

Tatlayoko Lake Bird Observatory Migration Monitoring Protocol



Version 3.0
January 2022



**Tatlayoko Field
Station Society**

TABLE OF CONTENTS

1. INTRODUCTION	1
2. STUDY AREA	2
2.1 Location.....	2
2.2. Census Area	2
3. BANDING STATION.....	5
4. OPERATION OF THE MIGRATION MONITORING STATION	7
4.1. Seasonal Coverage	7
4.2. Personnel	9
4.3. Safety	12
4.4. Permits	13
4.5. Bands.....	13
4.6. Habitat Management	14
4.7. Habitat Monitoring.....	14
5. DAILY COUNT PERIOD.....	16
5.1. Daily Logs.....	16
Table 6. Coverage Code	17
5.2. Hours of operation.....	18
5.3. Nets	19
5.4. Bird bags	20
6. COUNTING BIRDS	20
6.1. Count types.....	20
6.2 Census	20
6.3. General Observations (Obs)	21
6.4. Banding	22
6.5. Recording of Banding Data.....	23
7. OWL BANDING PROGRAM.....	32
7.1 Timing	32
7.2 Net Checks.....	33
7.3 Safety.....	33
7.4 Effort and Weather Data.....	33
8. DATA MANAGEMENT AND REPORTING	33
9. BLOG.....	34
10. ADDITIONAL PROJECTS.....	34
11. RECORD OF CHANGES OR MAJOR INTERRUPTIONS IN STANDARIZED DATA COLLECTION	34
12. REFERENCES	36
Appendix 1. The Bander’s Code of Ethics.....	38

Appendix 2. Daily Log Sheet – Weather (“Log” tab).	39
Appendix 3. Daily Log Sheet – Personnel (“Obs” tab).	40
Appendix 4. Daily Log Sheet - Owl Banding Effort (“Owls” tab).	41
Appendix 5. Banding/Recap Data Form.	42
Appendix 6. Daily Estimated Totals Spreadsheet (example).	43
Appendix 8. Empidonax flycatcher key.	45
Appendix 9. Passerine wing morphology.	46
Appendix 10. Emergency Contact Information	47
Appendix 11: Record of Protocol Revisions	Error! Bookmark not defined.

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The first version of this protocol was written by Steve Ogle. It was reviewed and modified by Chris Chutter in 2011, extensively edited by Gail Harcombe, and then reviewed and approved by Andrew Harcombe, Project Coordinator, Nature Conservancy of Canada in April 2012. Adjustments were made to follow the guidelines for protocols produced by the CMMN in 2011. A few very minor revisions were made by Avery Bartels in 2014. The current version was updated by Avery Bartels in response to the CMMN renewal in 2021 as a few requisite additions/changes need to be made as well as with regards to the organizational structure behind the program and formalizing the protocol for the Owl Banding program.

In addition to the above mentioned people, special thanks to the following for their input in previous editions of this document:

Dick Cannings, Bird Studies Canada (formerly), British Columbia
Wendy Easton, Canadian Wildlife Service, British Columbia
Peter Shaughnessy, TLBO Coordinator, Tatlayoko Field Station Society and formerly with Nature Conservancy of Canada

Much of the protocol used by this station was based on the experience and knowledge of people from other bird observatories. The Long Point Bird Observatory was used as the original model, while Mugaha Marsh Bird Observatory near Mackenzie, B.C., allowed us to use their written protocol to develop our own codes and systems.

Cover photo by Avery Bartels

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1. INTRODUCTION

The Tatlayoko Lake Bird Observatory (TLBO) began operation in 2006 as a pilot study under a science program initiative by the Nature Conservancy of Canada (NCC), in conjunction with the Canadian Wildlife Service (CWS) and Bird Studies Canada (BSC). After a year of not operating, 2016, the TLBO was taken on by BC Spaces for Nature who oversaw the project until 2020 when it was run jointly by BC Spaces and the recently created Tatlayoko Field Station Society (TFSS). As of 2021 the TLBO is a project of the TFSS.

Nestled on the lee side of the Coast Mountain Range of southwest British Columbia, the spectacular Tatlayoko Valley offers an unbroken north-south habitat corridor between the interior Fraser Plateau and the Coast Region. Especially during autumn migration, birds may be funneled into this valley since it offers a pathway around ice fields on either side of the lower Homathko River system. Excellent riparian and bottomland habitat is available for birds migrating between breeding and wintering grounds. Relatively stable weather, secure landholdings, and a supporting infrastructure, among other variables, allow the potential for long-term monitoring at this site.

The goals of the project are to:

- monitor and assess bird migration patterns (in the Tatlayoko Valley during fall migration) over a period of at least 10 years, using banding and censusing methods in adherence to Canadian Migration Monitoring Network (CMMN) standards.
- ensure that the data collected are rigorous and useful to the CMMN, CWS and NCC for both short- and long-term monitoring and other analyses.
- gain a regional perspective of habitat use, abundance, and diversity of breeding and migratory birds.
- provide Tatlayoko residents and visitors with an interesting and educational program in which they may participate and learn about birds in their own backyard.

Data are submitted to the CMMN, the US Geological Survey and Bird Banding Lab (ECCC) and the Canadian Wildlife Service, Delta office as part of international programs to evaluate migratory bird population trends over long-term periods.

2. STUDY AREA

2.1 Location

The bird banding station is located on the south end of the NCC Tatlayoko Lake Ranch approximately 1km north of Tatlayoko Lake, British Columbia, at UTM 402835 5723416 (NAD83, 51 degrees, 39', 12" N, 124 degrees, 24', 16" W). Tatlayoko Lake is roughly situated between the cities of Williams Lake, Bella Coola, and Whistler (Figure 1).

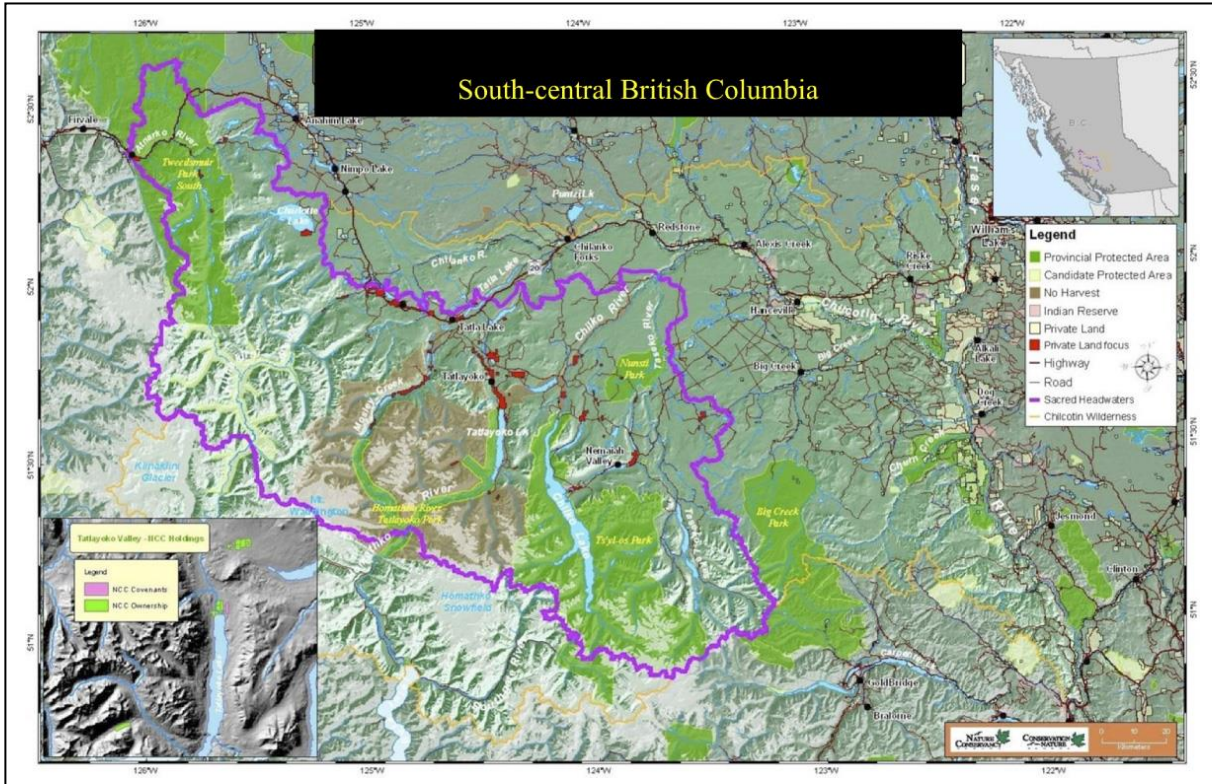


Figure 1. Location of Tatlayoko Lake and the Tatlayoko Lake Ranch. Ranch is shown in the lower left insert, as a green property immediately north of the lake.

2.2. Census Area

The census area is a defined area where bird observations are collected during the banding season. It is located at the north end of Tatlayoko Lake (see Figure 2), and is bounded on the north by a fence cutting through the NCC hayfields, 300 m north of the banding station. To the south, a portion of the lake is included in the count area, bounded by a line connecting the first point south of the Homathko River entrance to the lake, across to the low point in the line of sight up to the Jellostone Valley in the Niut Range. To the west, the count area includes the flat part of the valley and the bench on the other side of the Homathko, and goes upslope for 100 m. To the east, the Tatlayoko Road is included, plus an additional 100 m upslope. Figure 2 includes the census route and net lanes (see Figure 3 for details of net lanes and banding

station). Note: much of the census area is not covered on a regular basis; however, birds observed flying or heard calling at a distance are recorded in the daily observations. The banding site is in riparian woodland, adjacent to a large hay field that is used by cattle during winter months. The banding lanes (except net 18) are fenced to exclude cattle. Vegetation is deciduous, with alder, willow, and trembling aspen dominating the site. The route from Net 1 to the Homathko River is an old road, with herbaceous vegetation. The rest of the route to Net 16 is upstream, and is a combination of sedge wetland and riparian vegetation.

