected by sight and sound (other than those captured in mist nets) are counted and recorded as incidental observations on page 2 of the Daily Log Sheet (**Appendix V**). These observations are especially important to account for species that are not targeted by mist netting operations (e.g., waterfowl, raptors, etc.). The combination of banding totals (number of birds captured) and incidental observations provide an estimate of the number of species and individuals present at the site (Estimated Totals; ET). Estimated totals are compiled in the online eBird database (ebird.org). eBird is a public database of bird observations providing scientists, researchers, and amateur naturalists with real-time data about bird distribution and abundance. The eBird database can be queried to obtain detailed accounts of species presence / absence and abundance for a given site.

12. REFERENCES

Blancher, P., A. Cyr, S. Droege, D. Hussell, and L. Thomas (compilers). 1994. Results of a U.S./Canada Workshop on Monitoring Landbirds during Migration and Recommendations towards a North American Migration Monitoring Program (MMP).

Hussell, D.J.T., and C.J. Ralph. 1998. Recommended Methods for Monitoring Bird Populations by Counting and Capture of Migrants. Report for the Intensive Sites Technical Committee of the Migration Monitoring Council, 1998.

Lepczyk, C.A., and P.S. Warren. 2012. Urban Bird Ecology and Conservation. University of California Press, Los Angeles, CA. 344 p.

National Geographic Society. 2011. Field Guide to the Birds of North America, Sixth Edition. National Geographic Society, Washington, D.C.

North American Banding Council. 2001a. The North American Banders' Study Guide. North American Banding Council, Point Reyes Station, California.

North American Banding Council. 2001b. The North American Banders' Manual for Banding Passerines and Near Passerines (Excluding Hummingbirds and Owls). North American Banding Council, Point Reyes Station, California.

North American Bird Conservation Initiative (NABCI), Canada. 2012. The State of Canada's Birds, 2012. http://www.stateofcanadasbirds.org/

Pyle, P. 1997. Identification Guide to North American Birds, Part I. Slate Creek Press, Bolinas California.

Ralph, C.J. 2005. The Body Grasp Technique: A Rapid Method of Removing Birds from Mist Nets. North American Bird Bander 2005:65-70.

Sibley, D.A. 2016. The Sibley Field Guide to Birds of Western North America, 2nd Edition. Alfred A. Knopf, Inc. 504 p.

Spotswood, E.N., K.R. Goodman, J. Carlisle, R.L. Cormier, D.L. Humple, J. Rousseau, S.L. Guers, and G.G. Barton. 2011. How Safe is Mist Netting? Evaluating the Risk of Injury and Mortality to Birds. Methods in Ecology and Evolution 2011:1-10.

Appendix I. The Bander's Code of Ethics (from the North American Banding Council (NABC); https://nabanding.net/).

1. Ensure the respect, safety, and welfare of birds and their populations, people, and the environment.
   - Handle each bird carefully, gently, quietly, and in minimum time; capture and process only as many birds as you can safely handle given your ability and the environmental conditions
   - Follow safety procedures as outlined in NABC materials and constantly innovate ways to conduct operations more safely
   - Follow the NABC Code of Conduct to help guide professional behaviour

2. Design or use appropriate studies, methods, and analyses to advance a valid scientific purpose.
   - Collect accurate data and submit to an appropriate data repository
   - Collaborate to maximize data collection and to avoid duplicating effort
   - Promote and contribute to projects using standardized protocols when appropriate

3. Be accountable and strive for high standards.
   - Engage in self-assessment and invite assessments from others to ensure that your work is beyond reproach
   - Share knowledge and offer honest and constructive feedback to others to improve skills and banding practices

4. Obtain all necessary permits and permissions; understand and adhere to the conditions, responsibilities, and limitations thereof.

Appendix II. When and How to Remove a Band (from NABC, 2001a).

Please refer to *The North American Banders Study Guide* (NABC, 2001a) for a more thorough treatment of this topic.

When to Remove a Band

Bands that are too loose, too tight or worn down (sharp-edged or hard to read) need to be removed. Getting a band safely onto a bird's leg is simple. Getting one off, however, can be difficult, especially if it is tight against the tarsus. Band removal should always be performed by the BIC with assistance of another volunteer. Any removed illegible band must be returned to the Bird Banding Office (along with information about the bird and details of any replacement band) to be etched and read.

If a band rotates freely and slides up and down without pinching the tarsus or causing foreseeable injury, it should be left on, even if it is the "wrong" size. On occasion, it may be better to slightly "oval" a band that is marginally too small rather than risk band removal.

