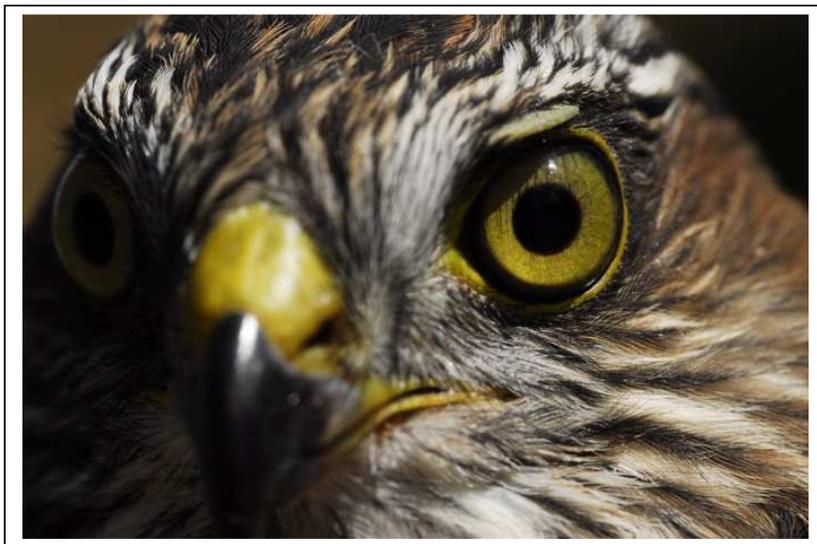


**Tatlayoko Bird Observatory**  
**Migration Monitoring Protocol**



February 2007  
Edition 1.4

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Peter and Roma Shaughnessy, Tatlayoko Project Managers

The residents of the Tatlayoko Valley

Much of the protocol used by this station is borrowed and adapted from the vast experience and knowledge of folks from other bird observatories. The Long Point Bird Observatory set the original tone, while Mugaha Marsh Bird Observatory near Mackenzie, B.C. (specifically the Lambies) allowed us to use their written protocol to establish our own codes and systems.

# 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 as follows:**

- 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 and your approach 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 BIC accept that the banding program is counter productive, should be shut down and re-assessed. Banders must continually observe ethical procedures, and recognize the privilege of handling birds.

## **2. INTRODUCTION**

The Tatlayoko Bird Observatory 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).

The primary goals of the project are as follows:

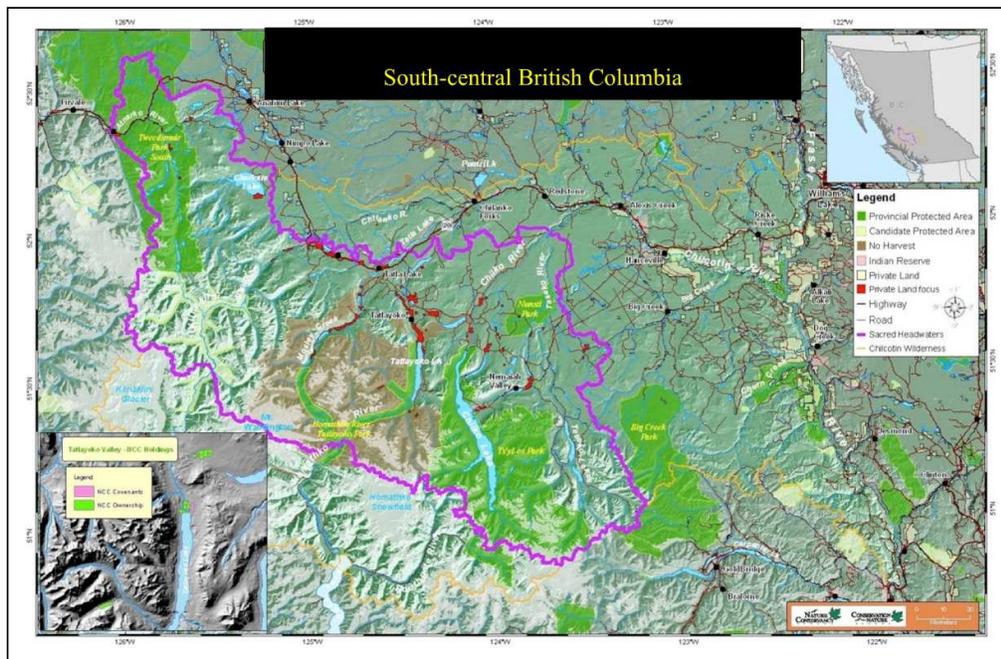
- a) In adherence to Canadian Migration Monitoring Network (CMMN) standards, to monitor birds passing through the Tatlayoko Valley during fall migration, using banding and censusing methods
- b) To ensure that the data collected are rigorous and useful to the CMMN, CWS and NCC for both short- and long-term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

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 through icefields 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.

## **3. STUDY AREA**

### **3.1 General Location**

The bird banding station is located at UTM 402835 5723416 (NAD83, 10U), at the south end of the “NCC field”, about 1km north of Tatlayoko Lake, British Columbia. Tatlayoko Lake itself is roughly situated between the cities of Williams Lake, Bella Coola, and Whistler. Figure 1 is a regional map of Southwestern B.C. showing the general location of Tatlayoko Lake.