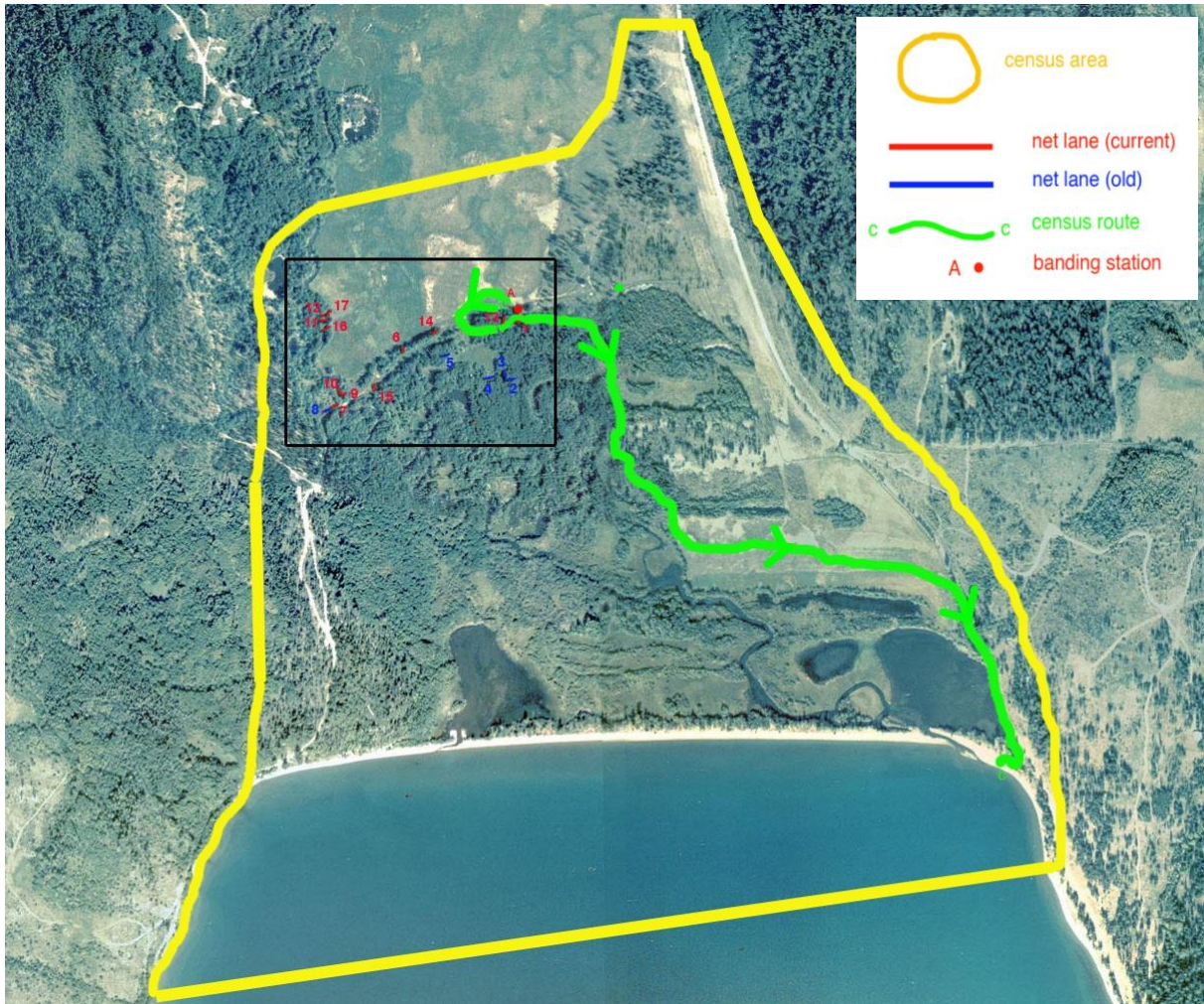


Figure 2. Map of the census area (a larger copy of this map is at the banding station).

For a written description of the census route see section 6.2.

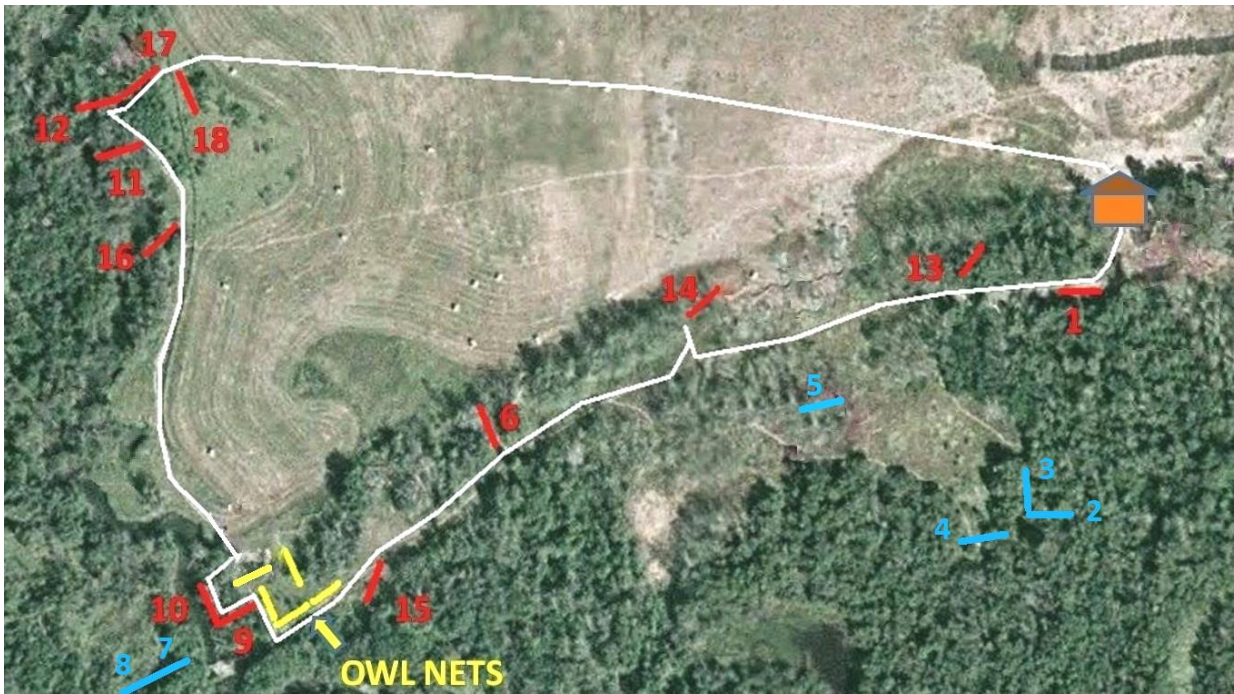


Figure 3. Detail of net lanes and station. Current nets are in red, inactive nets in blue and the net loop in white

3. BANDING STATION

Originally the banding station was an open canopy with table and chairs. All data were manually recorded on paper data sheets and entered on computer at a later date. After the second year of operation, a more permanent station was built on the site.

The banding station is now a 3m x 4m wooden building, with three sides hinged to allow them to be folded down (open) in good weather. Because the station is off the electrical grid, solar power equipment was installed to provide sufficient power to run the laptop (for data entry), lights, and weather station. Parking is limited to the area immediately outside the entrance to the station. An outhouse is on site, approximately 30m from the station building.



Figure 4. Banding building, with two walls opened for bird observation.



Figure 5. Banding station showing solar panels on roof.



Figure 6. Solar power control system.

4. OPERATION OF THE MIGRATION MONITORING STATION

4.1. Seasonal Coverage

The fall migration monitoring season occurs in August and September each year. Monitoring is to be done every day from August 3 to September 28th, weather permitting, with 1-2 days at the beginning and end of the season to set-up, shut down, and manage data. Peak numbers of birds generally occur in the latter parts of each month, but this could vary.

Owl monitoring may continue after the regular migration monitoring period, provided necessary Provincial raptor-banding permits are obtained. Bird counts from other periods may also be important however, the TLBO DET bird list should only include species recorded during standard monitoring.

4.1.1 Pre-season set up

The **TLBO Director** is responsible for:

- maintenance of TLBO infrastructure and tools as needed;
- instruction to contractors of the correct operation of the solar power system.

Each spring, the **TLBO Director** completes the following commissioning procedures:

- Visual inspection of the general condition of the building with an eye for wind and/or water damage, deteriorating paint, etc.
- Visual inspection of exterior electrical components, including solar panels and mounting brackets, wind sensor tower and bracket, with particular attention to exposed wiring, wire connections, and building penetrations. Repair/replace as necessary.
- Visual inspection of interior electrical components for physical damage, with particular attention to potential damage from rodents. Inspect battery terminal connections for signs of electrolyte leakage. Repair/replace as necessary.
- Turning on solar panel control module and checking battery charge condition and charge rate.
- Turning on breakers for inverter and branch circuits and testing function of light fixtures and receptacles.
- Installation of weather station control panel and checking functions.

At the beginning of the banding season, prior to the start of daily monitoring, the following tasks must be completed (this may be done by the **banders** and/or volunteers, with the assistance of the TLBO Director or others):

- Weed-whacking net-run trail, including a path across the hay field between the station and net 18 (see 4.6 Habitat Management).
- Checking net lanes and pruning/weed-whacking as necessary.
- Clearing and flagging census route.
- Dismantling fencing in select locations (eg. net 17, census route E of banding lab) and/or building stiles to aid personnel in crossing fences.

- Installing mist-nets (12m, 36mm mesh) as per net layout (note: re-bar for some net poles is left in place over the winter and all nets should be put in the same locations each year; see Figure 3 for net layout).
- Confirming sufficient number and sizes of bands for the season – ordering additional bands if necessary [a band inventory should be conducted at the end of each season (see 4.5)].
- Ensuring banders have what they need for the season because supplies are hard to come by in the valley.
- Ensuring tools are available (e.g., hammer, gas-powered weed-eater) and signed in and out through the TLBO Director.

Table 1. Net locations (NAD 83, 10U)

Net Number	Easting*	Northing*	Year established	Year discontinued
1	402819	5723385	2006	
2, 3 double	402818	5723307	2006	2006
4	402787	5723300	2006	2006
5	402714	5723345	2006	2006
7	402520	5723258	2006	2011
8	402510	5723257	2006	2006
6	402636	5723334	2006	
9,10, double	402546	5723286	2006	
11	402510	5723441	2006	
12 (double with 17)	402511	5723458	2006	
13	402787	5723396	2006	
14	402698	5723382	2006	
15	402602	5723298	2006	
16	402529	5723409	2006	
17 (double with 12)	402521	5723468	2006	
18	402538	5723456	2011	2021
19	402544	5723448	2022	

*UTMs are for the centre of each net.

4.1.2 Post-season (closing the station)

Fall decommissioning is essentially the reverse of the spring procedure. **Banders** are responsible for ensuring the following tasks are completed:

- Nets and other equipment
 - Bag the nets and store them at the Lincoln Creek house. Note that repairs to nets should be done on an opportunistic basis throughout the season, as needed.
 - Store poles in the rafters of the banding station.
 - Clean and pack up all other banding equipment and store at Lincoln Creek house.
- Band Inventory
 - Inventory the band supply and order for following season (in pre-season, band numbers just have to be checked to ensure adequate inventory is in place).
- Cleaning
 - Cleaning outhouse and removing sanitizer and TP.
 - Clean and vacuum out the banding lab
- Data Management
 - Complete data clean-up and submit to the relevant authorities. Banding data submitted to the USGS/Bird Banding Lab via Bandit; DET bird/effort data submitted to CMMN in the appropriate format; banding data/banding effort data submitted to Wendy Easton, CWS-Delta; raptor banding data submitted to FrontcounterBC as per instructions on the TLBO provincial wildlife permit.