How to Remove a Band

Circlip pliers are frequently used for band removal because they have fine, angled tips, enabling their insertion between a band and a bird's tarsus. When the handles of these pliers are closed, the tips open, thus opening the band. When removing a band with circlip pliers, all leverage must be applied to the band and none to the leg. As during banding, the tarsal joint must be supported throughout the whole process. The band and tarsal joint can be held by the thumb and forefinger, ensuring that the band cannot move during opening. Insert the tips of the pliers so that they are on either side of the seam of the band. Gradually apply pressure to the circlip pliers, opening the band a little at a time and readjusting the plier tip in the opening band until it is open far enough to be taken off the leg.

If the band is too tight against the leg to use circlip pliers, it can be removed by applying blunt-end pliers to both sides of the band to pry it open (requires two blunt-end pliers). This method works best if one person holds the bird in the bander's grip and the person removing the band holds a pair of pliers in each hand. The pliers are pressed firmly on the band on either side of the seam of the band, and the band is slowly pried open without applying pressure on the tarsus until it is open far enough to be taken off the leg.

After the band is removed, the BIC will determine whether another band will be applied, and whether to destroy or reuse the band, depending on its condition.

Appendix III. Banding Data Sheets and Instructions for Scribing.

New Band sheet (front):

VANCOUVER ISLAND UNIVERSITY - BIRD BANDING DATA SHEET

Page Number for Band Size:

First Band Number on Sheet: PREFIX - SUFFIX YEAR 2 0

INITIALS:

Band Size

LAST 2 NO. OF BAND	SPECIES	AGE	HOW AGED	SEX	HOW SEXED	WING	TAIL	FAT	BP CP SK	WEIGHT	DATE MON	DATE DAY	NET CHECK TIME	TIME RELEASED	CAPTURE MATHOD TYPE	CAPTURE MATHOD NO.	BANDER	SCRIBE	LOCATION	NOTES (use back, if needed)	ENTERED
													0	0							
													0	0							
													0	0							
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Last Band Number on Sheet: PREFIX - SUFFIX

DATASHEET: Proofed on sheet INITIALS Entered in Excel INITIALS Entered in Bandit INITIALS

TOTALS: SPECIES NO. SPECIES NO. SPECIES NO.

Recapture sheet (front):

VANCOUVER ISLAND UNIVERSITY - BIRD BANDING DATA SHEET

Page Number for Recaptures:

Recaptures YEAR 2 0 INITIALS: **Recaptures**

BAND NUMBER	SPECIES	AGE	HOW AGED	SEX	HOW SEXED	WING	TAIL	FAT	BP CP SK	WEIGHT	DATE MON	DATE DAY	NET CHECK TIME	TIME RELEASED	CAPTURE MATHOD TYPE	CAPTURE MATHOD NO.	BANDER	SCRIBE	LOCATION	NOTES (use back, if needed)	ENTERED
-													0	0							
-													0	0							
-													0	0							
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DATASHEET: Proofed on sheet INITIALS Entered in Excel INITIALS Entered in Bandit INITIALS

TOTALS: SPECIES NO. SPECIES NO. SPECIES NO. SPECIES NO.

New Band / Recapture sheet (back):

Additional Comments

LAST 2 NO. OF BAND		NOTES

Banding Codes

Age

0	Unknown
1	AHY - After Hatch Year
2	HY - Hatch Year
4	L - Local (nestling)
5	SY - Second Year
6	ASY - After Second Year
7	TY - Third Year
8	ATY - After Third Year

Sex

U	Unknown
M	Male
F	Female

How Aged / Sexed

BP	Brood Patch
CA	Calendar
CC	Combination of characteristics/measurements
CL	Cloacal protuberance
EG	Egg in oviduct
EY	Eye color
FB	Fault bar
FF	Flight feathers condition or color
IC	Inconclusive, Conflicting
LP	Molt limit present
MB	Mouth/bill
MR	Actively-molting flight feathers
NA	Not attempted
NF	Nestling recently fledged, incapable of powered flight
NL	No molt limit
NN	Nestling in nest (altricials), downy young (precocials)
OT	Other (explain in notes)
PC	Primary covert wear and/or shape
PL	Body Plumage
RC	Sexed upon recapture
SK	Skull
TL	Tail length
TS	Tail shape or wear
WL	Wing length

Capture Method (Type)

MN	Mist net
GT	Ground trap
FT	Feeder trap
NB	Nest box
HG	Hand grab

Location

BUWE	Buttertubs West
DEBA	VIU Deep Bay
MIGA	VIU Milner Gardens
VIUN	VIU Nanaimo Campus
CALA	Cathers Lake (ED Home)

Remark Codes

301	Normal wild bird. Colored leg band(s): plastic, metal, paint, tape.
302	Normal wild bird. Neck collar.
375	Normal wild bird. PIT tag.
500	Injured. Released in <24 hours.
5--	Banding or trapping mortality. Held <24 hours. No band.
700	Injured, rehabilitated, released. Held for >24 hours.
7--	Banding or trapping mortality. Held for >24 Hours. No band.