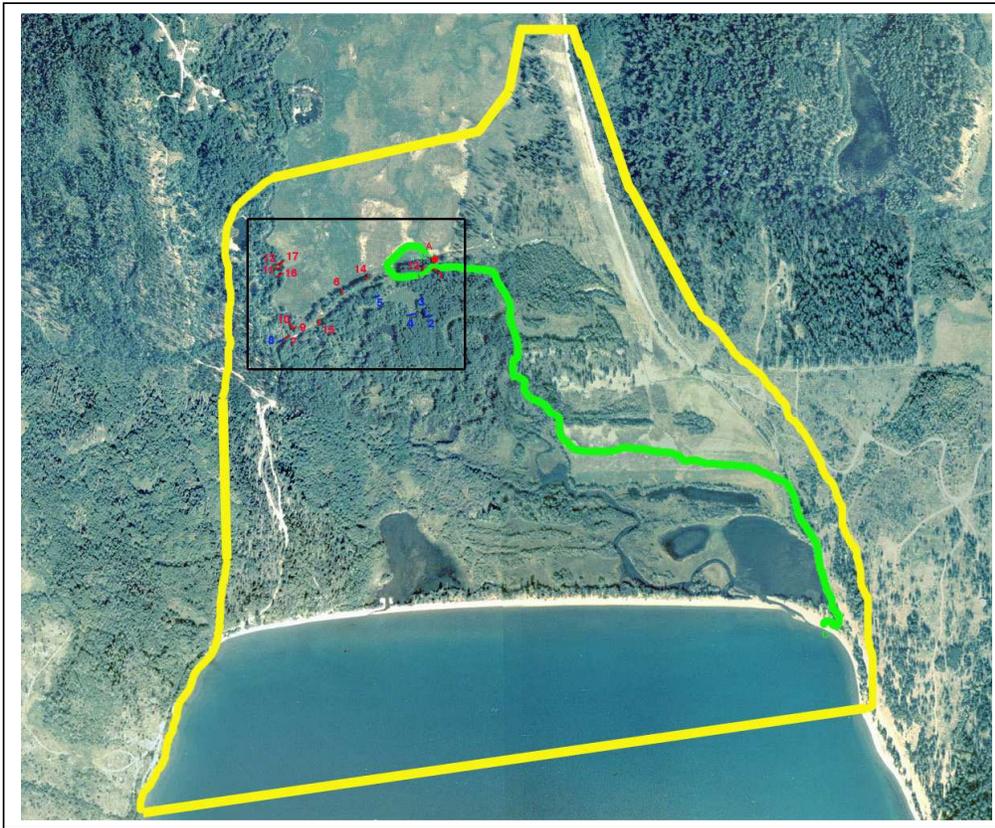


**Figure 1.** Location of Tatlayoko Lake. The NCC ranch is shown in the lower left insert, immediately north of the lake.

### 3.2. Census Area

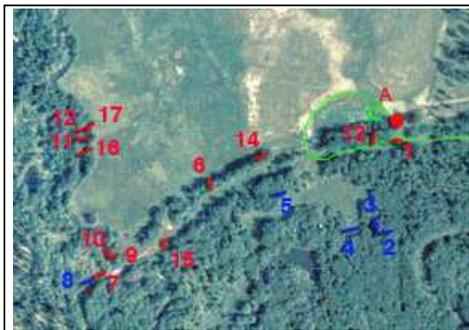
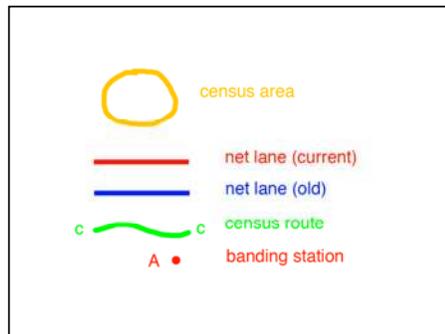
Figure 3 shows the census area, located at the north end of Tatlayoko Lake, within which birds are counted. The area is bounded on the north by a fence cutting through the NCC fields, three hundred meters north of the banding station. To the south, a portion of the lake is included in the count area—that which is bounded by a line connecting the first point south of the Homathko River entrance to the lake, all the way 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 100m. To the east, the Tatlayoko Road is included, plus an additional 100m upslope. Figure 3 also includes the net lanes and census route.

Much of the census area is not covered on a regular basis, but it still provides the opportunity to observe birds flying or calling at a distance.



**Figure 2:** Map of the census area  
 (a larger loose copy of this will be at the station)

**Legend:**



**Figure 3:** Detail of net lanes and station

## 4. OPERATION OF THE MIGRATION MONITORING STATION

### 4.1. Pre-season set-up

Before daily monitoring begins, the following tasks should be completed:

- checking and pruning net lanes
- cutting the net-run trail, including a path between the station and net 17
- dismantling fencing or building stiles to aid banders in crossing fences
- census route flagged and cleared
- banding tent set-up and guyed against the wind
- foot bridge over Homathko River built and secured
- putting up twelve mist-nets (12m, 36mm mesh) in the following locations:

**Table 1: Net locations**

<b>Net Number</b>	<b>Easting</b>	<b>Northing</b>
1	402819	5723385
6	402636	5723334
7	402520	5723258
9,10, double	402546	5723286
11	402510	5723441
12, 17 double	402511	5723458
13	402787	5723396
14	402698	5723382
15	402602	5723298
16	402529	5723409
The following net lanes were used in season 1 only:		
2, 3 double	402818	5723307
4	402787	5723300
5	402714	5723345
8	402510	5723257

\*UTMs are for the centre of each net; be aware that re-bar for poles is left in place over the winter and that nets should be put in the exact locations each year; see Figure 3 for specific net layout

- a band inventory should be conducted at the start of the season
- a reliable vehicle should be available for the banders for the daily commute
- banders should have what they need for the season because supplies are hard to come by in the valley
- tools are available (e.g., hammer, gas powered weed-eater), and should be signed in and out from the Project Manager

- a banding workshop should be considered for local volunteers

## 4.2. Chronology

The fall migration monitoring season encompasses the full months of August and September. Expect the peak numbers of birds in the middle part of the season, but be aware that this could vary. If an early winter shuts down operations close to the end of September, it might not be worth waiting for the weather to improve, and the season should be finished early.

Owl monitoring may continue after the regular migration monitoring period. Additionally, bird counts from other periods may be important. Both a Tatlayoko valley species list and the census area list can be augmented from observations made at other times of the year by birdwatchers or from other projects.

## 4.3. Safety

Both **Grizzly and Black Bears** are present in the banding area—a fact that should be taken seriously by all banders, volunteers and visitors. During 2006, bears were present on, or in close proximity to the net-round trail for at least a quarter of the operational days. Participants should be well versed in bear safety procedures and should carry bear spray at all times. Bear bangers should be present at the station. You **will** see bears, but this is not a warning that imminent death is at hand. Mostly, they are harmlessly going after the abundant berries in the area, and nets have been relocated midway in the first season to steer clear of this phenomenon. Having said that, the area around the station itself is prone to bear encounters, and we have seen or heard both species of bears munching away only twenty meters behind the station. Most of the time they will retreat quickly, but hopefully not through a net. Be wary of 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 at the station overnight!*

If a bear is present in the area, the BIC will decide whether 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.

FRS radios should be carried by both banders at all times. This is not just for safety, but they come in handy for other communication purposes,. Also, a VHF radio is located at the banding station at all times and should be charged regularly but not left on. For emergency call-outs or otherwise, the NCC frequency is found on channel 11. No other channels should be used unless in an emergency (visit the Project Manager in person for more details about radio protocol).

The nearest first aid station is at Tatla Lake (phone number 250 .....). A first aid kit is stored at the banding station, either in the tupperware bin or in the rafters of the banding tent. The Project Manager should be made aware of any personal medical requirements for any participants.

Be careful when crossing the Homathko River footbridge. Visitors and students should be discouraged from making this crossing.

Hygiene should be an important consideration. Raptors should be handled with care and bird bags washed regularly. Wash hands with anti-bacterial gel before eating your sandwich. Also, an outhouse will be located on-site, but this is hardly a safety issue—or shouldn't be.

Children are welcome at the site, but should be escorted by parents or guardians. Pets MUST be kept on a leash at all times in the vicinity of the nets and banding station.