The **TLBO Director** is responsible for completing the following:

- Visual inspection of the general condition of the building with an eye for wind and/or water damage, deteriorating paint, etc.
- Visual inspection of exterior electrical components, including solar panels and mounting brackets, wind sensor tower and bracket, with particular attention to wire connections and building penetrations. Repair/replace as necessary.
- Visual inspection of interior electrical components for physical damage, with particular attention to potential damage from rodents. Inspect battery terminal connections for signs of electrolyte leakage. Repair/replace as necessary.
- Turning off breakers for inverter and branch circuits.
- Turning off solar panel control module.
- Ensuring that gates into the TLBO compound are secure since the adjacent pasture is used for winter feeding of cattle.

4.2. Personnel

4.2.1. Banders

Bander in Charge

At TLBO, two experienced banders must be present the majority of the time: a Bander-in-Charge (BIC) and an Assistant Bander. Both banders require federal banding sub-permits for the banding of songbirds and the BIC should also have raptors listed on their federal sub-permit (see section 4.4 Permits for more on permits). The Bander-in-charge should have at least one

season experience leading a migration monitoring station—preferably more. The BIC should be able to proficiently band and accurately census birds, and generally be aware that the overall purpose of the station is for scientific and educational purposes. He/she/they should adhere to all CMMN standardization techniques, and be fully versed in the Bander’s Code of Ethics (see Appendix 1.). Extraction techniques should follow the Canadian Bird Banders’ Training Manual (CWS Technical Report Series No. 275). All birds should be processed quickly and safely. The BIC is responsible for daily operations and determining volunteer tasks.

Assistant Bander

The assistant bander should be proficient at bird identification, since he/she/they will need to be able to conduct censuses independently of the BIC. Therefore, the assistant bander should be a “1” in bird identification skill (see Table 2). An assistant bander also should ideally be adept enough at bird extraction and banding so that they can operate the station without the BIC if necessary.

Table 2. Observer identification codes.

Code	Identification skills
1	Can correctly identify 90% of birds at Tatlayoko w/out use of field guide
2	Can correctly identify 50%-90% of birds at Tatlayoko w/out use of field guide
3	Can correctly identify less than 50% of birds at Tatlayoko w/out use of field guide

4.2.2 Volunteers and training

Volunteers are recruited each year to assist at TLBO. Requests for volunteer are put out to the general public, usually in the summer, using a variety of online bird-work/volunteer related websites including the Jobs Board of the Ornithology Exchange (<https://ornithologyexchange.org/jobs/board/>) and on social media. Other options may be used as Banders/TLBO Director see fit.

Both experienced and novice volunteers are encouraged at the TLBO and the former are usually encouraged to volunteer during periods when a bander may be unavailable or during peak migration. While experienced volunteers may volunteer for shorter, such as one week, periods, in general, volunteers are encouraged to spend 3-4 weeks in order to build up an adequate skill set for future use. A preference will be given to applicants who show a strong interest in utilizing the skills gained at the TLBO in the future (eg. aspiring biologists, people who live near a banding operation who are interested in becoming long-term volunteers there etc.). Adequate training will be provided by the BIC and Assistant Bander to ensure both the volunteer and TLBO benefit from the experience.

Names of volunteers (and visitors) and hours present at the station are recorded in the Daily Log Sheet (see Appendix 3).

Data recording should be the first duty for a volunteer to learn, followed by releasing birds after they have been banded, then banding and finally, net extraction. The latter in particular requires dexterity and patience; it is up to the BIC to gauge a volunteer’s capability and duration of training period before they are permitted to extract birds on their own. In general extraction

should start on day 3 – 4 as determined by the BIC. In addition to the Bander’s Code of Ethics (Appendix 1), the following guidelines should be included in instructions given to new bird extractors:

- Determine into which side of the net the bird flew
- There is a fine line between being too gentle and too rough with the birds; extractors should err strongly on the gentle side. However, birds should be extracted as quickly as possible (the average bird should be extracted in less than one minute).
- Look carefully for net strands caught on the thighs
- Avoid wing strain (be aware of the natural movement of the wings).
- Carry a seam ripper sewing tool at all times as they are useful for releasing tongued birds (and cutting the net if absolutely necessary).

Volunteers interested in doing the census should be versed on the census protocol and route finding, and should be a code 1 for identification of birds. The census data should be input onto the Daily Estimated Totals (DET) spreadsheet at the first opportunity after census is completed.

4.2.3. Visitors

Whenever possible, visitor groups should give advance notice. However, drop in visitors are to be expected and not discouraged. Banders should actively encourage locals to visit and especially to participate in the process. All visitors must be instructed not to touch birds while walking around the nets. Dogs must remain in a vehicle in the study area.



Figure. 7. The Chilcotin Chapeaux local chapter Red Hat Society visits TLBO

4.3. Safety

The TLBO Director should be consulted about all safety issues, including the establishment of an emergency plan. A Wildfire Contingency Plan and Protocol (A. Bartels) was created in 2017 and a printout is to be kept on hand at all times in the banding lab.

Children are welcome at the site, but should be escorted by parents or guardians.

Pets are not permitted in the vicinity of the nets or banding station, unless kept in a vehicle.

Bears

Both **Grizzly and Black bears** are present in the banding area—a fact that should be taken seriously by all banders, volunteers and visitors. Bears are present on or in close proximity to the net-round trail regularly, most years. Participants should be knowledgeable of bear safety procedures and carry bear spray at all times when bears are known to be present. Bear bangers should be present at the station. Generally, bears are harmlessly going after the abundant berries in the area, and nets have been relocated to steer clear of their high traffic areas. However, bears have been encountered in the area around the station, and both species of bears have been seen or heard munching away only twenty metres behind the station. Most of the time, they will retreat quickly. Be wary if, when, and how you try to frighten a bear out of the area, and consult the project managers about it. *Absolutely no food should ever be kept in the station overnight!*



If a bear is present in the area, the BIC will decide whether or not operations will continue for that day. It is very important to avoid habituating a bear to the area, keeping in mind that there is always potential to draw bears in with the presence of squeaking birds and general human presence.

Figure 8. Tatlayoko Grizzly Bear (photo Steve Ogle)

Radios

Banders should carry FRS (Family Radio Service) radios at all times (for safety and other communication purposes, e.g., if a bird is in distress or a volunteer needs assistance in extracting a bird from the net). If volunteers go on net runs without a bander, at least one volunteer must carry a radio. A VHF (Very High Frequency) radio is located at the banding station at all times and should be charged regularly but left off until needed. For emergency call-outs or otherwise, be sure that the radio is tuned to the Snoring Horse Repeater (SHR)

channel. No other channels should be used unless in an emergency (contact the TBO Director for more details about radio protocol). Someone should always be available on the SHR channel.

First Aid

The nearest first aid station is at Tatla Lake (phone number 250-476-1114). The VHF radio at the station is to be used for emergency calls since there is no cell service at TLBO. A first aid kit is stored at the banding station, either in the tupperware bin or on the shelves of the side walls of the banding station. The Project Manager must be made aware of any personal medical requirements for any participants.

Hygiene

- Hands should be washed with anti-bacterial gel before eating food.
- Bird bags should be washed regularly. Ideally, a bag is used once before washing though flipping the bag and using it again is acceptable when needed.
- An outhouse is located on-site. This should be swept out and toilet paper replenished as needed.

4.4. Permits

Banding is conducted under the TLBO station permit for migratory birds, currently held by Andrew Harcombe. Banders in Charge and the Assistant Banders require a federal banding sub-permit to capture birds in mist nets and band federal migratory songbirds. The BIC (and Assistant bander if eligible) should also have raptors listed on their federal sub-permit. A provincial permit is required to band raptors, upland game birds, blackbirds and Belted Kingfisher. The provincial wildlife permit for banding raptors should be applied for from FrontcounterBC, Willliam’s Lake office, 2-3 months before the start of the season, with both banders listed on it. Hummingbirds are not normally banded at TLBO. All banding permits should be kept in the banding station and made available to any on-site inspection.

4.5. Bands

At the end of each season, an inventory of bird bands (number and sizes) should be conducted and additional bands ordered as required to ensure the appropriate number of bands and sizes are present at the beginning of the next season. Bands can be acquired through CWS and the Bird Banding Office. The recommended number of bands for a season at TLBO is:

0A: 800	2: 100
0: 1000	3B: 50
1: 600	3A: 100
1B: 600	4S: 200
1A: 100	

Larger sizes, as well as locking bands, should be available for banding hawks and owls (provided a raptor permit has been obtained), but it is likely that these captures will be rare unless targeted specifically.

4.6. Habitat Management

Habitat should be maintained in a similar condition from year to year (standard for migration monitoring stations) as much as possible, since vegetation changes could affect species composition and skew the monitoring results over time. Any habitat alterations beyond those laid out below should be done only after consultation with the Project Manager and property owner (NCC).

The banding site is in riparian woodland, adjacent to a large hay field that is used by cattle during winter months. The banding lanes (except Net 18) are fenced to exclude cattle. Vegetation is deciduous, with alder, willow, and trembling aspen dominating the site. The route from Net 1 to the Homathko River is an old road, with herbaceous vegetation with Aspen stands/regenerating Aspen along much of the first $\frac{3}{4}$ of it. The rest of the route to Net 17 is upstream, and is a combination of sedge meadow and willow/alder riparian vegetation. The actual walking route and all net lanes are weed-wacked at the beginning of each season, net lanes are trimmed to cut back any encroaching branches and any newly-dead material in net lanes is removed. The vegetation is slowly succeeding towards a more mature woodland. At the end of each season thinning and topping (to a height of ~2.5m) of vegetation within 2-3m of nets 16, 12/17 and 18 is done to avoid the vegetation getting much taller. In previous years, after such vegetation management was not undertaken, catch rates for these nets decreased, in some cases notably. Similar trimmings should be done on the west side of Net 6 as well. In order to maintain visibility and consistent, open habits along the net loop, young aspens along the east/west portion of the net loop path should be removed every year or two or as needed. In addition to maintaining visibility for detecting birds, this is important as bears regularly forage in the berry bushes in these areas. Finally, the small triangular grassy area between the main path and net 14 should be kept clear of saplings as well to maintain the funnel effect of vegetation towards net 14.

The field in front of the banding station is generally cut for hay sometime at the end of August or early in September. The haying will have an impact on only a few species, so interference should be minimized.