Instructions for Scribing Banding Data Sheets

- The banding data binder includes at least one New Band sheet for each band size (0A, 0, 1, 1B, 1A, 1D, 2, and 3+), one Recapture sheet, one sheet to record unbanded birds, and spare blank sheets. The sheets are separated by tab dividers labelled with each band size, or with R or U for recaptures and unbanded birds, respectively.
- *INITIALS*: The bander code and name of any *new* bander or scribe should be listed at the top of the sheet.
- *Page Number for Band Size* / *Band Size*: Record the page number for the band size and the band size in the upper-left corner.
- *First Band Number on Sheet* / *Last Band Number on Sheet* (New Band sheet): The first and last band numbers used on the page must be included in the top left and bottom left, respectively.
    - Each band number consists of a prefix (3 or 4 digits) and a suffix (5 digits).
    - For a band number with a 3-digit prefix, the number “0” is added as the first number.
- *LAST 2 NO. OF BAND* (New Band sheet): The last two digits of each bands is listed in the first column.
    - Each band sheet holds space for 25 bands. Since bands come in strings of 100 bands, it takes four sheets to record all bands for a string. The last two digits of the bands on a sheet must span any of the following ranges: 01-25, 26-50, 51-75 or 76-00.
    - If a partial string of bands is to be used (e.g., because some of the bandes were used in a previous season), then the first band number must be on the appropriate line on the sheet, which may not be on the first line (e.g., band number 2061-70128 would be

recorded on the 3rd line since the first and last lines must be 2061-70126 and 2061-70150, respectively).
    - **NOTE**: Every band must be accounted for no matter how it is used. Therefore, there must be no gap in the number sequence in the first column.
- *BAND NUMBER* (Recapture sheet): The complete 9-digit band number is recorded in this column. For a band number with a 3-digit prefix, the number "0" is added as the first number.
- *SPECIES*: Record the 4-letter species code.
    - Refer to the **Species Reference Sheet** for the code for each species (e.g., BEWR for Bewick's Wren). Please note that some species have non-standard banding codes (e.g., SAVS for Savannah Sparrow).
    - *BALO* and *BADE* codes are used for band that are lost or destroyed, respectively.
- *AGE* / *HOW AGED* / *SEX* / *HOW SEXED*: Refer to the back of any banding sheet or the **Banding Codes Reference Sheet** for ageing and sexing codes.
    - Bird age is recorded using numbers (e.g., "2" for HY) and sex is recoded using letters (e.g., "F" for Female).
    - Information about how a bird was aged or sexed is recorded using 2-letter codes (e.g., "PC" for a bird aged by examining the primary coverts).
    - If multiple characteristics are used for ageing, the code "CC" (combination of characteristics) should be recorded, and the characters used are listed in the Notes column. Alternately, the most reliable code is entered in the How Aged column and other codes are listed in the Notes column.
    - Birds that cannot be aged conclusively are recorded as "IC" (inconclusive, conflicting).
    - Birds that are not aged (i.e., escaped prior to ageing) are recorded as 0 (unknown; summer, fall) or 1 (AHY; spring), and how aged as "NA" (not attempted).
    - Birds that are banded as nestlings are recorded as age "4" (local) and how aged as "NN" (nestling in nest).
- *WING* / *TAIL*: Wing chord and tail length are recorded to the nearest millimetre.
- *FAT*: Fat score is recorded on a scale of 0-7 (refer to the **Banding Codes Reference Sheet**).
- *BP* / *CP* / *SK*: The score for a bird with a brood patch (BP; 0-5) or cloacal protuberance (CP; 0-3), or a bird aged by skull ossification (SK; 0-6) is recoded in this column (refer to the **Banding Codes Reference Sheet**).
    - The sexing codes "BP" or "CP" should be included in the How Sexed or Notes column for birds with these characteristics.
- *WEIGHT*: Weight is recorded to the nearest 0.1 gram.
- *DATE*: The date is recorded with two digits for month and day. The year should also be noted on the top left of the sheet.
- *NET CHECK TIME* / *TIME RELEASED:* The time of the net round (i.e., when extractors left the banding table to check nets) and the time when the bird is released are recoded to the unrounded 10-minute block (e.g., net check time = 06:33, recoded as "0630"; time released = 06:48, recoded as "0640").
    - The 24-hour clock is used throughout (e.g., 1:54 PM is recoded as "1350").

- *CAPTURE METHOD* / *TYPE* / *NO.*: The capture method type and number are recorded in these columns (e.g., “MN05” for mist net number 5; “NB28” for nest box number 28; “GT” for ground trap). Refer to the back of any banding sheet for capture method codes.
- *BANDER* / *SCRIBE*: The 4-letter codes for the bander and scribe are recorded in these columns.
- *LOCATION*: The 4-letter code for the location is recorded in this column (e.g., “BUWE” for Buttertubs West Marsh; “VIUN” for VIU Nanaimo Campus). Refer to the back of any banding sheet for location codes.
- *NOTES*: Any additional comments should be noted in the Notes column. This may include additional ageing or sexing codes, if the bird escaped or was released at the net, description of moult, unusual characteristics, old injury, or ID number for any sample taken (e.g., feathers, ectoparasites). Additional space is available on the back of each banding sheet.
- *ENTERED* / Fields at the bottom of the sheet: These areas are reserved for data entry and checks by the BIC.