The Project Manager should be consulted about all safety issues, including the establishment of an emergency plan.

#### **4.4. Permits**

Banding is conducted under a master permit from CWS-Delta for migratory birds. The banders must also have the appropriate permits for other species such as raptors and blackbirds, which are provincially governed. Hummingbirds are not banded at Tatlayoko Bird Observatory. Permits should be kept in the DET binder and made available to any on site inspection.

#### **4.5. Bands**

The appropriate number of bands and sizes should be present before the season, and can be acquired through CWS and the Bird Banding Office. Here is the recommended number of bands needed for a season at TBO

0A: 500	1A: 100
0: 500	2: 100
1: 600	3B: 100
1B: 500	3A: 100

Larger sizes, including locking bands, should be available for banding hawks and owls, but these captures will be rare unless targeted specifically.

#### **4.6. Habitat Management**

Maintaining the habitat in a similar condition is one of the standardization techniques to which a migration monitoring station should adhere. Any habitat alterations should be done only after consultation between the Project Manager and the Science Coordinator. The idea is that if vegetation changes, species composition could change and therefore bias the monitoring results over time.

The field in front of the banding station is generally cut for hay sometime at the end of August or early in September. This will have an impact on only a few species, and makes the commute to net 17 a bit easier. Please do not interfere with the haying process.

## 5. PERSONNEL

### 5.1. Banders

At this banding station, a minimum of two experienced bird observers must be present, since it is relatively remote and drop-in volunteers cannot be incorporated into a resource plan. 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 should adhere to all CMMN standardization techniques, and be fully versed in the Bander’s Code of Ethics. Any bird, no matter if rare or common, should be processed quickly and safely. The BIC makes decisions about volunteer tasks and daily operations, and all decisions made by him/her are final unless the assistant bander has a better idea.

The assistant bander should be proficient at bird identification, since he/she will need to conduct censuses. Therefore, the assistant bander should be a “1” in bird identification skill (see Table 2). An assistant bander adept at bird extraction and banding is an asset, as is someone who can operate the station alone if necessary.

**Table 2: Observer identification codes**

Code	Identification skills
1	Can correctly identify 75% of birds or greater at Tatlayoko
2	Can correctly identify 50%-75% of birds at Tatlayoko
3	Can correctly identify <50% of birds at Tatlayoko

### 5.2. Volunteers and training

If scheduling permits, a short workshop should be conducted before the banding season to refresh previous volunteers and to train others who are interested in helping throughout the season. This takes stress away from the banders who may not have time or energy to separately train individuals throughout the season. Trained volunteers can be valuable assets and should be scheduled in advance, preferably in week-long blocks, especially during the peak of migration or when the banders are seeking time off.

Scribing should be the first duty for a volunteer to learn, followed by net extraction. The latter requires dexterity and patience; it is up to the BIC to gauge a volunteer’s capability and duration of training period before they are set free to extract birds on their own. Aside from showing them the Bander’s Code of Ethics, the following basic guidelines should be a part of the training instruction to new bird extractors:

- assess which side of the net the bird flew into
- most birds should have their feet extracted first, followed by the wings, then the head (or one wing then the head, then the other wing)
- be wary of net strands still caught on the thighs
- there is a zone between being too gentle and too rough with the birds; extractors should seek this zone, but should strongly err on the gentle side. However, time is of the essence and the average bird should be extracted in less than one minute.
- extractors should be aware of the natural movement of the wings, and not strain wings beyond this boundary
- a seam ripper sewing tool should be carried at all times by people on net runs, which are useful for tongued birds and cutting the net if absolutely necessary.

Those volunteers interested in doing the census should be versed on the census protocol, route-finding, and should be a code 1 for identification of birds. The census data should be input onto the DET sheet directly after census is completed.

Contacting volunteers: In an ideal world, there would be some way to contact volunteers on an as-needed basis, especially first thing in the morning if the action is fast-paced. Arrangements of this type of communications should be made in advance.

### **5.3. Visitors**

Whenever possible, the banders should seek advanced notice from visitors before they show up. Drop-ins with no experience should be subtly discouraged during the busy part of the season. Aside from this, the banders should 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 are discouraged unless well-behaved and leashed.

## **6. DAILY OPERATIONS**

The first order of business for the day, after arriving at the station, is to record the weather information and start times on the Daily Log. Netting begins at dawn and continues for exactly six hours. To help with scheduling, the best chart for annual sunrise/sunset times (for Whistler, B.C.) can be found at:  
<http://www.timeanddate.com/worldclock/astronomy.html?n=1114>

### **6.1. Daily Log**

The Daily Log is shown in Appendix 1, and contains a variety of information, as follows:

*Date:* a sheet should be filled out with a date even if nothing happens, so the records show that nothing happened on that day.

*Effort:* Observer initials, and number of hours spent observing birds (ie. during a busy banding day it would be less); volunteers are counted as observers, and vice versa

Observer bird identification skills are also accounted for, (see Table 2).

*Coverage code:* Record the scope of coverage for that day (see Table 3).

**Table 3: Coverage Codes**

Code	Criteria
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.

*Visitors:* Who dropped in . Visitors may fill this section in themselves.

*Comments:* Anything notable for the day, such as early closure due to wind, etc.

*Weather:* Recorded at three intervals during the day: sunrise, census start, and net close.

A reliable thermometer should be on site. The following are recorded at each interval:

Time: 24 hour clock

Wind (dir): the direction the wind is coming from (eg. NNW)

Wind (Bf): wind strength on the Beaufort scale (see Table 4)

Cloud: The general sky condition (see Table 5).

Temp: The temperature in Celsius, rounded to the nearest whole degree

**Table 4. Beaufort wind and sky condition 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
6	Intermittent showers
7	Snow

*Net hours:* Record, for each group of nets (eg. 1-17) the time of opening and closing. The total net hours is a sum of each net's hours of being open (max. of 6 per net). All 12 nets open for 6 hours is a coverage of 72 hours.

*Unbanded birds:* If a bird escapes at the net, it should be recorded in this section, but only if it escaped due to the observer's presence; all hummingbirds go into this section.

*Highlight sightings:* Anything unusual, bird or otherwise (eg. first Steller's Jay banded this year)

## 6.2. When to operate

Temperature, precipitation and wind are all factors in deciding if the conditions are appropriate for bird banding. Here is a guideline whether or not the nets should be opened on a given morning, or whether they should be closed down on a given day. Each of these factors has a point value associated with it; if your situation adds up to three, close the nets:

- heavy precipitation for more than five minutes: 3

- light precipitation for more than twenty 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
- due to bird volume and banders present, net rounds can only be completed once every 40 minutes: 1
- birds are showing signs of stress (as occurs after a multi-day period of inclement weather): 1

At TBO, the temperature invariably seems to start off cold, but warms rapidly if 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 help 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 bander presence is such (ie. one bander) that nets must be closed in order to run census, then so be it. Although on rare occasions, census may be delayed or started earlier and the nets opened after it is complete. Do your best and appreciate the value of experienced volunteer effort!