Since the 2012 season, there has been intermittent photographic documentation of each net lane. As per CMMN request, basic vegetation height measurements will be done during first two weeks of the season. This will better document existing conditions, so subsequent vegetation management will attempt to “maintain” the current condition as much as possible. Shortly before the inception of the TLBO, there was major insect kill of trembling aspen, which is now resulting in tree downfall. This is cleaned up to prevent possible net damage and keep access routes clear. This has also created areas of dense, young aspen stands.

4.7. Habitat Monitoring

As per the CMMN Habitat Monitoring Requirements a habitat assessment should be done every 5 years. Assessments should be conducted in the first half of August.

The photographic documentation will be taken **annually** of the census route and of each net lane as a means of assessing habitat change. These shots should be taken from the same locations during the first 2 weeks of August, each season.

Net Photos: Photos should be taken from each end of the net, from a position that shows the net and surround vegetation to maximum effect. At all nets, the ideal locations should be within 1-3m of the net poles. These locations are evident and/or limited by vegetation structure.

Census Photos: Photos should be taken in each of the four cardinal directions from the following points in Table 3 (note that UTM coordinates have been updated but descriptions should be used in conjunction with UTM when taking census photographs).

Table 3 Locations of photos on census route for habitat monitoring

Name	Easting	Northing	Description
Cen01	402749	5723423	In field, just north of old barn roof
Cen02	402752	5723381	Where census route meets back up with banding road
Cen03	402896	5723396	Where census route crosses old fence line, east of banding lab
Cen04	402999	5723308	Where meadow opens up
Cen05	402997	5723251	10m after entering Aspen stand
Cen06	402975	5723141	SW corner of Pine flats, where trail takes short jog east from fence
Cen07	403011	5723102	10m past where route passes through huge, fallen pine
Cen08	403105	5723026	In field, 30m south of where route exits alders
Cen09	403310	5722951	In field, midway across, ~30m N of south fence line
Cen10	403518	5722947	SE corner of field, 25m before crossing east fence line
Cen11	403582	5722831	On road, just N of power pole #359 (E side of rd)
Cen12	403612	5722766	On road, with clear view of lagoon to W
Cen13	403659	5722644	On road, at entrance to driveway down to lake
Cen14	403619	5722618	End of census route, at lake ~20m E of mouth of Homathko

Net photos should be named using the following convention “TLBO_Net number_which end of net taken from (cardinal direction)_Date (yearmonthday)_image number” eg. “TLBO_Net14_East_20180816_IMG061169”.

Census photos should be named using the following convention “TLBO_Census point name(see above table)_ cardinal direction facing_Date (yearmonthday)_image number” eg. “TLBO_Cen01_East_20180816_IMG061169”.

Photos should be deposited in a folder titled “Site Photos_TLBO_YYYY(insert year)” within TLBO Dropbox/TLBO Data/CMMN Habitat Monitoring/Site Photos. These photos are to be submitted to the CMMN along with DET data at the end of each season.

Full habitat assessments should be completed every five years, starting in 2022, again in 2027, 2032 etc. If large-scale habitat changes (eg. forest fire) occur additional habitat assessments should be undertaken in the immediate aftermath. *****Protocol for habitat assessments is to be developed prior to the 2022 season.**

5. DAILY COUNT PERIOD

All banding data are entered directly onto a laptop computer. Observation and census data are entered on the laptop as time permits, or at the conclusion of the banding session.

Netting begins at sunrise and continues until exactly six hours after sunrise. To help with scheduling, the best chart for annual sunrise/sunset times (for Whistler, B.C.) can be found at: <http://www.sunrisesunset.com>. Weather information and start times must be recorded on the Daily Log (section 5.1.1). All recorded times are Pacific Standard Time (PST). The daily monitoring period starts at sunrise and ends 6.5 hours afterward (30 minutes after scheduled net closing).

Census is a top priority and should begin approximately 1.5 hours after sunrise unless doing so would jeopardize birds at the station.

5.1. Daily Logs

Data is recorded on a laptop computer (input directly) (see also section 8. Data Management and Reporting). The Daily Log is maintained for the entire banding season in an MS Excel file. There are two tabs to be filled out each day (regardless of banding effort): “Log” (Weather) and “Obs” (see Appendix 1 and 2). Note that unless noted in “hours closed” and/or “other notes” the net opening time is that given under the Start, Time field (column 2). Net closing time is recorded in “Net closing Time” (column N).

5.1.1 Weather

First Tab (“Log”)

Weather: To be recorded three times during the day: sunrise, census start, and net close.

Time: 24 hour clock

Wind (dir): Direction the wind is coming from (use the weather station)

Wind (Bf): Wind strength on the Beaufort scale (see Table 4, use personal judgment, not the weather station)

Cloud: General sky condition (see Table 5).

Temp: Temperature in Celsius (use the weather station)

Coverage Code: see table 6 below.

Hours closed: Include any early net closures/late net openings in this column

Weather notes: Additional relevant information regarding weather.

Other notes: late arrivals/early departures of banders, why census/net opening delayed, wildlife sightings etc.

Table 4. Beaufort wind scales.

Scale	KPH	Wind Speed Indicators
0	<1	Smoke rises vertically
1	2-5	Wind direction shown by smoke drift
2	6-11	Wind felt on face; leaves rustle
3	12-18	Leaves and twigs in constant motion
4	19-30	Wind raises dust; small branches moving
5	31-39	Small trees in leaf begin to sway
6	40-50	Large branches in motion
7	51-62	Whole trees in motion

Table 5. Sky Condition

Scale	Sky condition indicator
0	Clear or a few clouds
1	Partly cloudy or variable sky
2	Cloudy or overcast
3	Fog or smoke
4	Drizzle/intermittent showers
5	Rain
6	Snow

Table 6. Coverage Code

Code	Description
0	No coverage
1	No census or ET. Some obs. or non-standard banding.
2	Census. Possibly some obs. or non-standard banding
3	Census and ET. At least 1 class 1 observer present for 7 hours and some banding (<50% of 6 hour banding period)
4	Census, ETs, at least 2 class 1 observers + 50-100% of standard banding effort. One class 1 observer must be present for 7 hours.
5	Census, ETs, at least 3 class 1 observers +100% of standard banding effort. One class 1 observers must be present for 7 hours.

5.1.2 Personnel

Second Tab (“Obs”)

Effort: Observer initials and number of hours spent observing should be recorded for all qualified observers, be they banders, volunteers or visitors (non-qualified observers should be recorded as visitors or volunteers only, as the case may be)

Volunteers: (added 2013) record volunteer name and hours present for all volunteers

Visitors: Fill in the first name of anyone who visited the station, add in brackets “Owls” after their name if they came for owling program

5.2. Hours of operation

Netting begins at sunrise (as indicated in “Daily Log” spreadsheet) and continues until exactly six hours after sunrise. Temperature, precipitation and wind are among the factors used to determine if conditions are appropriate for bird banding and thus whether or not the nets should be opened or closed down on a given day. Point values are assigned to each factor. Nets should be closed if the total number of points is three or more.

- heavy precipitation for more than five minutes: 3
- light precipitation for more than 20 minutes: 2
- periodic light precipitation: 1
- the temperature will likely be around or below zero for more than two hours: 1
- wind is Bf 4 or 5: 1
- wind is Bf 6 or 7: 3
- net rounds can only be completed once every 40 minutes due to bird volume and number of banders present: 1
- birds are showing signs of stress (as occurs after a multi-day period of inclement weather): 1

At TLBO, the temperature is generally cold at daybreak but warms rapidly as the sun comes over the ridge. Cold, cloudy mornings require caution because the sun does not warm things up. Closing some of the nets may be necessary on some mornings, especially those nets exposed to any wind. **Note that census takes a priority over netting**, so unless the weather is extremely bad, someone should be out doing census. If only one bander is present and no qualified volunteer is available to run census, nets must be closed in order to run census. On rare occasions, census may be delayed or started earlier and the nets opened after it is complete but this should be avoided if at all possible.

Note that closing down the nets takes a lot longer than running a quick net round. If absolutely necessary, individual nets may be furled quickly on a net round and tied later on when all the nets are closed.

5.3. Nets

The mist nets for the diurnal migration Monitoring are 12 metres wide and 3 metres high, with 36mm mesh size. Each net has 4 panels separated by trammels. Owl nets follow the same specifics but have 60mm mesh. All nets are made by Avinet.

5.3.1 Daily net set up and closure

Assuming two banders are present, one person should start at each end of the loop and both should meet in the middle, and then cross paths to check each other's nets before returning to the station. Nets should be raised to within 5cm of the pole tops. The lower trammels should be raised to about 40cm (1.5') off the ground; other trammels are spread evenly between top and bottom. Nets should be taut (i.e., trammels fully horizontal from pole to pole) and adjusted if they are not so. Net tensions will vary depending on environmental conditions. Be sure to neatly furl and clip or tie the nets at the end of the day to prevent bird capture while the station is closed - if the nets are properly closed this should never happen. Nets should be closed as they are opened. If two or more people present, close nets from either end of net loop, meeting in the middle.

5.3.2 Checking nets (net runs)

Nets should be checked at least every 30 minutes, in order of location starting with net 1 and ending at net 18. Each net should be checked thoroughly from top to bottom and from end to end. The bottom trammel should be lifted to see if there are any "hidden" birds (note that female hummingbirds are often caught in the top trammels). During inclement weather, but not serious enough to warrant closing of nets, net check times should happen as often as possible, i.e., every 15/20 minutes. A selection of, or even all, nets should be closed immediately if there are not enough net-runners present to handle the number of birds in the nets or in the event of inclement weather. In the event of a necessary partial closure, nets should be closed starting with those furthest from the station, ie net 18. Often in these cases, nets 16, 11, 12, 17 and 18 will be closed at the same time allowing for a shorter, more manageable net run. Note that problems with birds can occur quickly, and that foresight is the best prevention for bird casualties/injuries. Once extracted, each bird should be placed inside its own bird bag (do not put more than one bird in a bag). Birds in bags should be carried either looped over the wrist or attached to a carabineer on the extractor's chest/rope around the neck. Special care should be taken to avoid knocking the birds in bags against vegetation, letting them rest on the ground or swinging them about while using binoculars or any other action that could put them at risk.

5.3.3 Net care

Nets should be checked for holes, and those holes repaired as soon as possible. A hole greater than one metre likely requires a net replacement (there should always be a couple of spare nets). Small holes are easy to fix, but also easy to create. Prevention is the key. All nets should be marked with a quality grading or comments before putting them away into storage; winter is the best time for nets to be professionally repaired.

5.4. Bird bags

Bird bags should be washed after a maximum of two uses (flipped inside out after first use). When flipping bags at end of the day, keep an eye out for any loose threads and cut these immediately. Occasionally, bags start unraveling at the seams or have continual problems with loose threads. These bags should be removed from use immediately.

