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The Golondrinas Handbook: A Guide for Field Workers with *Tachycineta* Swallows

Welcome to the Golondrinas Handbook and to *Golondrinas de las Americas.* This document is the distillation of many years of experience working with the breeding biology of *Tachycineta* swallows. Though most of this experience comes from work with *T. bicolor* in Ithaca, NY, we are soliciting feedback and suggestions from *Tachycineta* workers over much of the Western Hemisphere. This is a work in progress, and if you have any experiences that you think could improve the material here or its presentation, PLEASE e-mail Erin Eldermire (erb29@cornell.edu) with any and all comments and suggestions.

An Overview of a Golondrinas Season

It is important to think of a Golondrinas season as being made up of many individual nesting seasons. Each female in the population will bring to her breeding attempt a different set of inherited properties and a different set of experiences leading up to the current breeding attempt. Most importantly for the biologist, females may vary greatly in the pace of nest building and in the date of egg-laying. Thus, one cannot plan on going out, for instance, and banding all the chicks in a Golondrinas plot on one specific day. Rather the chicks can only be banded within a window of days that varies according to the timing at each nest. Thus, we think of a Golondrinas season as being composed of a great many individual nesting attempts, and our data gathering and recording are structured to reflect this fact.

There are a few key dates that summarize the female's breeding phenology and serve as temporal anchors to which all of our observational activities will be tied. The first of these, the clutch initiation date, is the day the first egg is laid. Up until the clutch initiation date, nests are usually checked at least every third day. If possible, we often check the nests every day while the females in them are laying. Then, at the end of laying, we check for the clutch completion date (the last day that a new egg appears in the nest). After clutch completion, nest checks can be less frequent, until near the projected hatch date. Around hatching, the rate of nest-checks often goes up so that a good measurement of the nest's hatch date (the date the first chick emerges from an egg) can be gained. Then, depending on how much growth data is to be collected, the nest is checked periodically during chick development until nestling day 12. From then on the nest is not opened at checking, and we peer at intervals into the nest hole with mirrors or fiber-optics until we get measures of the day the last chicks fledge from the nest. The following is just one example of how the activities planned at each of the nests in an area might be planned for a season.

Checking nests pre-laying

What do the nests look like?

Tachycineta nests are usually made of dry grasses or bits of other dried vegetation. They very seldom use twigs or sticks. And, if available, they line the nest with lots of feathers from other species: usually large feathers with the shaft of the feather placed down along the edge of the nest cup.

How do I check the nests?

This depends a good deal on where you are and whether the boxes are on land or over water.

We sometimes have problems with wasps building nests in our boxes. The best way to deal with wasps is not to let them get ahead of you. If you have wasps with a substantial nest on the first nest-check of the season, let us know, and we'll figure out a solution with you. If not, the best strategy is just to remove wasp nesting activity during every nest visit. On the first nest-checks of the season, as you approach each nest, watch for any sign of wasps flying into or out of the box. If there are not many wasps in a box, use a stick to remove any wasp nests being built on every visit. If there are wasps in a box, it is often much safer to return at night when the insects are less active.

If you are working from a canoe by yourself, get a piece of cord, tie one end to the side of the canoe, and put a hook of some kind on the other end. Then, when you paddle up to a box's pole, put the cord around the pole and hook it back to the canoe or cord to secure the canoe. Bungee cords are also a good and easy to find solution. They can be moved along the gunwales depending on the boat's orientation with the box door, and, due to their elasticity, can keep the boat snug with the pole, providing a little more stability. If there are two of you in the canoe (probably better for at least the first few nest checks), then one can hold the canoe in position while the other looks inside.

To get into the box, remove the inclined keeper nail (if it is rusty, you may need to use a pair of pliers to pull it out), on the lower right or left side of the front panel of the box (it should be drilled through the side that is longer). Hold onto the nail so you can put it back when you are done! (It helps to have some extra nails with you during the season, as nails are sometimes lost from the box and from the wig-wag trap.) Then slowly lift the bottom of the side panel that you have just released to look inside. If there is a bird inside, quietly close the box and make a note to come back after a bit (on the same day) to check the nest contents. (We try not to handle the birds until after their clutch is complete, and birds during laying are seldom in the box after about 8:00 a.m.) If there is no bird inside, then open the box-side all the way and inspect the nest to see what is going on. Use the codes detailed below to describe the nest contents.