Remember that closing down the nets takes a lot longer than running a quick net round. In desperate times, furl down the nets quickly on a net round and come back and tie them up later on when all the nets are closed.

### 6.3. Setting up nets

Each day, net opening begins at sunrise. One person should start at each end of the loop and both should meet in the middle, then back-track to check the 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.

### 6.4. Checking nets

Nets should be checked at least every 30 minutes, considering it takes 15 min to walk the loop with no birds encountered. 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, and keep in mind the top trammels have a habit of attracting overworked, nondescript female hummingbirds with hungry and defenseless chicks waiting in the nest. With two people, net check times should happen as often as possible: every 15 minutes unless it is very slow with mild temperatures and winds. Nets should be closed

immediately if there are not enough net-runners present to handle the number of birds in the nets. Remember that problems with birds can happen quickly, and that foresight is the best prevention for bird casualties.

## **6.5. Bird bag and mist net care**

Bird bags should be washed at least once per week- preferably more often, especially during busy periods. You'll know if they need washing. The blue and white cotton Avinet bags are a good size, but are cheap and should be used inside out at all times to avoid injury to birds from loose threads.

Mist nets should be checked for holes, and those holes repaired when possible. A hole greater than one meter likely requires a net replacement, (there are three spare nets). Small holes are easy to fix, but also easy to create. Prevention is the key. Mark all nets with a quality grading or comments before putting them away into storage; winter is the best time to get nets sent away to be professionally repaired (see NCC Science Coordinator for details)

## **7. COUNTING BIRDS**

The migration monitoring at Tatlayoko Bird Observatory consists of three different components: census; banding (banded and recaptured birds); and observations. All three methods are important in gathering an index of bird abundance over time.

### **7.1. Census**

The census occurs every day during the migration period, and should be conducted even on days when the nets are closed. It should take priority over netting if staff numbers are low, requiring the closure of nets to complete the route if necessary. The census route is outlined in Figure 2. It begins at the station, curves into the field and around the old barn roof, onto the banding road to about 100m east of the station. From there, the route continues south on the east side of the NCC fence, occasionally detouring around dense vegetation. When the route reaches the "lagoon field" (the large field closest to the lake), it continues along the old beachfront dune (ie. height of land in centre of the field) all the way to the eastern fence. Crossing the fence about 50m 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.

Census should ideally begin about the same time the sun hits the banding station. This occurs approximately one hour and forty-five minutes after sunrise. This is usually the period of highest bird activity, and in fact the sun should again be just reaching the Tatlayoko road once the observer arrives there. If things are busy, census can be delayed, but hopefully not for too long. Timing of census, although ideally important, cannot

always be perfect 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 abandoned if a huge net round occurs, requiring immediate help back at the station.

The census should ideally take about 45 minutes to one hour in total regardless of how busy or how quiet the morning. Sometimes it may take a bit longer or shorter depending on circumstances. 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. Many species are also detected on the Tatlayoko road, for instance, that are not recorded near the net lanes. Time should be spent at the end of the census to assess bird numbers on the lake and north shore.

The census-taker should be a “code 1” observer: able to identify more than 75% 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.

Binoculars, 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 sheet.

## **7.2. General Observations (Obs)**

General observations are those that are noted within the census area during normal operations. This includes all birds sighted or heard during the net runs, while at the table, while driving in/out, etc. This does not include birds recorded on the census or birds that were observed in the nets. It does include birds that were sighted bouncing out of the nets or escaping. On busy days, few observations are 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.

Returning to the station from census is one of the prime times for taking obs, and it usually occurs back along the road to the south airfield gate, then cutting through to the station along cattle trails. If the person at the station says that things are under control, the census person may return to the station via the lakeshore and the west road, passing net 7 en route. 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 here is that you must cross the river.

Observations should be recorded on the DET sheet in the “Obs field” section in tally form, then at the end of the day should be added up under the “Obs” section. Field observations should be recorded at regular intervals and discussed with other people at

the station, rather than trying to remember everything and recording it later. A good rule to remember at a busy banding station is to never put something off for later, because something else will happen that will make you forget what the original thing was.

### 7.3. Banding

Many of the instructions for setting up a day of banding are found under section 6: Daily Operations. However, again it should be noted that banding should only occur if the proper people and circumstances are in place for that particular day, since a lot of responsibility lies on the shoulders of the banding staff. Once the weather, staffing, etc. has been assessed and is deemed okay for banding, only then should the operation commence. The nets should be opened at sunrise, after the opening weather has been recorded and the banding equipment has been set-up in the banding shelter. This way you can return with a bunch of birds and can begin processing immediately. Remember that the first hour and a half is an important time to be vigilant with the safety of the birds.

Banding birds is primarily a method of counting, and therefore the recording of banding data should be completed in a neat and orderly fashion. Appendix 2 shows the banding sheet and all the fields that must be recorded for any newly banded bird. Appendix 3 shows the recapture sheet, which pretty much is a replica of the banding sheet, with a different field for the band number (the entire band number must be recorded instead of only the last two digits). 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”, or person recording information, can be really helpful on a busy day.

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. *The Bird Banding Office mandates that bands only be put on birds that can be properly identified.* This shouldn't normally be a problem except possibly for *Empidonax* flycatchers. Secondly, every bird should be checked to see if it already has a band or not. If it has a band, the 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 sheet. Thirdly, don't forget to put a band on! That's a guaranteed way of messing up your system.

Banding and recapture data sheets should be organized in the banding book so that the newest sheet for each band size can easily be flipped open. Band sequences should be followed diligently, and each new string should follow the last one.

### 7.4. Recording of Banding Data

The fields on the banding and recapture data sheets are as follows, and all the codes are outlined here. An understanding of the meaning behind the codes can help with bander-scribe communication. All information is recorded on the Banding Data Sheet, Appendix 2.

#### Region/Location

The region is Tatlayoko. The location is “1” for the Tatlayoko Migration Monitoring Station.

#### Band no. last 2 digits

Enter the last two numbers of the bird band and ensure it follows the same band sequence as listed in the column above it. If band numbers are recorded out of order, make a note that they are indeed used in that order so it isn't considered a scribe error.

#### Species

Enter the four letter alpha code (Figure 8) for the bird species. Record BADE if the band is destroyed or BALO for a lost band, and put a line through the rest of the fields.