6. COUNTING BIRDS

The migration monitoring at TLBO consists of three different components: census, banding (banded and recaptured birds), and observations. All three methods are important in gathering a measure of bird abundance over time.

6.1. Count types

NOTE: If, e.g., non-standard target netting was being done or some method of capture other than the mist nets was used, or if obs are done from a specific location regularly (such as along Homathko River between nets 10 and 16), descriptions will be provided in the Daily Log.

6.2 Census

The census is conducted every day during the migration period, even on days when the nets are closed. The daily number of census-takers is one, and therefore requires regular rotation of personnel. It should take priority over netting if staff numbers are low, even though this may require the closure of nets to complete the route. The census route is shown in Figure 2. In order to maintain consistency in “pace” of the census from day to day, the route can be broken into four “sections” each requiring the same amount of time.

The route begins at the banding lab (UTM 10U 402840, 5723425), curves westward into the field and around the old barn roof, onto the banding road and back east to about 100 m east of the banding lab. From there, the route continues south on the east side of the NCC fence, through a section of meadow (end of “section 1”) before entering a forested section. The route through the forest more or less parallels the old fence but detours around dense vegetation. When the route reaches the “lagoon field” (the large field closest to the lake and the end of “section 2”/the routes mid-point), it continues along the southern edge of the old beachfront dune (i.e., height of land in centre of the field) to the eastern fence beside the Tatlayoko Road (end of “section 3”). Crossing the fence about 50 m from the SE corner of the lagoon field, the route follows the Tatlayoko Road south past the lagoon, then down the driveway to the parking lot for the north beach. The census terminates at the Homathko River outlet into Tatlayoko Lake (UTM 10U 403570, 5722649) and a few minutes should be spent here to end the census.

Ideally, census begins one hour and thirty minutes after sunrise (*Note: this has been changed from the original which was 1 hour and forty-five minutes after sunrise, see document “Record of TLBO Protocol Revisions” for justification). Weather conditions are recorded in the daily log at census start. This is usually the period of highest bird activity. If things are busy, census can be delayed, but not for too long. Timing of census, although important, cannot always be consistent with only two staff, given that it can be difficult to

manage the nets with only one person. Therefore, discretion must be used, and census might need to be delayed if a very busy net round occurs, requiring both banders at the station.

The census should take as close to 60 minutes as possible (*Note this is a change on previous protocols which was 45-75minutes). This is a one-way census route, meaning that birds are counted from the start to the finish, with no doubling-back or looping around. This method reduces the amount of potential double-counting, but it causes the census person to be away from the station for longer. Even walking fast, it can take 20 minutes to return to the station from the lake. Despite the relatively long census route, it is valuable to pass by the lagoon and the lake to broaden the species coverage for monitoring. Time should be spent at the end of the census to assess bird numbers on the lake and north shore. Many species not recorded near net lanes have been observed on the Tatlayoko road.

The census-taker should be a “code 1” observer: able to identify at least 90% of birds encountered, including those by call note. This is an ideal situation, but not always possible. Visiting census-takers should be versed on the census methodology, the route, and the notion that rarities, although interesting, are not as important in the data set as an accurate count of more common migrant species. Ideally, personnel permitting, the census will not be done by the same person every time (particularly if this person is a “super-birder” able to identify species by sound and/or at distance).

Binoculars (8x or 10x magnification – not a scope), a pencil, and a note pad are required equipment for the census. Immediately after the census, it is the responsibility of the census-taker to record their observations on the DET spreadsheet on the laptop at the banding station.

If possible, photographs should be taken along the census route at least once every 3-5 years.

6.3. General Observations (Obs)

General observations are those noted by banders and volunteers within the census area during normal daily operations. This includes all birds sighted or heard during the net runs, while in the station, while driving in/out, etc. This does not include birds recorded on the census or birds that were observed in the nets; however, it does include birds that were sighted bouncing out of the nets or escaping. On busy days, few observations may be recorded, but some effort should be spent in all of the main habitats to record birds. Binoculars should be carried on net rounds to help with distant observations.

Volunteers (depending on bird identification skill level) should be encouraged to take notes during the day of all birds detected (other than those observed on census and at nets) and provide this information to the BIC.

Returning to the station from census is one of the prime times for taking obs, particularly on route back along the road to the south airfield gate, then cutting through to the station along cattle trails. In the past, if the person at the station indicated that things are under control, the census person rarely would return to the station via the lakeshore and the old west road, crossing the old Homathko River bridge en route. However, this bridge has not been in place

since 2010 so this is now done typically less than once per season. There are often some birds in the hidden lagoon 2/3 down the lake, and on the dry bench along the west road. The disadvantage to this is that the census taker must cross the river.

Observations should be recorded in the DET file under the “Obs” column (see Appendix 4). Note that field observations should be recorded as soon as possible (or at the very least, at regular intervals) and discussed with other people at the station to avoid double counting.

6.4. Banding

Banding should only occur if the proper people and circumstances are in place for that particular day. If all is in place, after opening the nets at sunrise, recording the opening weather, and setting up the banding equipment and computer in the banding station, net rounds can commence. Note that the first hour and a half, before the sun warms the valley bottom, is an important time to be vigilant with the safety of the birds.

Banding data are entered directly into the Banding spreadsheet on the laptop. Appendix 2.3 shows a banding sheet and all the fields that must be recorded. The banding spreadsheet has one tab for each band size, allowing band numbers to be recorded ahead of time, thereby reducing processing time and risk of clerical errors. The same data are recorded on the ‘recaps’ tab for recaptured birds, although band numbers must be entered individually for each recap. Some redundancy may occur in the banding sheet, but it is important that few mistakes be made, because once the bird is released, it is too late to change data. A dedicated “scribe” (person recording information) can be very helpful, particularly on a busy day.

The Bird Banding Office mandates that bands only be put on birds that can be properly identified. Therefore, the first thing that should happen when a bird is taken out of the bag is not to put a band on the bird, but rather to properly identify the species. This should not normally be a problem except possibly for *Empidonax* flycatchers [see Appendix 3.2. *Empidonax* (flycatcher) key]. Second, every bird should be checked to see if it already has a band or not. If it has a band, the band number should be checked and read back by the scribe to ensure accuracy, and unless that individual was already captured on that same day, it should be fully processed as per usual on the recapture tab. Third, don’t forget to put a band on!

6.4.1. Bird Casualties and Injuries

Protocols at TLBO can be adjusted during the field season to minimize injury and casualties to birds, most often due to low temperatures and presence of predators. The temperature at dawn, even at the beginning of August, is generally close to zero degrees Celsius, and birds caught in nets when it is that cold can very quickly become stressed. The utmost care must be taken for the 1.75 hours after sunrise (until the sun rises over the ridge). This period can require more frequent net rounds, for example every 15 or 20 minutes. As a general rule, birds should not be held for more than 1 hour and during busy net rounds and inclement weather species such as kinglets, flycatchers and Wilson’s Warblers should be processed first.

Two common predators are in the area: accipiter hawks and Short-tailed Weasels. Other than closing the station permanently, there is little that can avoid bird mortality occurring on a random basis due to these predators. If hawks are present and hunting (they often perch near the access road coming into the banding station), nets should be checked frequently (nets 1, 10, 14 and 15 are particularly vulnerable). Nets should be closed if hawks are perching above them and the nets cannot be patrolled often. If a weasel is observed by or near a net, that net and surrounding nets should be closed *immediately*. If a weasel kills a bird on one day, the next day those nets in the vicinity should be monitored on the first two rounds and the bottom trammels be raised to thigh-height for the duration of the day. Every effort should be made to avoid conditioning predators to the nets.

Wing strain and broken legs, while rare, are the most frequent injuries, and banders should be aware of the causes of these. Wing strain is far more common than injured legs, and is more likely to be caused by an inexperienced bird extractor than injured legs. It may not be possible to determine if a bird has wing strain until after it is released. Birds should be briefly examined during extracting for injuries and stress. Leg fractures and stress are particularly important to detect early as additional handling and time in a bird bag can often greatly exacerbate these problems. Birds with injuries noted for which no treatment can be applied should be released at the net.

All bird injuries and deaths, whether the bird was banded or not, should be reported in the Injuries tab of the banding spreadsheet, along with a description of what happened and what actions were taken to prevent it from happening again. Injured birds that were not banded should also be recorded in the Unbanded tab of the banding spreadsheet. Mortalities are to be reported to the Bird Banding Office, through Bandit, at the end of the season.

6.5. Recording of Banding Data

All information for new captures and recaptures is recorded in the Banding/Recap Data Form spreadsheet (see Appendix 2.3). The banding spreadsheet should be saved frequently, as well as backed up every 15 and every 60 minutes with the SyncBackSE program found on the laptop (see section 8), or whatever the current backup system is. The fields on the banding data sheets and codes to be used are described/defined below. An understanding of the meaning of the codes can help with bander-scribe communication.

On busy days, if the number of birds captured exceeds the ability of the banders to process and release all birds in a timely fashion than certain data can be excluded. In these cases the volume is typically made up of one or two abundant species, such as Yellow-rumped Warblers or Ruby-crowned Kinglets. For these abundant species an attempt should be made to collect full data on at least 10 individuals, however after that banders can forgo taking all data except age and sex.

Recaptures—birds caught in the net that are already banded—are recorded on the Recap tab of the banding data form (spreadsheet). All information that would be recorded for a new bird is also recorded for recaps. Note that there is a single tab for recaps, i.e., there are no

separate sheets for each band size, and therefore the band number must be read and recorded individually.

Note that banders should make an effort to call out the banding data in the order laid out on the data spreadsheet for ease of scribing and to minimize likelihood of data entry errors.

6.5.1 Data Form Fields and Codes

Prefix and Suffix

All bands numbers can be separated into a four-digit prefix and a five-digit suffix, and must be entered correctly in the database. New band numbers must be sequential, and thus can be filled in ahead of time, but band numbers for recaptured birds must be entered at the time of capture. It is recommended that the scribe repeat the band number read out by the bander to ensure accuracy.

Species

Species is entered as the full species/subspecies name as found in Pyle et al. (1997). Because this can be outdated, the most up-to-date checklist should be used: <http://www.aou.org/checklist/north/print.php>. If entered correctly the first time, autotype will fill in each subsequent entry.

Bander

Record the initials of the person banding the bird.

Net

Record the net number in which the bird was caught. Each net should have 4-6 numbered clothes pegs to attach to the bag(s) of bird(s) extracted from it for accurate record keeping. One peg is sufficient for multiple birds/bags.

Time

Record the time of the start of the net round to the nearest ten minutes.

Age

Enter the appropriate code for the age class of the bird (age birds as precisely as possible).