How do I record data?

You will either be using a data sheet generated by EXCEL to record your data, or you will record it in a "Rite in the Rain" notebook. We strongly recommend the latter, and, assuming you have 100 boxes to check, you can set up four double-page charts in the notebook to contain the nest data for this year. In front of the pages you will use to record

data, in the first page of the book, put your names, initials, and contact numbers. This first page is a record of all the people that did a nest check in that book for the season, so, if you are starting in with an already active nest-check book, be sure to add your name and initials in the first page the first time you do a check with a nest-check book. Also, somewhere on the first page, include the name and contact numbers (phone and e-mail) of the responsible person to whom the book should be returned if lost and found. Then make the two-page charts by listing the box numbers ***in the order that they are most efficiently checked*** down the left-hand side of the left pages and leave space at the top of each page for the dates, times, and observer initials (for each check) at the top of each column (from left to right across both pages). You may have to draw in column lines (about 2 cm apart). When you begin checking the nests, enter initials (for all observers), date and start time at the top of the column and then fill each space in the grid with the relevant code for each nest. When you skip to the next page of checks enter the current time at the head of the column and carry on. When you get to the end of the nest-check enter the time that check ended at the very bottom of the column in the last row. For an example of how a field book should look, see "examples of field notebook entries" on page 9, below.

If you are using data sheets, be sure to write in your name, initials, and contact info as well as the start and end times for each check. It is important that everyone on your team know who did a given nest check and how to get in touch with them if there are any questions. Use pencil for all field notes and every two weeks make two photocopies of all the data pages and place one copy in a safe place in the field lab and send the other to another lab or scientist for safe keeping.

As you continue doing nest checks, you will eventually fill up the eight-page block with the original grid. When you do so, re-create the grid in the next section of the notebook. Not only is this method of recording data more efficient (you don't have to write down dates, times and nest-numbers so many times), but it helps you to remember the most efficient order in which to check the nests. Most importantly, with this method you can tell at a glance where you stand with the whole nest-box population: which nests have eggs or chicks, or should not be checked because of wasps that haven't yet been dealt with, or chicks that are older than 12 days and can't be disturbed, etc. This method of notation will allow you to <u>avoid opening boxes if the chicks in them are older than 12 days and have not yet fledged.</u> It is a very depressing experience to have chicks flutter from their nest to the ground or water, and to continue doing so when you put them back in the nest. Avoid premature fledging, and don't handle the chicks after day 12. (Note: We site 12 days for *Tachycineta bicolor* but this may differ for some species which fledge at later dates.)

When monitoring boxes with chicks > 12 days old, boxes must be handled cautiously to avoid premature fledging. After day 12, don't visit the nest until day 25 to be sure that chicks aren't forced to fledge. The visit at day 25 will be a final nest fate check. In the interim, it's a good idea to keep an eye on the box while in the field to notice parents guarding or entering the box to make sure it is still active. To conduct a fledge-check, either look through the hole with a fiber-optic scope or dental mirror and flashlight, or <u>very</u> carefully cover the hole with your hand and crack the door open just enough to peek inside to see if the chicks are still there. When you are convinced that all the chicks in the nest have fledged (or died), *slowly* open the box to be sure. If you see any movement or bright eyes looking back at you, shut the box immediately and come back on the next day. If there are no live chicks remaining in the nest, open it up and search through the nest contents for any dead chicks. Record the number dead ("cx"

followed by the number dead is the code), and if they have any bands on them, record the band numbers before you drop the corpses into the lake or throw them on land well away from the box (these chicks near fledging are usually too rotten to save, but if one is still in good shape, then return it in a labeled (nest number, date, collector's names) zip-lock bag to the lab freezer). At the same time, you can recycle all the nest contents into the lake or onto the surrounding ground as well.