#### Age

Enter a single digit code for the age class of the bird. Try to age birds as precisely as possible. The codes are:

- 0 Unknown age. A bird that cannot be placed in any of the year classes below. If you don't know, don't guess.
- 1 After hatch year. A bird known to have hatched before the calendar year of banding, but whose exact year of birth is unknown.
- 2 Hatch year. A bird capable of sustained flight known to have hatched during the calendar year in which it is banded.
- 4 Local. A young bird incapable of sustained flight. Pyle suggests using this for birds that have not fledged (these birds should be released in the area they were captured).
- 5 Second year. A bird known to have hatched in the calendar year preceding the year of banding and in its second calendar year of life. Example: Banded 2006 - Hatched 2005.
- 6 After second year. A bird known to have hatched earlier than the calendar year preceding the year of banding, year of hatch otherwise unknown. Example: Banded 2006 - Hatched 2004 or earlier.
- 7 Third year. A bird known to have hatched in the calendar year preceding the year before the year of banding, now in its third year of life. Example: Banded 2006 - Hatched 2004.
- 8 After third year. A bird know to have hatched prior to the calendar year preceding the year before the year of banding, now in at least in its fourth calendar year of life. Example: Banded 2006 - Hatched 2003 or earlier.
- 9 Other

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### How aged

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

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

### Sex

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

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

### How sexed

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

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

### Wing

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

### Weight

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

### Status

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

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

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

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

**Table 6. Status and Additional Information Codes**

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

Date

Record two digits each for day and month.

Loc

Location (1 for Tatlayoko Bird Observatory).

Net

Record net number.

Time

Record time of net round to nearest ten minutes.

Brood Patch (BP) as adapted from 2004 MAPS protocol (DeSante et al. 2004)

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

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

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

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

Cloacal Protuberance (CP) as adapted from 2004 MAPS protocol (DeSante et al. 2004)

The extent/stage of a bird's cloacal 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 which serves a role in sperm storage. The development of the cloacal protuberance is recorded according to a system shown below.

1. none: Cloaca not enlarged.
2. 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

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cannot be used to age or sex thrushes of the genera *Catharus*, *Hylocichla*, *Turdus*, or *Ixoreus*.

3. medium: Cloacal protuberance large, with a diameter fully as large near the tip as at the base (cylindrical).
4. large: Cloacal protuberance very large and with a diameter considerably larger in the middle than at the base (bulbous).

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

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

#### Moult

Always record 1 or 0 (i.e. present/absent) in the moult column of the banding sheet. Even if the bird is moulting one feather, it is still moulting. If feather re-growth is accidental (i.e. not symmetrical) it's still considered moulting, however make a note for this. See Pyle et al (1997), Froehlich (2003) and Jenni and Winkler (1994) for a description of moult.

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

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

- 0 none: No fat in the furculum or anywhere on the body.

- 1 trace: A very small amount of fat in the furcular hollow (less than 5% filled) but not enough to cover the bottom of the furculum. No or just a trace of fat under the wing, on the abdomen, or anywhere else on the body.
- 2 light: the bottom of the furculum is completely covered but the furcular hollow is less than 1/3 filled. A small amount of fat may be present under the wing, on the abdomen or both.
- 3 half: the furcular hollow is about half full (actually anywhere from 1/3 to 2/3). A covering pad of fat is definitely present under the wingpit and usually on the abdomen.
- 4 filled: The furcular hollow is full (actually anywhere from 2/3 full to level with the clavicles). A thick layer of fat also occurs under the wing and on the abdomen.
- 5 bulging: The furcular hollow is more than full; that is, the fat is bulging slightly above the furculum. The fat under the wing as well as that on the abdomen is also well mounded.
- 6 greatly bulging: Fat is bulging greatly above the furculum. Large mounds of fat occur under the wings and on the abdomen.
- 7 very excessive: The fat pads of the furculum, "wingpit," and abdomen are bulging to such an extent that they join. Nearly the entire ventral surface of the body is covered with fat, and fat even extends onto the neck and head.

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

In order to determine the degree of skull pneumatization, it is necessary to part the feathers of the head to get them out of the way (wetting them slightly may help), then gently rock the skin back and forth over the skull while looking through the skin to the skull. The best procedure is to start at the back of the skull and proceed toward the front looking for the pattern of the line that separates the 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. We very strongly recommend the use of a binocular magnifier such as the OptiVISOR for determining the degree of skull pneumatization. See Ralph et al. 1993, and Pyle 1997 for more complete information on the determination of age by skull pneumatization. See Appendix 6 for a diagram on skulling.

Skull should be recorded by means of the scale shown below (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. Beware of thick-skinned species such as corvids and parids, whose skull can be very difficult to see because the skin itself tends to be rather opaque; and heavily-muscled species such as grosbeaks and cardinals, whose jaw muscles can obscure the rear of the skull.
- 1 trace: A trace of skull pneumaticization can be seen at the very back of the skull, usually appearing as an opaque, grayish crescent or a very small triangular area. Somewhere from 1 to 5% of the skull is pneumaticized.

- 2 less than 1/3: Skull less than 1/3 pneumaticized but some pneumaticization is obvious. Thus, somewhere from 6 to 33% of the skull is pneumaticized. Generally, the posterior part of the cranium has an inverted “u” or “v” shaped area of pneumaticization that is usually distinctly grayish and contrasts with the unpneumaticized area. The grayish area typically shows the characteristic, small, whitish dots of a pneumaticized skull.
- 3 half: Skull greater than 1/3 but less than 2/3 pneumaticized. In typical birds, most of the rear half of the skull is pneumaticized, as is a small portion of the front part extending back around the eyes. This front part of the skull is usually very difficult to see because the feathers of the forehead are dense and short and difficult to move out of the way. In most cases, a bird given a “3” skull will show a pneumaticized area extending up the midline or sides of the skull.
- 4 greater than 2/3: Skull at least 2/3 pneumaticized but at least small areas of the skull not pneumaticized. Thus, somewhere from 67% to 94% of the skull is pneumaticized. The un-pneumaticized areas generally show either as two oval, pinkish spots on either side of the cranium or (rarely) as a single spot in the center of the skull.
- 5 almost complete: Somewhere from 95 to 99% of the skull is pneumaticized. These birds have virtually a fully pneumaticized skull that shows one or two tiny, dull pinkish areas where the pneumaticization is incomplete. It should be noted that some birds, including many flycatchers, thrushes, and vireos, never develop a fully pneumaticized skull, even when adult, but retain a “5” skull throughout life. Thus, a “5” skull bird cannot necessarily be called a HY/SY bird because it could be an AHY/ASY bird whose skull never completely pneumaticized.
- 6 complete: Skull fully pneumaticized.

#### Bander's initials

Record the initials of the person banding the bird.

#### Comments

Use this space to record anything of importance such as special measurements taken (exposed culmen, bill depth, bill width, comments on subspecies etc.).

### **7.3. Recaptured Birds (Recaps)**

Recaptures—birds caught in the net that are already banded—are recorded on the Recapture Sheet (Appendix 3). Basically, all the same information that would be recorded for a new bird is recorded here in the same manner. One exception is that you must write in the full band number instead of just the last two digits. There are no separate sheets for each band size.