- U Unknown age. A bird that cannot be placed in any of the year classes below. If you do not know, do not guess.
- AHY After hatch year. A bird known to have hatched before the calendar year of banding, but whose exact year of hatch is unknown.
- HY Hatch year. A bird capable of sustained flight known to have hatched during the calendar year in which it is banded.
- L Local. A very young bird incapable of sustained flight, often still growing all its flight feathers. (These birds should be released in the area they were captured).
- SY Second year. A bird known to have hatched in the calendar year preceding the year of banding and in its second calendar year of life.
Example: Banded 2006 - Hatched 2005.
- ASY After second year. A bird known to have hatched earlier than the calendar year preceding the year of banding, year of hatch otherwise unknown.
Example: Banded 2006 - Hatched 2004 or earlier.

- TY Third year. A bird known to have hatched two calendar years before the year of banding, now in its third year of life. Example: Banded 2006 - Hatched 2004.
- ATY After third year. A bird known to have hatched at least three calendar years before the year of banding, now in at least its fourth calendar year of life.
Example: Banded 2006 - Hatched 2003 or earlier.

How aged

Enter the appropriate code for how the bird was aged.

- P - Plumage
- S - Skull
- E - Eye colour
- C - Cloacal protuberance
- B - Brood patch
- L - Moulting limit
- Z - Multiple measurements

Sex

Enter the appropriate code for the sex of the bird.

- U - Unknown sex. To sex the bird was attempted, but couldn't be identified with confidence.
- M - Male
- F - Female

How sexed

Enter the appropriate code for how the bird was sexed. Codes in **BOLD RED** are the more commonly used ones.

- BO - Behavioural observation
- BP - Brood patch
- CC** - Combination of characteristics (clarify which in "Remarks" section)
- CL - Cloacal Protuberance
- EY** - Eye colour
- FB** - Fault bar
- FF** - Flight feather shape or wear
- FS - Feather shape. To be used for "How Sexed" only, eg. sexing EAKI by shape of p10
- IC - Inconclusive/conflicting. To be used with age/sex code "U"
- LP** - Moulting limit present
- MB** - Mouth/bill colouring or gape present
- MR** - Moulting remiges
- NA - Not attempted
- NF - Nestling, recently fledged. Incapable of powered flight. To be used for "How Aged"
- NL** - No moulting limit (eg. for HY NSW)
- OT - Other, clarify in "Remarks" section
- PC** - Primary coverts, shape, wear, edging etc.
- PL** - Plumage
- SK** - Skull
- TS** - Tail shape

Wing Chord

Measure the length of a closed, *unflattened* wing to the nearest mm.

Weight (g)

Use the electronic balance or a Pesola spring scale (larger species) to record the weight of the bird to the nearest tenth of a gram. The best way to do this is to keep a light basket/plastic container on the scale in which the bird, still in the bag gets placed prior to banding. Zero the scale, remove the bird from the bag for processing and place the empty bag in the basket/container on scale. The weight given will be the weight of the bird.

Brood Patch (BP)

[adapted from 2004 MAPS protocol (DeSante et al. 2004)]

The extent/stage of a bird's brood patch (BP) is a standard measure of an individual's breeding condition and an opportunity to sex more species. Just prior to and during the time that the female (and in some species, the male as well) is incubating eggs in a nest, the feathers of the lower breast and abdomen are lost, vascularization increases just below the skin, and considerable fluid collects below the skin. These changes facilitate the transfer of heat from the incubating bird's body to the eggs. The scale shown below should be used to record the sequence of events in the development and regression of a brood patch.

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

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

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

Cloacal Protuberance (CP)

[adapted from 2004 MAPS protocol (DeSante et al. 2004)]

The extent/stage of a bird's cloacal protuberance (CP) is a standard measure of an individual's breeding condition and an opportunity to sex more species. As the breeding season approaches, the cloaca of most male birds (and female Wrentits) begins to enlarge and forms an obvious protuberance that serves a role in sperm storage. The development of the cloacal protuberance is recorded according to the system below.

0. None: Cloaca not enlarged.
1. Small: Cloaca somewhat enlarged and noticeably swollen. The shape of the protuberance is generally such that it is widest at the base and narrowest near the tip (conical). Since small cloacal protuberances (CPs) can be hard to discern, caution should be used in ageing or sexing birds on the basis of a CP of 1 alone. A CP of 1 cannot be used to age or sex thrushes of the genera *Catharus*, *Hylocichla*, *Turdus*, or *Ixoreus*.
2. Medium: Cloacal protuberance large, with a diameter fully as large near the tip as at the base (cylindrical).
3. Large: Cloacal protuberance very large and with a diameter considerably larger in the middle than at the base (bulbous).

Unlike a brood patch (see above), a regressing CP simply goes back down the scale: 3-2-1-0. CPs vary greatly in size and shape among species, being largest and most prominent in sparrows and thrushes and much less prominent in jays and Wrentits. It may be possible to sex species that rarely show prominent CPs by examining the angle of the CP with respect to the body axis. In males, the CP seems to point straight out, more or less perpendicular to the body axis. In females, the cloaca seems to point toward the rear of the bird, somewhat more parallel to the axis of the body. This same tendency can be used with caution to distinguish the occasional slightly enlarged cloacal region of a female from a true class 1 CP of a male. Class 2 and Class 3 CPs of males, of course, cannot be confused with those of females in any species except, possibly, in Wrentits.

Note: All cloacas, whether enlarged or not, stick out. A true CP is characterized by firmness and lateral swelling. Note also that immature birds do not get CPs. By and large, it is rare to have birds with enlarged CP during the fall monitoring period at the TLBO so use of this code should be with caution and experience and should be only considered a possibility during the early part of the season.

Moult

Enter the appropriate code describing the bird's moult. For the purpose of moult identification, the term 'flight feathers' encompasses primaries, primary coverts, secondaries, and rectrices. Flight feather moult does not count if it is clearly adventitious moult caused by some sort of accident. The term 'body feathers' encompasses all non-flight feathers.

1. Moulting body feathers, but not flight feathers.
2. Moulting flight feathers, but not body feathers.
3. Moulting both flight feathers and body feathers.

Fat

[adapted from 2004 MAPS protocol (DeSante et al. 2004)]

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

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

Skull

[adapted from 2004 MAPS protocol (DeSante et al. 2004)]

In order to determine the degree of skull pneumatization, it is necessary to part the feathers of the head to get them out of the way (wetting them slightly may help but only do so in warmer conditions) then gently rock the skin back and forth over the skull while looking through the skin to the skull. The best procedure is to start at the back of the skull and proceed toward the front looking for the pattern of the line that separates the pneumatized area from the area that is not pneumatized. A pneumatized skull consists of two layers of bone connected by tiny

“struts” and filled with air, much like the wing of a plane. A pneumatized skull appears opaque and grayish with tiny white dots. In contrast, an un-pneumatized skull, consists of a single thin layer of bone, appears pinkish and somewhat translucent and never shows the minute dots characteristic of a pneumatized skull. It is strongly recommend that a binocular magnifier such as the OptiVISOR be used for determining the degree of skull pneumatization. See Ralph et al. 1993 and Pyle et al. 1997 for more complete information on the determination of age by skull pneumatization. See Appendix 7 for a diagram on skulling.

Enter the appropriate code for the degree of skull pneumatization (leave blank if not skulled):

- 0 None: Skull not pneumaticized; that is, only a single thin layer of bone covers the entire brain, which shows through the thin covering of bone and appears as an unmarked, pinkish color. Note that in thick-skinned species such as corvids and parids, the skull can be very difficult to see because the skin itself tends to be rather opaque; and in heavily-muscled species such as grosbeaks and cardinals, the jaw muscles can obscure the rear of the skull.
- 1 Trace: A trace of skull pneumaticization can be seen at the very back of the skull, usually appearing as an opaque, grayish crescent or a very small triangular area (1-5% of the skull is pneumaticized).
- 2 Less than 1/3: Skull less than 1/3 pneumaticized but some pneumaticization is obvious, i.e., from 6 to 33% of the skull is pneumaticized. Generally, the posterior part of the cranium has an inverted “u” or “v” shaped area of pneumaticization that is usually distinctly grayish and contrasts with the unpneumaticized area. The grayish area typically shows the characteristic, small, whitish dots of a pneumaticized skull.
- 3 Half: Skull greater than 1/3 but less than 2/3 pneumaticized. In typical birds, most of the rear half of the skull is pneumaticized, as is a small portion of the front part extending back around the eyes. This front part of the skull is usually very difficult to see because the feathers of the forehead are dense and short and difficult to move out of the way. In most cases, a bird given a “3” skull will show a pneumaticized area extending up the midline or sides of the skull.
- 4 Greater than 2/3: Skull at least 2/3 pneumaticized but at least small areas of the skull not pneumaticized, i.e., from 67% to 94% of the skull is pneumaticized. The unpneumaticized areas generally show either as two oval, pinkish spots on either side of the cranium or (rarely) as a single spot in the center of the skull.
- 5 Almost complete: from 95 to 99% of the skull is pneumaticized. These birds have virtually a fully pneumaticized skull that shows one or two tiny, dull pinkish areas where the pneumaticization is incomplete. It should be noted that some birds, including many flycatchers, thrushes, and vireos, never develop a fully pneumaticized skull, even when adult, but retain a “5” skull throughout life. Thus, a “5” skull bird cannot necessarily be called a HY/SY bird because it could be an AHY/ASY bird whose skull never completely pneumaticized.
- 6 Complete: Skull fully pneumaticized.

Date

Record the date in mm/dd/yyyy format. The formula in Excel will change this to, e.g., 4-Sep-2012, in the spreadsheet.

Status

The codes used to define the status of a bird are as defined on the US Geological Survey website at <https://www.pwrc.usgs.gov/bbl/manual/status.cfm> with the shortened definitions below (Table 7).

The status code contains three digits. The first digit provides the status of the bird and the second and third digits provide additional information. If in doubt as to what code to use, explain in comments and fill it in later.

The most commonly used code is “300”. The first digit of “3” relates to a normal wild bird released in same 10 minute block as captured, held 24 hours or less. A “00” for the second and third digits means federal (USGS) numbered metal band only.

The code “500” may also be used. The first digit of “5” relates to a bird that is sick, exhausted, injured (old or new), crippled, or with a physical deformity; held 24 hours or less, may or may not be treated or transported.