ADDITIONAL NOTES:

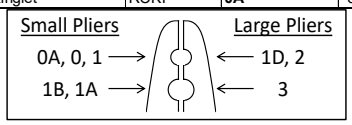
- For the columns between Date and Location, it is appropriate to use a solid horizontal line to denote information that is repeated from above. However, a horizontal line should never be used for the columns between Band Number and Weight.
- Never use ditto marks (") as they can be misinterpreted as the number 11.
- For a given bird, no column can be left empty, except for the columns between Wing and Weight (for these columns, an empty field indicates that the measurement was not taken).

Appendix IV. Banding Reference Sheets.

Species Reference Sheet

Species	Code	Band	Pyle	Tab	Sibley
RAPTOR					
Sharp-shinned Hawk	SSHA ***	M**2**-3,F**3B**-3	415ii	4	98
Cooper's Hawk	COHA ***	M**4**-5,F**5**-6 LO	415ii		98
Northern Saw-whet Owl	NSWO	**4SH**, 3A	98	6	216
Merlin	MERL ***	M3-**3A**,F**4L-3B**	462ii	5	241
WOODPECKER					
Red-breasted Sapsucker	RBSA	**1A**	180	15	246
Downy Woodpecker	DOWO	**1B**	187	18	250
Hairy Woodpecker	HAWO	**1D**	189	22	251
Pileated Woodpecker	PIWO	**4**	204	29	242
Red-shafted Flicker	RSFL	**3**	200	25	253
FLYCATCHER					
Olive-sided Flycatcher	OSFL	**1B**	213	33	274
Western Wood-pewee	WEWP	**0A**	215	35	275
Willow Flycatcher	WIFL	**0A**	224	40	269
Hammond's Flycatcher	HAFL	**0A**	230	43	272
Western Flycatcher	WEFL	**0A**	235	47	270
VIREO, SHRIKE, JAY					
Hutton's Vireo	HUVI	**0**	283	55	289
Cassin's Vireo	CAVI	**1**	281	53	291
Warbling Vireo	WAVI	**0**	285	57	293
Northern Shrike	NSHR	**2**	271	51	287
Steller's Jay	STJA	**3**	295	62	295
SWALLOW					
N. Rough-winged Swallow	NRWS	**0**	325	68	309
Purple Martin	PUMA	**1D**	320		310
Tree Swallow	TRES	**1**	322	64	308
Violet-Green Swallow	VGSW	**0**	324	66	308
Barn Swallow	BARS	**1**	328	70	306
Cliff Swallow	CLSW	**1**	330	72	307
CHICKADEE, BUSHTIT, NUTHATCH, CREEPER					
Chestnut-backed Chickadee	CBCH	**0**	339	76	314
Bushtit	BUSH	**0A**	349	78	317
Red-breasted Nuthatch	RBNU	**0**	351	80	318
Brown Creeper	BRCR	**0A**	356	82	320
WREN					
House Wren	HOWR	**0**	365	85	323
Pacific Wren	PAWR	**0A**	366	87	324
Marsh Wren	MAWR	**1**	369	89	325
Bewick's Wren	BEWR	**1**	363	83	322
KINGLET					
Golden-crowned Kinglet	GCKI	**0A**	374	91	332
Ruby-crowned Kinglet	RCKI	**0A**	375	93	332