It may be possible, if time allows, to compare the data from a particular recapture with the data from the original processing (from the day before or earlier). Often, a bird will be caught many times during the season. Regardless, it is important to record recapture data with as little bias as possible, however some piece of evidence might jump out that allows a better understanding of the bird's age and/or sex.

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. This protocol will be in place until the need for analyzing local movements or some other project is implemented. When in doubt, bring the bird in for processing. Otherwise, call your partner at the station and check to see if the bird is releasable at the net.

Recaptures are important, so don't let them get away at the net. Remember, as unlikely as it may seem, there is always a chance for a recapture from another station! Also, in future years, data from returning birds will be highly prized.

## 8. DAILY ESTIMATED TOTALS

Daily estimated totals, or "ET's" are completed on the DET form (Appendix 4), and are a compilation of banding and recap data, census, and observations. The following excerpt is from Hessel and DeSante (1996):

**Comment [ah1]:** how much of the following is a direct quote? All



The "Daily Estimated Total" (or ET) approach to deriving a daily count has been used at many European and some North American observatories and has been validated as a population monitoring method with data from Long Point, Ontario (Hussell 1981, Hussell et al. 1992), and Southeast Farallon Island, California (Pyle et al. 1994). The ET method should combine data from the at least two of the four methods described above.

Regardless of the components used as input, the objective is to integrate all available information to estimate the numbers of each species in or passing through a defined count area during the count period.

ETs are likely to be most successful in small areas with relatively open habitat, where personnel housed on-site are making more or less continuous observations. New stations planning to use ETs should develop procedures that are standardized to the maximum practicable extent. Nevertheless, when incompletely standardized procedures are used to collect data that form a component of the ET input (e.g. unstandardized banding captures, incidental observations), then the ET procedure might be helpful in overcoming those deficiencies in standardization.

At sites that experience fairly wide fluctuations in numbers of migrants (particularly at exposed coastal sites), the ET procedure might be preferable to visual counts or banding captures alone. We recommend that each component of the ET (census, visible migration count, banding, other observations) be standardized to the maximum extent feasible and be recorded separately (in addition to the ET), so that each can be analyzed separately. A procedure should be included for estimating the numbers of stopovers and residents.

The ET method has the following advantages:

1. It is based on 2 or more separate sampling procedures and attempts to take

advantage of the strengths of each while mitigating their weaknesses, by compensating for variation in effort and day-to-day variation in the effectiveness of each procedure.

2. It usually covers a longer period of the day than is allocated to a census, visible migration count, or banding alone and is therefore likely to detect more species and individuals.

3. It attempts to include all individuals of all species that were detected in the count area in a specified time; a procedure that is intuitively appealing and a challenge to many birders and volunteers.

4. Because an ET is often larger and never smaller than counts derived by other methods, ETs may conform more closely to the assumptions required by analysis methods used to estimate population indices and trends.

#### Disadvantages of the ET:

1. Preparation of the daily totals is comparatively subjective, rather than strictly objective and standardized. Rules for preparation of daily totals must be devised and followed. Nevertheless, such rules will be open to subjective interpretation, making it difficult to ensure a fully consistent estimation procedure.

2. Variation in effort devoted to any of the component procedures may introduce a bias into the estimates.

3. When birds are moving quickly around or through the site, ETs will be particularly subject to error unless effort devoted to incidental observations is standardized, or standardized visible migration counts are part of the regular procedure.

4. In heavily vegetated sites, the ET for many species is likely to be based mainly on capture samples, and will be affected by any variation in trapping or netting effort.

The bander-in-charge must ensure that everyone's observations have been considered and that the DET form is completed properly. Don't forget to record the date on the top of each form, and to carefully check your tallies so that no species are left out.

## 9. OTHER DETAILS

### 9.1. Bird Casualties

Tatlayoko Bird Observatory experiences a relatively high rate of bird mortality for several reasons. First, the temperature at dawn, even at the start of August, is generally at or below zero. The utmost care and efficiency must be taken for the 1.75 hours from sunrise until the sun pokes over the ridge (if it does). Usually, this period requires "constant net rounds", whereby nets are opened and patrolled continuously by as many staff as are available. Secondly, two common predators are in the area: Accipiter Hawks and Short-tailed Weasels. Other than closing the station permanently, there is little that can deter bird mortality on a random basis due to these predators. If hawks are present and hunting (they perch near the banding road, and nets 01, 10, 14 and 15 are particularly vulnerable), be wary and check those nets frequently. Close nets if hawks are perching

above them and they cannot be patrolled often. If a weasel is detected by a net, close that net and surrounding nets *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. All efforts should be made to avoid conditioning predators to the nets. Weasels may go after birds in bags at the station too.

All bird deaths should be reported in the “comments” section of the daily log, and compiled later on.

Wing strain and broken legs are other factors to contend with, and banders should be aware of the causes of these. Wing strain is far more common than injured legs, but is more prone to being caused by an inexperienced bird extractor. If a bird has wing strain, you probably won't know until after it is released. It is best just to leave the bird alone, or in some cases put it up on a stump or leafy branch out of harm's way.

## **9.2. Narrative**

This is where the creative writer in all of us gets a chance to show off. On the backside of each Daily Log Sheet is a section where someone can write about the events of the day. Banders are strongly encouraged to fill in a few paragraphs about rare birds, strange events, migration waves, or anything else that is or isn't recorded on the Daily Log. Take turns filling this in, and mix it up by encouraging volunteers or visitors to make some comments.

## **9.3. Data entry and reporting**

The data are of the utmost importance and should be guarded with care. The banding and DET binders should be brought back to the ranch house overnight and never left at the station. All data should be entered on a regular basis, backed-up and photocopied if possible. The BIC is responsible for this, and also for personally entering the DETs.

Weekly summaries of banding data and other interesting sightings and occurrences should be compiled and sent to the NCC Science Coordinator. The Bander-in-charge is responsible for compiling the annual migration monitoring report. See previous reports and contact the NCC Science Coordinator for guidance and editing.