Table 7. Status and Additional Information Codes

Code	First digit	Second & third digits	Requires remark
200	Transported (see banding manual (Gustafson et al. 1997) for details)	USGS band	Yes
300	Normal bird	USGS band	No
301	Normal bird	USGS band + colour leg band	No
308	Normal bird	USGS band + temporary markers (e.g. paint or dye)	No
318	Normal bird	USGS band + blood sample taken	No
319	Normal bird	USGS band + blood sample taken + auxiliary marker(s)	Yes
325	Normal bird	USGS band + two or more auxiliary markers	Yes
380	Normal bird	USGS band + Satellite/Cell/GPS transmitter	Yes
381	Normal bird	USGS band + Radio transmitter	Yes
385	Normal bird	Miscellaneous (combination or situation not covered by other additional information codes) eg. transmitter and blood sample	Yes
500	Sick, exhausted, Injured (old or new), crippled, or with physical deformity held <24hrs.	USGS band	Yes
700	Rehabilitated and held >24 hrs	USGS band	Yes
800	Held >24hrs for experimental or other purposes	USGS band	Yes

Loc

Location where banding is taking place. Generally, records should have a location “1” for TLBO (some past records were given a location “2” for Potato Mountain Bird Observatory), and if that project were to resume, location code should be entered as appropriate. Likewise were a new project location(s) to be initiated, a new location code would be allocated.

NSB

Non-standard banding should be denoted with a “Y” in this column if birds caught by any manner other than passively, during the allocated times in one of the 12 standard mistnets (diurnal monitoring) or seven Owl Nets (Owl banding).

Remarks (was Notes)

Use this space to record anything of importance that does not fit in another column, such as special measurements taken, deformities/injuries, subspecies, etc.

6.5.2 Recaptured Birds (Recaps)

It is recommended that if time allows, the data gathered on a recaptured bird be compared to the data from its previous capture(s). This helps to minimize errors made on recaptures and correct errors made on previous capture(s). It also provides an excellent opportunity to compare data gathered on the same bird by different banders and ensures consistency (One can use the VLookup function in MS Excel as an excellent tool to compare data quickly).

If the same bird is recaptured twice in one day, or a bird is recaptured on the same day that it was banded, that bird may be released at the net. However, if there is any doubt regarding recapture, the bird should be brought back to the station or the station should be called to confirm whether or not the bird can be released without processing.

Recapture data provide a record of recaptures from TLBO over time, and information about recaptures from other stations. These data are important as they can show not only the rate of returns (i.e., annually to TLBO) but patterns in migration routes if birds banded at one station are captured at a different one.

6.5.3 Daily Estimated Totals

Daily estimated totals, or “DET’s” are completed in the DET spreadsheet (Appendix 2.4), and are a compilation of banding data, recap data, census, and observations made over the standard monitoring period of 6.5hrs, starting at sunrise.

The bander-in-charge is responsible for ensuring that:

- DET columns are completed properly at the end of each day
- all observations are considered (all observers have had the opportunity to put their observations in the obs column)
- all banded and recaptured birds are listed in the appropriate columns
- all census data are added to the Census column.

The BIC or his/her/their delegate should use their best judgment to estimate how many different birds were actually observed in total and this number is entered into the ET column. All personnel taking part on a given day should join in the preparation of the DETs. DETs require informed judgement to eliminate duplicates. A certain distinctive bird might have been seen on census and reseen on obs; so it is somewhat subjective which of the birds seen are unique for the day and how many may have been reported more than once. The number in the ET column should always be less than or equal to the sum of the numbers in the other four columns.

In the event that some birds cannot or were not identified to species, an effort should be made to at least record the family/genus eg. dabbling duck sp., sparrow sp. etc. These should also be recorded in the DETs.

7. OWL BANDING PROGRAM

The TLBO started banding Northern Saw-whet Owls in 2012 using a setup of four passerine nets including songbird nets 9 and 10. In 2013, four 60mm owl nets were bought and with these and a larger gauge raptor net the standard 7 net locations that have been used since were implemented. The playback location used in 2013 has been used each year since and should be considered the standard location. In 2019 the raptor net was replaced with a 60mm owl net (ON5). Initially, the playback setup consisted of personal cell phone/small speaker. Starting in 2017 an Escape Platinum portable speaker was purchased for the TLBO and near the end of the 2019 season, an mp3 player.



Figure 9 Owl Nets setup, playback is marked by the star

7.1 Timing

Owl banding has historically begun around September 5 and this should be considered the standard start date going forward. Net opening should occur once dark and the standard owl banding period is three hours starting once all nets are opened and playback has started. The

owl banding season has traditionally ended at the end of September, along with the diurnal migration monitoring program. However in 2021 a pilot project to determine the feasibility of extending the program until October 15 was conducted with great success. Moving forward, annual funding permitting, the Owl Banding Program will have the end date of October 15.

7.2 Net Checks

Net checks should take place at intervals of 30 to 45 minutes (30 minutes on colder nights) and an effort should be made to ensure all staff and visitors are quiet around the nets. Owls should, as a general rule, be extracted using the feet first method.

7.3 Safety

Due to the presence of wildlife such as bears and cougars in the area the Owling Program should always be run by a minimum of two personnel present for the duration of each session.

7.4 Effort and Weather Data

Effort and weather data should be recorded in the “Owls” tab of the Daily Log spreadsheet (see Appendix 4). This data includes date; start and end times and weather at both; total hours and total nets used; net setup (standard or non-standard); and comments which should include notes on owls detected outside the nets as well as anything noteworthy with regards to effort/nets.

8. DATA MANAGEMENT AND REPORTING

The data are very important and should be managed with care. The BIC is responsible for data management and for submitting the final data in the correct formats at the end of the season to the appropriate agencies.

During banding hours, the banding database should be saved frequently, as well as backed up every 15 and every 60 minutes with the SyncBackSE program (or whatever current backup program is being used) found on the laptop. SyncBackSE should be setup to save at least the 15 most recent copies to the flash-drive so that older editions can be checked should something go wrong. SyncBackSE should also be set-up to only run between 6:30am and 12:30pm. This helps avoid frustration and errors while the laptop is in use outside the banding hours. Data should be backed up on the external hard drive at the end of each birding session, and that hard drive should be kept at Lincoln Creek ranch house.

It is important to maintain at least two backups of the data in case the NCC laptop fails or is stolen. It is recommended that all data be backed up onto a personal laptop or external hard-drive at least once per week. Also, the data can be emailed to the BIC as another good way to backup the data.

Annual Report

The Bander-in-charge is responsible for compiling the annual migration monitoring report. Reports should follow same format as previous years. See previous reports on the “Migratory Bird Count” page of the TLBO Blog <https://tatlayokobirds.wordpress.com/migratory-bird-count/>

9. BLOG

TLBO has a blog at tatlayokobirds.wordpress.com (started 2010). At the end of each day, a description of the day should be entered on to the TLBO blog. Anything of note, including rare birds, unusual behavior, anecdotal stories, bird quizzes, and daily stats should be entered for viewers to read. The BIC and the assistant-BIC should probably alternate responsibility in this regard, and any interested volunteer should be encouraged to participate. It is important to try to take photographs during the day to add to the day’s blog post. Note that the blog represents the Tatlayoko Field Station Society, our funders and the project at large and everyone with Internet can read the blog, so while humour is fine be sure to keep it professional and politically correct.

10. ADDITIONAL PROJECTS

Side projects are encouraged so long as they do not interfere with the usual operation of the banding station. Collecting samples for other researchers (such as pulling feathers, taking blood, or specific measurements) that do not impose time issues or pose a serious risk to the birds are a good method to increase esteem and public-awareness of the station. Be sure that any such side project is covered by a banding permit, preferably that of the other researcher, and that all methodologies are properly explained and followed. When possible, recognition of the Tatlayoko Field Station Society and TLBO in published works should be sought.

11. RECORD OF CHANGES OR MAJOR INTERRUPTIONS IN STANDARDIZED DATA COLLECTION

Important interruptions to operations should be recorded here, such as flooding or lack of personnel that reduced effort for periods of a week or more. Also to be recorded are any permanent changes to data collection methods. Although operational changes are sometimes necessary (as when a netting location is destroyed), changes in data collection are not to be made unless absolutely necessary, and must first be discussed with CMMN advisors.

Instructions for record keeping

If any standardized operational change or interruption occurs, enter details into the table below, underneath any previous entries. Refer to parts of the text that were changed (e.g. section number, altered locations on a map, new GPS points). Revise the ‘latest version’ date on page 1 of this protocol. If changes have been made to the protocol other than adding to the table below, submit a copy of the entire revised protocol to Birds Canada along with year-end data submission; otherwise, send only a copy of the table.

Date	Description of change and justification (if applicable)
2006	Start of standardized monitoring with 12 nets and current census route, within first couple weeks of operation, nets 2, 3, 4, 5, 8 were retired and replaced with nets 13-17.
2011	Replaced net 7 with net 18 (see Table 1 for UTM's), because bridge to net 7 was destroyed annually
2011	Census start time inadvertently changed to 1:30 after sunrise for duration of season, instead of 1:45 as stated in protocol. Census start time returned to 1:45 after sunrise from 2012-2014.
2012	Total census time adjusted to aim for as close to 60min as possible (previously stated in protocol as 45-75min). Prior to this year, total time on census varied quite widely day to day
2015	From this year until present, census start time has been 1:30 after census. This has been adopted as the new standard
2016	Station not operated
2017	While not a change in protocols, a change in the effort of where we got observations: from this season onwards, the conifer flats in the NE quadrant of the census area (NE of banding lab) have been birded on a regular, near daily basis. Previously, this area was almost never birded. The field and oxbow (NW corner of census area) also birded much more regularly from 2017 to present (previously only infrequently covered). This has undoubtedly affected numbers detected of species such as MOCH and grassland birds such as SAVS and VESP.

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Appendix 1. The Bander's Code of Ethics.

(adapted from the North American Banding Council 2001)

a) More than anything else, banders are responsible for the safety and welfare of the birds they study. This means that stress and risks of injury or death need to be minimized. Some basic rules are:

- handle each bird carefully, gently, quietly, and with respect
- capture and process only as many birds as you can safely handle
- close traps or nets when there are known predators in the area
- do not band in inclement weather
- frequently assess the condition of traps and nets and repair them quickly
- trainees must be properly trained and supervised
- check nets every 20-30 minutes
- check traps as often as possible as is recommended for each trap type
- properly close all traps and nets at the end of the banding day
- do not leave traps or nets set and untended
- only double bag non-aggressive birds of the same size and species, and only when absolutely necessary
- use the correct band size and banding pliers for each bird
- treat all bird injuries in the most humane way

b) Banders must continually assess their own work to ensure that it is beyond reproach.

- reassess methods whenever an injury or mortality occurs
- accept constructive criticism from other banders

c) Banders must offer honest and constructive assessment of other's work to maintain the highest standards possible.

- publish innovations in banding, capture and handling techniques
- educate prospective banders and trainers
- provide feedback of any instances of mistreatment of birds to the bander
- if there is no improvement, then file a report with the banding office

d) Banders must ensure that the data gathered are accurate and complete.

e) Banders must obtain permission to band on private property.

If injuries and casualties are occurring frequently (3+ per week), it is imperative that the Bander in Charge (BIC) accept that the banding program is counter productive, and therefore the program should be shut down and re-assessed. Banders must continually observe ethical procedures and recognize the privilege of handling birds.