Species	Code	Band	Pyle	Tab	Sibley
THRUSH, ROBIN					
Varied Thrush	VATH	**2**	405	106	343
Swainson's Thrush	SWTH	**1B**	397	99	339
Hermit Thrush	HETH	**1B**	399	101	338
American Robin	AMRO	**2**	403	103	342
STARLING, WAXWING					
European Starling	EUST	**2**	421	108	353
Cedar Waxwing	CEDW	**1B**	437	109	358
FINCH, CROSSBILL,					
Evening Grosbeak	EVGR	**1A**	688	195	453
House Finch	HOFI	**1B**	670	184	449
Purple Finch	PUFI	**1**	668	182	448
Red Crossbill	RECR	**1B**	673	186	450
Pine Siskin	PISI	**0**	680	191	444
American Goldfinch	AMGO	**0**	686	193	445
House Sparrow	HOSP	**1B**	690	197	457
TOWHEE, SPARROW, JUNCO					
Chipping Sparrow	CHSP	**0**	550	147	405
Fox Sparrow	FOSP	**1A**	577	151	408
Oregon Junco	ORJU	**0**	593	162	412
White-crowned Sparrow	WCSP	**1B**	589	157	416
Golden-crowned Sparrow	GCSP	**1B**	591	160	417
White-throated Sparrow	WTSP	**1B**	587		417
Savannah Sparrow	SAVS	**1**	565	149	400
Song Sparrow	SOSP	**1B**	579	153	410
Lincoln's Sparrow	LISP	**1**	584	155	411
Swamp Sparrow	SWSP	**1**	585		411
Spotted Towhee	SPTO	**1D**	536	145	394
ORIOLE, BLACKBIRD, COWBIRD, TANAGER, GROSBEAK					
Bullock's Oriole	BUOR	**1A**	658	178	441
Red-winged Blackbird	RWBL	M**2**,F**1A**	626	171	434
Brown-headed Cowbird	BHCO	M**1A**,F**1B**	646	176	431
Brewer's Blackbird	BRBL	**2**	638	174	432
Western Tanager	WETA	**1B**	528	142	423
Black-headed Grosbeak	BHGR	**1A**	612	165	428
WARBLER					
Orange-crowned Warbler	OCWA	**0**	448	112	372
MacGillivray's Warbler	MGWA	**1**	509	135	370
Common Yellowthroat	COYE	**0**	510	137	371
Yellow Warbler	YEWA	**0**	459	118	382
Yellow-rumped Warbler	AUWA,MYWA,UYRW	**0**	469	122	384
Black-throated Gray Warbler	BTYW	**0A**	472	127	386
Townsend's Warbler	TOWA	**0A**	474	130	387
Wilson's Warbler	WIWA	**0A**	515	139	388



Banding Codes Reference Sheet (front)

Age Codes

Code	Description
0	Unknown
1	*AHY* – After Hatch Year
2	*HY* – Hatch Year
4	*L* – Local (nestling)
5	*SY* – Second Year
6	*ASY* – After Second Year
7	*TY* – Third Year
8	*ATY* – After Third Year

Sex Codes

Code	Description
U	Unknown
M	Male
F	Female

How Aged Sexed Codes

Code	Description
BP	Brood Patch
CA	Calendar
CC	Combination of characteristics
CP	Cloacal protuberance
EG	Egg in oviduct
EY	Eye color
FB	Fault bar
FF	Flight feathers condition, color
IC	Inconclusive, conflicting
LP	Molt limit present
MB	Mouth, bill
MR	Actively-molting flight feathers

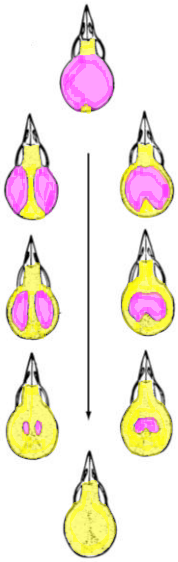
How Sexed Codes

Code	Description
NA	Not attempted
NF	Nestling recently fledged
NL	No molt limit
NN	Nestling in nest
OT	Other (explain in notes)
PC	Primary covert wear, shape
PL	Body Plumage
RC	Sexed upon recapture
SK	Skull
TL	Tail length
TS	Tail shape or wear
WL	Wing length

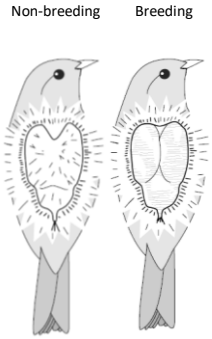
Score	Furculum			Abdomen
0	0%		No fat	No fat
1	1-5%		Scattered patches	None or trace
2	5-33%		Thin layer	Trace or thin layer
3	33-66%		Half full	Scattered patches
4	66-100%		Full	Covering pad
5	>100 %		Slightly bulging	Mounded pads
6			Greatly bulging	Large mounds
7			Fat of furculum and abdomen meet	

Banding Codes Reference Sheet (back)

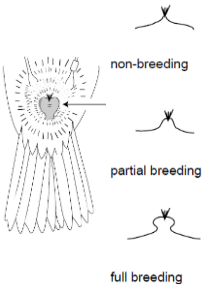
Score	Skull Ossification	
0	0%	None, pinkish
1	1-5%	Tiny triangle at posterior end
2	5-33%	Distinct triangle at posterior end
3	33-66%	Rear half complete
4	66-95%	Oval areas remain
5	95-99%	Tiny windows remain
6	100%	Full



Score	Brood Patch
0	*None* Feathered
1	*Smooth* skin Loss of breast feathers
2	*Vascularized* Some wrinkles
3	*Heavy* vascularization Skin thickly wrinkled
4	*Wrinkled* skin remains Vascularization finished
5	*Moulting* Pin feathers present



Score	Cloacal Protuberance
0	*None* Not enlarged
1	*Small* (conical) Enlarged at base
2	*Medium* (cylindrical) Enlarged throughout
3	*Large* (bulbous) More enlarged at tip



Appendix V. Daily Log Sheet and Instructions for Scribing.