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# APPENDIX 1: Daily Log Sheet

Date:	Day	Month	Year		Coverage Code:	
			2006			

**Effort:**

Observer	Code	Hours	Comment

Visitors:

**Comments:**

**Banding totals:**

Category	Daily		Season	
	# Birds	# Species	# Birds	# Species
Banded				
Recaps				
Census				
ET				

**Weather:**

Condition	Sunrise	Census	Closing
Time			
Wind (Dir)			
Wind (Bf)			
Cloud (%)			
Temp, C			

Synopsis:

**Census:**

Start	Finish	Initials

**Net Hours:**

Net Numbers	Time open	Time Closed	Subtotal hours
Total net hours / 72:			

0.25 hr. intervals

**Unbanded Birds:**

Species	Time	Net	Age/Sex

**Highlight sightings:** Out of census area?





**APPENDIX 4: Daily Estimated Totals Sheet**

**Daily Species Totals**

Tatlayoko Bird Observatory

Date: \_\_\_\_/\_\_\_\_/06

Species	Band	Recap	Obs Field	Obs	Census	ET
Common Loon						
Pied-billed Grebe						
Horned Grebe						
Red-necked Grebe						
American White Pelican						
Great Blue Heron						
Tundra Swan						
Trumpeter Swan						
Canada Goose						
American Wigeon						
Mallard						
Blue-winged Teal						
Cinnamon Teal						
Northern Shoveler						
Northern Pintail						
Gadwall						
American Green-winged Teal						
Unidentified Teal						
Ring-necked Duck						
Greater Scaup						
Lesser Scaup						
Bufflehead						
Common Goldeneye						
Barrow's Goldeneye						
Duck Spp.						
Hooded Merganser						
Common Merganser						
Osprey						
Bald Eagle						
Golden Eagle						
Northern Harrier						
Cooper's Hawk						
Sharp-shinned Hawk						
Northern Goshawk						
Unidentified Accipiter						
Red-tailed Hawk						
American Kestrel						
Merlin						
Peregrine Falcon						
Ruffed Grouse						
Sora						
American Coot						
Killdeer						
Sandhill Crane						
<b>Subtotal</b>						

**Daily Species Totals**

Tatlayoko Bird Observatory

Date: \_\_\_\_/\_\_\_\_/06

Species	Band	Recap	Obs Field	Obs	Census	ET
Greater Yellowlegs						
Solitary Sandpiper						
Spotted Sandpiper						
Wilson's Snipe						
Wilson's Phalarope						
Bonaparte's Gull						
Herring Gull						
Unidentified Gull						
Black Tern						
Rock Dove						
Mourning Dove						
Great Horned Owl						
Barred Owl						
Northern Saw-whet Owl						
Common Nighthawk						
Calliope Hummingbird						
Rufous Hummingbird						
Belted Kingfisher						
Red-naped Sapsucker						
Red-breasted Sapsucker						
Downy Woodpecker						
Hairy Woodpecker						
Black-backed Woodpecker						
Three-toed Woodpecker						
Pileated Woodpecker						
Red-shafted Flicker						
Flicker Integrate						
Olive-sided Flycatcher						
Western Wood-pewee						
Alder Flycatcher						
Least Flycatcher						
Hammond's Flycatcher						
Dusky Flycatcher						
Pacific-slope Flycatcher						
Empidonax Spp.						
Say's Phoebe						
Northern Shrike						
Cassin's Vireo						
Warbling Vireo						
Red-eyed Vireo						
Gray Jay						
Steller's Jay						
Clark's Nutcracker						
American Crow						
Common Raven						
Horned Lark						
<b>Sub-total</b>						

**Daily Species Totals**

Tatlayoko Bird Observatory

Date: \_\_\_\_ / \_\_\_\_ / 06

Species	Band	Recap	Obs Field	Obs	Census	ET
Tree Swallow						
Violet-green Swallow						
North. Rough-winged Swallow						
Bank Swallow						
Cliff Swallow						
Barn Swallow						
Black-capped Chickadee						
Mountain Chickadee						
Chestnut-backed Chickadee						
Red-breasted Nuthatch						
Brown Creeper						
Winter Wren						
Marsh Wren						
American Dipper						
Golden-crowned Kinglet						
Ruby-crowned Kinglet						
Mountain Bluebird						
Townsend's Solitaire						
Swainson's Thrush						
Hermit Thrush						
American Robin						
Varied Thrush						
American Pipit						
Gray Catbird						
Cedar Waxwing						
Bohemian Waxwing						
European Starling						
Tennessee Warbler						
Orange-crowned Warbler						
Yellow Warbler						
Yellow-rumped Warbler						
Townsend's Warbler						
Blackpoll Warbler						
Magnolia Warbler						
American Redstart						
Northern Waterthrush						
MacGillivray's Warbler						
Common Yellowthroat						
Wilson's Warbler						
Unidentified Warbler						
Western Tanager						
Spotted Towhee						
Chipping Sparrow						
Vesper Sparrow						
Savannah Sparrow						
<b>Sub-total</b>						



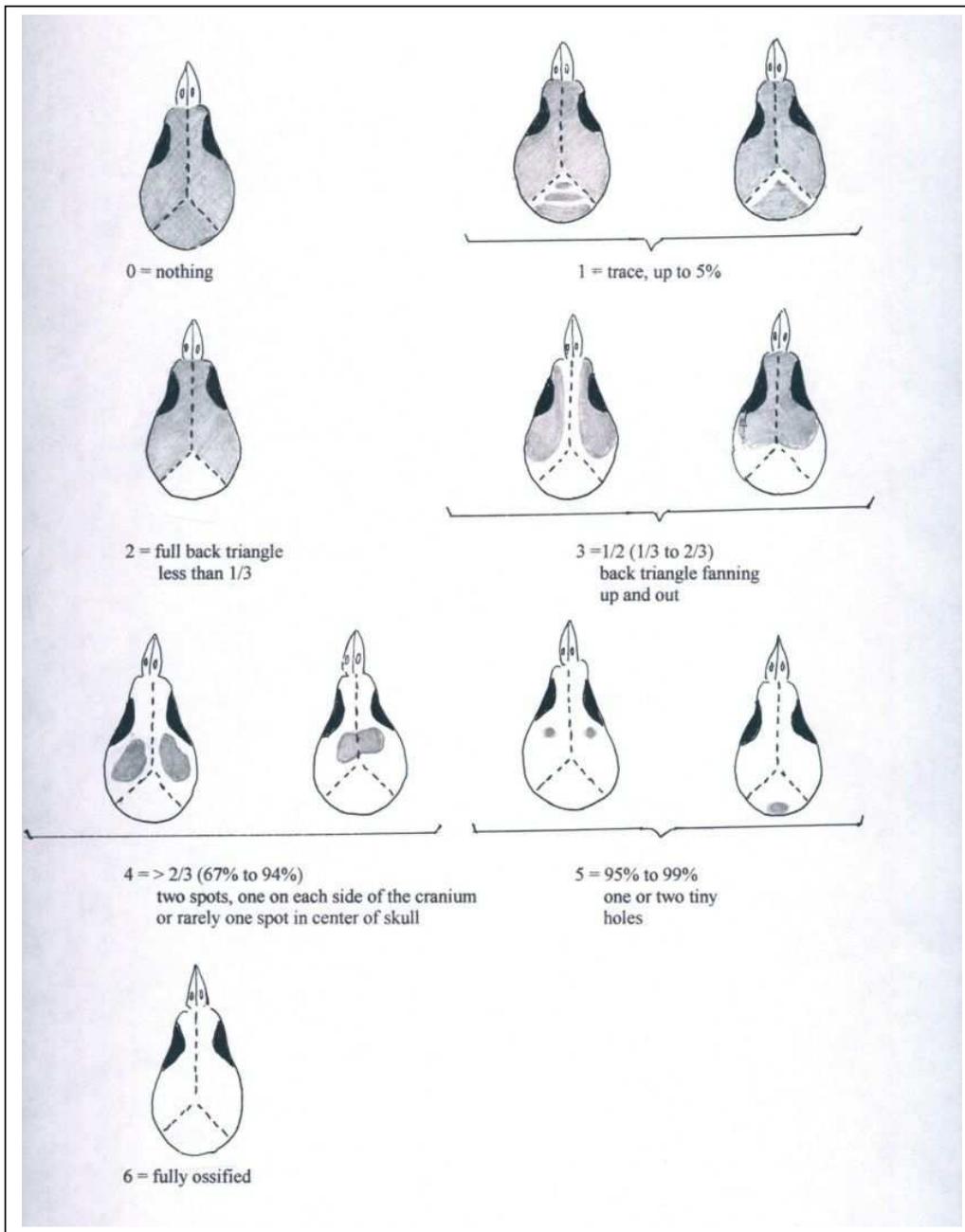
**APPENDIX 5: Empidonax flycatcher key**