Appendix 2. Daily Log Sheet – Weather (“Log” tab).

Date	Start					Census							End					STATUS	Weather Notes		
	Time	Temp	Wind (dir)	Wind (Bf)	Sky	Time start	Temp	Wind (dir)	Wind (Bf)	Sky	Time end	Initial s	Time	Temp	Wind (dir)	Wind (Bf)	Sky				
3-Aug																					
4-Aug																					
5-Aug																					
6-Aug																					
7-Aug																					
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30-Aug																					
31-Aug																					

Appendix 3. Daily Log Sheet – Personnel (“Obs” tab).

(Filled out for each day by BIC at the station.)

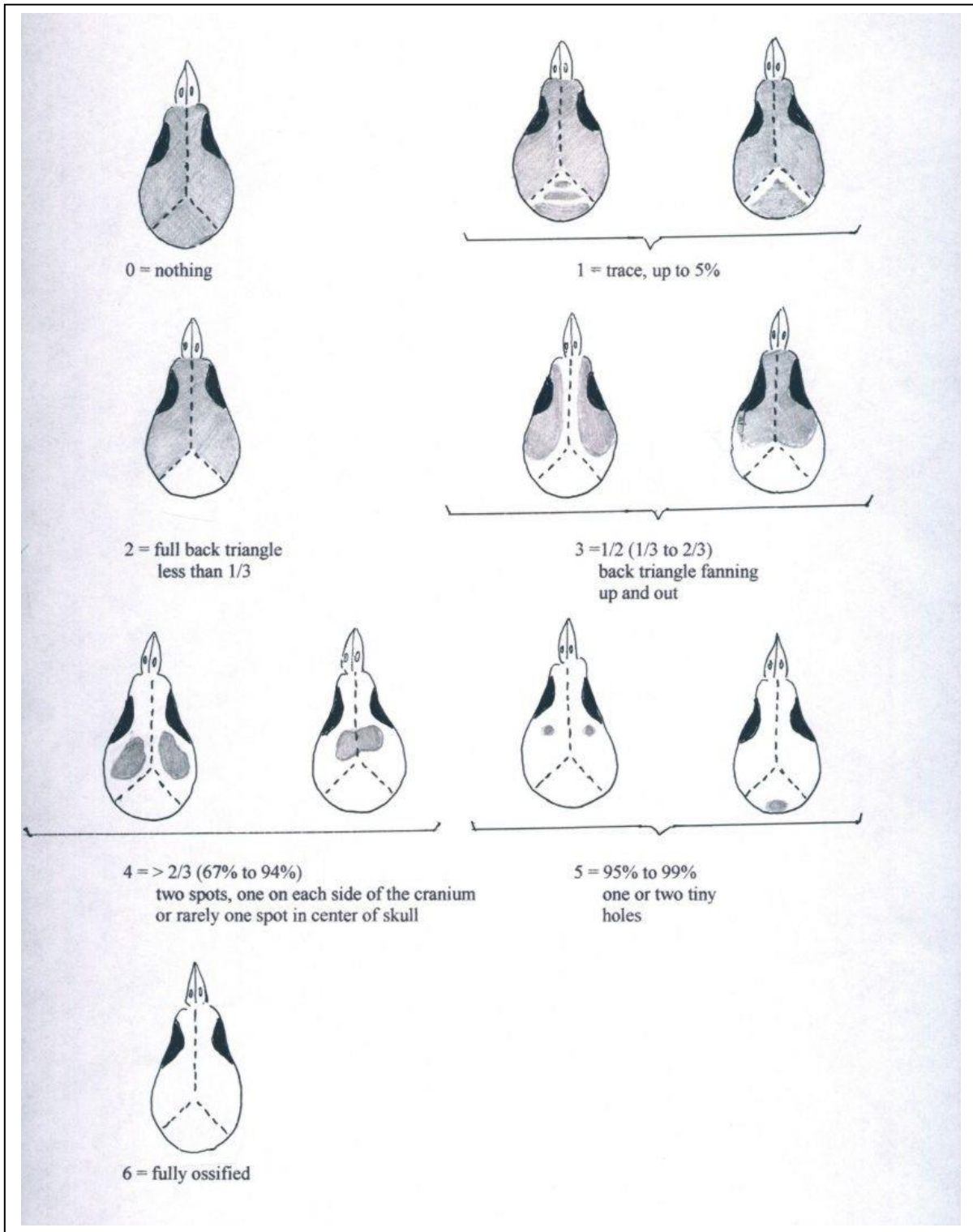
Date	OBS 1	hours	OBS 2	hours	OBS 3	hours	OBS 4	hours	OBS 5	hours	OBS 6	hours	OBS 7	hours	Visitor 1	Visitor 2	Visitor 3	Visitor 4
3-Aug																		
4-Aug																		
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30-Aug																		
31-Aug																		

Appendix 6. Daily Estimated Totals Spreadsheet (example).

Year	2011	2011	2011	2011	2011	2011	2011	2011	2011	2011	2011
Date	3-Aug	3-Aug	3-Aug	3-Aug	3-Aug	4-Aug	4-Aug	4-Aug	4-Aug	4-Aug	4-Aug
Julian Date	29	29	29	29	29	29	29	29	29	29	29
Species	Band	Recap	Obs	Census	ET	Band	Recap	Obs	Census	ET	
1	Common Loon										
2	Pied-billed Grebe										
3	Horned Grebe										
4	Red-necked Grebe										
5	American White Pelican										
6	Great Blue Heron										
7	American Bittern										
8	Tundra Swan										
9	Trumpeter Swan										
10	Canada Goose										
11	American Wigeon										
12	Mallard										
13	Blue-winged Teal										
14	Cinnamon Teal										
15	Northern Shoveler										
16	Northern Pintail										
17	Gadwall										
18	American Green-winged Teal										
19	Unidentified Teal										
20	Ring-necked Duck										
21	Greater Scaup										
22	Lesser Scaup										
23	Wood Duck										
24	Bufflehead										
25	Common Goldeneye										
26	Barrow's Goldeneye										
27	Duck Spp.										
28	Hooded Merganser										
29	Common Merganser										
30	Red-breasted Merganser										
31	Osprey										
32	Bald Eagle										
33	Golden Eagle										
34	Northern Harrier										
35	Cooper's Hawk										
36	Sharp-shinned Hawk										
37	Northern Goshawk										
38	Unidentified Accipiter										
39	Red-tailed Hawk										
40	American Kestrel										
41	Merlin										
42	Peregrine Falcon										
43	Ruffed Grouse										
44	Dusky Grouse										
45	Sora										
46	Virginia Rail										
47	American Coot										
48	Killdeer										
49	Sandhill Crane										
50	Greater Yellowlegs										

Spreadsheet is laid out so that subsequent days appear to the right and there are separate tabs for August and September

Appendix 7. Skulling key (from Pyle et. al. 1997).



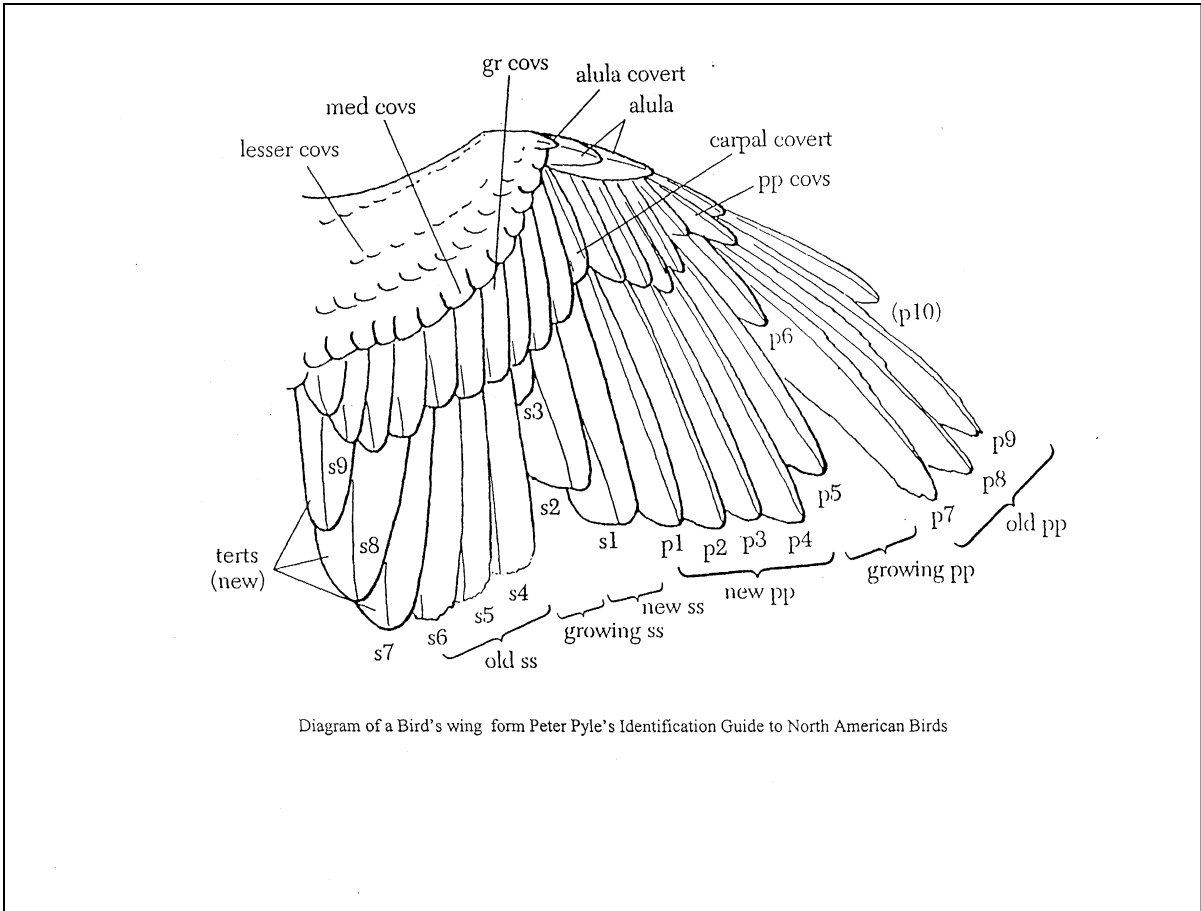
Appendix 8. Empidonax flycatcher key.

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

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

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

Appendix 9. Passerine wing morphology.



Appendix 10. Emergency Contact Information

Radio:

Snoring Horse Ranch frequency is channel 1.

Project Manager:

Peter Shaughnessy, TLBO Director

tatlayoko@gmail.com

250-476-1170

First aid station:

West Chilcotin Health clinic

Tatla Lake: phone number 250-476-1114