Daily Log sheet (front)

VANCOUVER ISLAND UNIVERSITY
BIRD BANDING - DAILY LOG

MON	DAY	YEAR	LOCATION
		2 0	

PERSONNEL

Initials	Name	Hours	eBird
BIC			

WEATHER

Parameter	Open	Close	Cens.
Wind direction			
Wind strength			
Cloud cover (%)			
Temperature (^{o}C)			
Precipitation			

Synopsis:

DAILY SUMMARY

Parameter	Band	Rec.	Cens.	Obs	ET	SEASON Bdg Totals
No. individuals						
No. species						
No. species combined			Total captures:			

CENSUS

Start time	End time	Initials
:	:	

Catch Rate: .

Total

BANDING EFFORT

Net	Open	Close	"	Re-Open	Re-Close	"	Re-Open	Re-Close	"	Hours	Min
1	:	:		:	:		:	:			
2	:	:	☐	:	:	☐	:	:	☐		
3	:	:	☐	:	:	☐	:	:	☐		
4	:	:	☐	:	:	☐	:	:	☐		
5	:	:	☐	:	:	☐	:	:	☐		
6	:	:	☐	:	:	☐	:	:	☐		
7	:	:	☐	:	:	☐	:	:	☐		
8	:	:	☐	:	:	☐	:	:	☐		
9	:	:	☐	:	:	☐	:	:	☐		
10	:	:	☐	:	:	☐	:	:	☐		
11	:	:	☐	:	:	☐	:	:	☐		
12	:	:	☐	:	:	☐	:	:	☐		
13	:	:	☐	:	:	☐	:	:	☐		
14	:	:	☐	:	:	☐	:	:	☐		
15	:	:	☐	:	:	☐	:	:	☐		
R1	:	:	☐	:	:	☐	:	:	☐		
R2	:	:	☐	:	:	☐	:	:	☐		
R3	:	:	☐	:	:	☐	:	:	☐		
R4	:	:	☐	:	:	☐	:	:	☐		
R5	:	:	☐	:	:	☐	:	:	☐		

NARRATIVE AND COMMENTS:	UNUSUAL SPECIES:
	VISITORS:

Daily Log sheet (back)

VANCOUVER ISLAND UNIVERSITY
BIRD BANDING - SPECIES TOTALS

MON	DAY	YEAR	LOCATION
		2 0	

Species	Band	Rec.	Cens.	Obs.	ET
Gr. White-fronted Goose					
Canada Goose					
Trumpeter Swan					
Wood Duck					
Northern Shoveler					
American Wigeon					
Mallard					
Northern Pintail					
Green-winged Teal					
Ring-necked Duck					
Bufflehead					
Hooded Merganser					
Common Merganser					
California Quail					
Pied-billed Grebe					
Rock Pigeon					
Band-tailed Pigeon					
Eurasian Collared-dove					
Common Nighthawk					
Black Swift					
Vaux's Swift					
Anna's Hummingbird					
Rufous Hummingbird					
Virginia Rail					
American Coot					
Sandhill Crane					
Killdeer					
Wilson's Snipe					
Spotted Sandpiper					
Glaucous-winged Gull					
Double-crested Cormorant					
American Bittern					
Great Blue Heron					
Green Heron					
Turkey Vulture					
Osprey					
Northern Harrier					
Sharp-shinned Hawk					
Cooper's Hawk					
Bald Eagle					
Red-tailed Hawk					
Great Horned Owl					
Barred Owl					
Belted Kingfisher					
Red-breasted Sapsucker					
Downy Woodpecker					
Hairy Woodpecker					
Pileated Woodpecker					
Northern Flicker					
American Kestrel					
Merlin					
Peregrine Falcon					
Olive-sided Flycatcher					
Western Wood-Pewee					
Willow Flycatcher					
Hammond's Flycatcher					
Pacific-slope Flycatcher					
Hutton's Vireo					
Cassin's Vireo					
Totals					