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

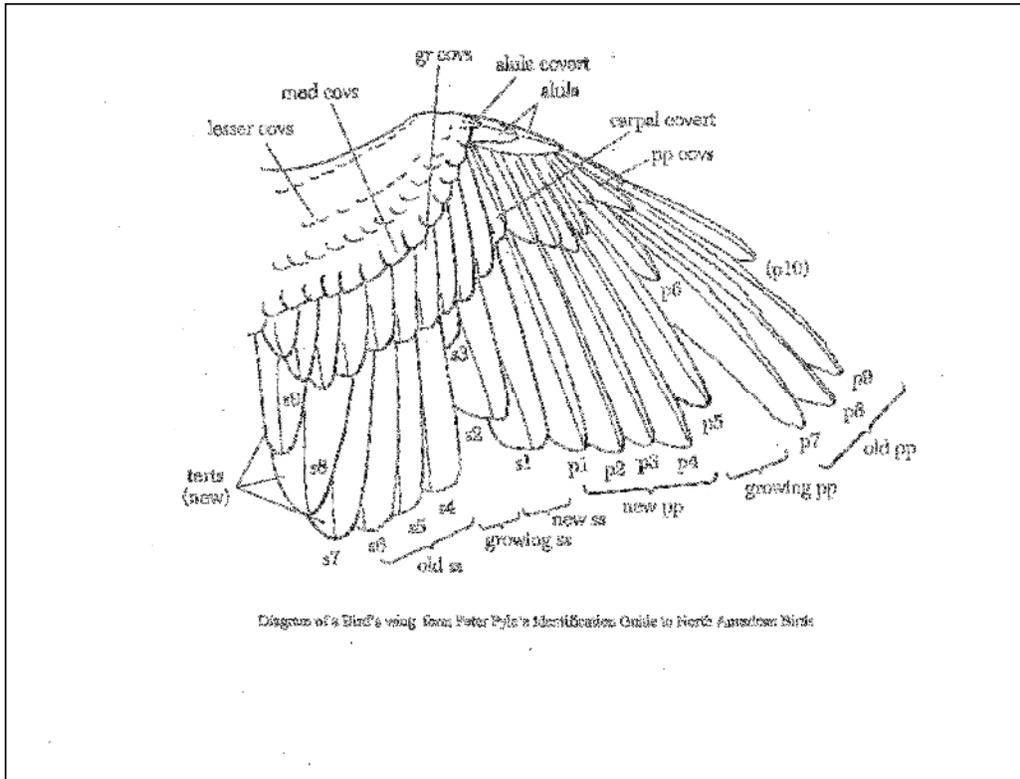
	Upper parts	Eye Ring	Leg Color	Moult	Lower Manible	Bill from Nares	Bill Width	p6 emarg?	Wing Cord	Tail Length	Wing - Tail	p9 - p5	p6 - p10	p10 - p5	Longest p - longest s	Longest p - p6
<b>Trail's (Alder or Willow)</b> (page 224)	Brownish olive to green	pale, absent or incomplete	blackish		yellowish-pinkish	<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
<b>Least</b> (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
<b>Hammond's</b> (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
<b>Dusky</b> (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
<b>Yellow-bellied</b> (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
<b>Western</b> (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 6: Skulling key (from Pyle et. al. 1997)**



## APPENDIX 7: Passerine wing morphology



## APPENDIX 8: Banding codes

	<b>SEX</b>		<b>STATUS CODES</b>			
	Unknown	0	Code	First digit	Second & third digit	
	Male	4	200	Transported (see manual for details)	USGS band	
	Female	5	300	Normal bird	USGS band	
			301	Normal bird	USGS band + color leg band	
			308	Normal bird	USGS band + temporary markers (e.g. paint or dye)	
			318	Normal bird	USGS band + blood sample taken	
			319	Normal bird	USGS band + blood sample taken + auxiliary marker(s)	
					USGS band + two or more auxiliary markers	
<b>AGE</b>	<b>HOW AGED AND SEXED</b>		325	Normal bird		
Unknown age	Plumage	1	500	Sick, exhausted, injured (old or new), crippled, or with physical deformity, held < 24 hrs	USGS band	
After hatch year	Skull	2	700	Rehabilitated and held > 24 hrs	USGS band	
Hatch year	Eye color	3	800	Held > 24 hrs for experimental purposes	USGS band	
Local (nestling)	Wing length	4				
Second year	Cloacal protuberance	5				
After second year	Brood Patch	6				
Third year	Molt/bill color	7				
After third year	Culmen length	8				
Other (specify)	Other (specify)	9				
	<b>BREEDING CONDITION</b>		<b>FEATHER WEAR</b>			
<b>Brood Patch (BP)</b>	<b>Cloacal Protuberance (CP)</b>		None	0	Moderate	3
None	None	0	Slight	1	Heavy	4
Smooth	Small	1	Light	2	Excessive	5
Vascularized	Medium	2				
Heavy	Large	3				
Wrinkled						
Moulting						
			<b>MOULT</b>	<b>FAT</b>	<b>SKULL</b>	
			No	0	None	0
			Yes	1	Trace	1
					Light	2
					Half	3
					Full	4
					Bulging	5
					Greatly bulging	6
					Very excessive	7
					None	0
					Trace	1
					Less than a 1/3	2
					Half	3
					Greater than 2/3	4
					Almost complete	5
					Fully Complete	6
					Invisible	8