Species	Band	Rec.	Cens.	Obs.	ET
Warbling Vireo					
Northern Shrike					
Steller's Jay					
Northwestern Crow					
Common Raven					
Chestnut-back. Chickadee					
N. Rough-winged Swallow					
Purple Martin					
Tree Swallow					
Violet-green Swallow					
Barn Swallow					
Cliff Swallow					
Bushtit					
Golden-crowned Kinglet					
Ruby-crowned Kinglet					
Red-breasted Nuthatch					
Brown Creeper					
House Wren					
Pacific Wren					
Marsh Wren					
Bewick's Wren					
European Starling					
Varied Thrush					
Swainson's Thrush					
Hermit Thrush					
American Robin					
Cedar Waxwing					
House Sparrow					
Evening Grosbeak					
House Finch					
Purple Finch					
Red Crossbill					
Pine Siskin					
American Goldfinch					
Chipping Sparrow					
Fox Sparrow					
Dark-eyed Junco					
White-crowned Sparrow					
Golden-crowned Sparrow					
White-throated Sparrow					
Savannah Sparrow					
Song Sparrow					
Lincoln's Sparrow					
Swamp Sparrow					
Spotted Towhee					
Bullock's Oriole					
Red-winged Blackbird					
Brown-headed Cowbird					
Brewer's Blackbird					
Orange-crowned Warbler					
MacGillivray's Warbler					
Common Yellowthroat					
Yellow Warbler					
Yellow-rumped Warbler					
Black-thr. Gray Warbler					
Townsend's Warbler					
Wilson's Warbler					
Western Tanager					
Black-headed Grosbeak					
Totals					

Instructions for Scribing the Daily Log

The 2-page Daily Log sheet records the personnel, weather, daily / season summary, census information (if completed), capture effort, and species totals.

- *PERSONNEL*: The bander code and name of each person involved in the banding activity (i.e., gear setup / operation, extraction, banding, scribing) is recorded. The hours volunteered can be included, otherwise it is assumed that a person participated in the full activity. The "eBird" column is used to confirm that the final eBird checklist for the day has been shared with all personnel.
- *WEATHER*: The weather should be recorded at the start and end of the banding activity, and during census (if completed).
    - Wind strength is recorded on the Beaufort scale: 0 = Calm, smoke rises (0-1 km/h); 1 = Light movement, smoke drifts (2-5 km/h); 2 = Slight breeze, wind felt on face, leaves rustle (6-11 km/h); 3 = Gentle breeze, leaves and twigs in constant motion (12-19 km/h); 4 = Moderate breeze, dust and loose paper are raised, small branches are moved (20-28 km/h); 5 = Fresh breeze, small trees and leaves sway (29-38 km/h); 6 = Strong breeze, large branches in motion (39-49 km/h); 7 = High wind, whole tree in motion (>49 km/h).
    - Cloud cover is recorded by assigning the percentage (to the nearest 10%) of the sky covered with clouds (e.g., 0 = clear sky, 100 = overcast).
    - Precipitation is recorded as RA = rain, MI = mist, FO = fog, SN = snow, blank = none.
    - A brief synopsis of the weather should be included, especially if it is variable during the banding activity.
- *DAILY SUMMARY* / *SEASON*: The daily and season summaries are filled out by the BIC during data entry.
- *CENSUS*: Census start and end times are recorded, if completed.
- *BANDING EFFORT*: Net opening and closing times must be recorded for each net. This information is used to calculate total banding effort and catch rate. Differential effort among nets should be recorded in this table (e.g., some nets were closed for some time due to wind, rain, repair, or personnel availability).
- *NARRATIVE* / *UNUSUAL SPECIES* / *VISITORS*: A brief description of the banding day should be included, including general impressions of the banding day, unusual species captured or seen, and visitors. Notable observations of other animals should be included in the narrative. This information makes it easier to recall this day by just skimming through the daily logs.
- *SPECIES TOTALS* (back page): The number of birds banded, recaptured, observed on census and during general observations and tallied on this page.
    - Species names are ordered based on the most recent eBird taxonomy.
    - Hummingbird released unbanded are recorded in the Band column (in parentheses).
    - Any species not included in the list should be added at the bottom and included in the daily totals.
    - Estimated total (ET) are the sum of the other columns but should be realistic.

Appendix VI. Bander Training Levels (adapted from the Vancouver Avian Research Centre).

A structured, graduated training program will be followed for anyone who wants to assist in banding operations. The purpose of the training program is to ensure that banders are fully trained and evaluated before handling birds and that the welfare of the birds is always the top priority. The criteria listed in **Appendix VII** are used to evaluate the progress of trainees.

Individuals involved in banding operations are encouraged to maintain a personal log to document their experience. At a minimum, this should consist of the total number of hours spent extracting and banding, total number of birds extracted and banded, and the identity and number of each species banded. This information is often requested to volunteer at other banding stations and is required to apply for a banding permit.

General - Level 1

Level 1A – Visitor

Any guest with no or unknown banding / bird handling ability. May not participate in activities, except holding birds for release.

Level 1B – Return Visitor

Guest who may have visited on multiple occasions (e.g., spouses, friends of regular volunteers, etc.), but has not received any formal training. No extraction or banding allowed. May hold birds, but only with direct supervision. May be introduced to scribing and other non-handling related activities.

Extraction - Level 2

Level 2A – Beginning Extractor

Individual who is undergoing training on mist net extraction. May perform net extraction of birds that are not badly tangled but must still be supervised by a Level 2C extractor.

Level 2B – Intermediate Extractor

Able to extract most species of birds unsupervised, but willing and understands the need to call for help when needed. Can assist Level 2A extractors.

Level 2C – Advanced Extractor

Able to extract all birds, unsupervised. Can supervise other Level 2B and 2C extractors.

Banding - Level 3

Level 3A – Beginning Bander

Individual who is undergoing training on banding and processing of birds. No banding without direct one-on-one supervision from a Level 3B or 3C bander.

Level 3B – Intermediate Bander

Individual who has banded a significant number of birds of multiple species. Has shown due care in bird handling and processing. Can accurately identify most local species. Can band with minimal supervision, but ID / band / ageing / sexing must be confirmed with Level 3C bander before bird is released. Can hold birds in multiple grips. Can supervise other Level 3A banders.

Level 3C – Advanced Bander

Individual who has continued to work on her/his skills and has banded a large number of birds (hundreds) of most of the species that can be encountered. Able to identify all local species of birds and show an ability to use resources to identify possible rarities. Accurate with bird processing and with ageing and sexing techniques. Able to use all handling grips quickly and safely. Able to band and release birds unsupervised and remove bands. Able to record accurate data and know the measurement ranges of common species.

Bander-in-Charge

Bander licensed by the Bird Banding Office of the Canadian Wildlife Service who oversees the entire operation and has decision-making authority. Level 2C extractor and Level 3C bander who has worked at various banding stations during multiple seasons. Can use sound judgment and reasoning to make tough decisions independently. Responsible for animal care requirements and adherence to applicable protocols and standard operating procedures. Responsible for the data integrity and reporting requirements. Provides theoretical / classroom, extraction, and banding training. Addresses media requests and ensures that banding activities are beyond reproach.

Appendix VII. Bander's Report Card (adapted from the North American Banding Council).

Background Material
- Understand how banding fits into scientific studies

Erecting, Opening, and Closing Nets
- Choose an appropriate netting site and appropriate net
- Correctly set up nets unaided
- Properly furl and unfurl nets
- Take in and store nets and associated equipment properly

Operation and Extraction
- Judge how many nets to use safely and check them frequently and carefully
- Demonstrate an astute, accommodating approach to extraction
- Extract a variety of species quickly and safely
- Deal proficiently with tricky situations
- Recognize and repair nets that are in poor condition

Identification and Handling
- Recognize all target species, and release a bird unbanded if identification cannot be made with virtual certainty
- Appreciate the importance of minimizing handling time while not compromising safety
- Use the bander's grip on a variety of species
- Use the photographer's grip safely
- Transfer a bird from hand to hand safely
- Handle a variety of "awkward" species
- Release a variety of species correctly

Banding
- Select correct band size
- Read band numbers correctly
- Apply a band correctly
- Recognize when and how to correct an improperly applied band
- Know when and how to remove a band safely
- Place birds in bags, and carry and hang them correctly
- Recommend when bags need cleaning

Biometrics
- Use and accurately read measuring devices (rulers, balances, calipers)
- Correctly and accurately measure various anatomical features
- Accurately score fat deposits

Ageing and Sexing
- Correctly use guides for ageing and sexing
- Accurately use skull ossification
- Correctly use other characteristics for age determination
- Correctly use colour, size, brood patch, and cloacal protuberance for sex determination

Field Data Collection and Data Management
- Record data clearly, legibly, and accurately on field sheets
- Able to recognize and take description of or photograph rarities or unusual birds
- Maintain complete and accurate daily logs
- Proof and correct banding sheets

Ethics and Injuries
- Know and practice the Bander's Code of Ethics
- Show familiarity with all aspects of animal care and welfare requirements
- Show excellent awareness of injury prevention
- Demonstrate ability to treat minor injuries
- Recognize and demonstrate the need for euthanasia
- Assess whether a specimen is worth preserving
- Record details of all injuries and casualties

Health and Safety of Banders
- Demonstrate a responsible attitude towards potential injuries from birds
- Demonstrate a responsible attitude towards physical hazards in the banding area

Public Relations
- Communicate effectively with the public about banding
- Communicate effectively using banding data

Appendix VIII. Photographs of the banding shelter and mist net setup at Buttertubs West Marsh.

Photo A. Banding shelter at the Buttertubs West Marsh banding station. The shelter includes a table, chairs, a rope line with hooks to hold bird bags, and space to leave personal effects.

Photo B. Rope line with hooks used to hold bird bags prior to processing.

Photo C. Net pole and pulley rope assembly shown with a closed and furled net.

Photo D. Net pole and pulley rope assembly shown with a net open for capture. Note the net tag attached to the top trammel line loop.

Photo E. Mist net shown in the closed and furled configuration. Note the clothes peg securing the first 30 cm of netting and the rope used to secure the middle of the net.

Photo F. Rope used to secure the middle of a closed and furled net. Note the slipknot and clothes peg.

Photo G. Net tags attached to the rope line at the banding shelter, indicating that all nets are closed and furled.