We use the same code (cx) to deal with chicks that die long before fledging, removing any dead chicks to the lab freezer or to a place distant from any boxes. *One thing to be sure of though, especially far from the equator, is that the chick is actually dead before you dispose of it.* During a cold snap, chicks can be left for a day or so by the parents and still fledge in good shape, and they can be very cold to the touch during this period of parental inattention. We suggest that you not remove dead chicks during a cold snap, then, on the next nest check, when temperatures have returned to normal, remove any chicks that are clearly cold and lifeless. If you have a reason to collect the dead chicks as freshly as possible, just be sure that the cold ones show no signs of life after being warmed in your hands for at least two minutes.

Codes for nest-checks

Nest Building

If there is **nest material** in the box and no eggs or chicks, we describe the (1) **amount**, the (2) **degree of construction** and the (3) **numbers of feathers in** and **out of the nest cup** with a four-number code, each number of which is separated from the next by a period.

(1) The first number is the estimated height (in cm) of the nest material from the nest-box floor. Using a centimeter rule (most notebooks have one printed on their cover—if not, pencil one in on yours), measure the distance from the floor to the approximate mean level of nest material along the box walls. Because the nests are usually higher in the corners, this often amounts to a height about 1 cm less than the maximal height of nest material. When nest construction is just beginning, the code TR can be used to indicate traces of nest material found in the box before an actual mass with any shape and at least 1cm. tall accumulates. Traces do not need a grade for degree of construction; if there are any feathers, they should be noted.

(2) Next, on a 4-point scale, judge the degree to which the nest cup is formed.

0=totally flat top to nest

1=slight depression in nest center and nest material piled up a little along walls

2=well formed nest cup with some lining, but a lot of stray pieces of vegetation in the cup

3=well formed deep cup with a uniform shoulder and very few pieces of vegetation loose in the cup

4=beautiful deep cup with steep uniform shoulder and no stray vegetation in cup.

You can xerox *Figure 2* and take it in the field (we trim it and fasten it to the back cover of our field books) with you to make sure you are getting the nest codes right…

(3) Count or estimate the number of feathers lining the nest cup. That's the third number. And the number of feathers anywhere outside the cup is the fourth. It is not worth the disturbance it would cause to rummage through the entire nest to find every last feather,

just try to estimate to an accuracy of five or better. A feather is within the nest cup if an egg or chick in the cup would have a good chance of touching part of the feather.

This coding will seem very bulky at first, but you will soon understand that a code of 9.4.25.0 is a bird with a really big nest in which the tight deep cup is lined perfectly, with all 25 feathers in the cup, whereas a 3.2.5.10 is a smaller nest with loose material and more feathers out of the cup than in. Whenever there is any ambiguity of what the numbers in the code refer to, it is important to use the periods to make the codes absolutely clear.

Egg Laying

Once eggs appear in the nest, we don't describe the nest anymore; however, we continue counting feathers (both inside and out) at the following stages: (1) clutch initiation, (2) clutch completion, (3) chick hatching and (4) chick banding. On any of these occasions, the estimated number of feathers is recorded after a lower case "f" and the number in and out of the cup separated by a "/". If you are using nest-check sheets, the numbers of feathers can be recorded in the appropriate columns, and all codes for eggs and chicks are to be written in the footnote ("ft note") column.

We count eggs in the nest, and record their number right after the upper case letter "E". If have to begin your nest checks before 9:00 AM (the presumed latest time females lay eggs), please note the time when you checked the nest. We also place one of the eggs to our cheek or upper lip to check its temperature and write "warm" (or "wm"), "luke" (for moderate or lukewarm temperature), "cool" or "cold" accordingly. Because incubation does not usually start until the penultimate egg is laid, seeing an "E1 cool" in the data is of much less concern than seeing an "E5 cool"...

Some of you may choose to weigh eggs. Eggs should be weighed on the day they are laid or before incubation begins. Weigh eggs on a scale protected from the wind and mark each egg to ensure you don't reweigh eggs. Eggs can be marked **gently** at the blunt end using the side of a pencil.

To protect eggs, a cotton-lined container is a good idea to prevent damage while handling eggs. Tupperware, short cylindrical nut cans, and ½ dozen egg cartons lined with cotton all make good containers. If an egg is damaged with a small hairline crack, a small amount of nontoxic school glue on a q-tip spread thinly over the crack shortly after the damage is done can help prevent the egg from desiccating and aborting (but being very careful with the eggs is obviously the best protocol).

During and After Hatch

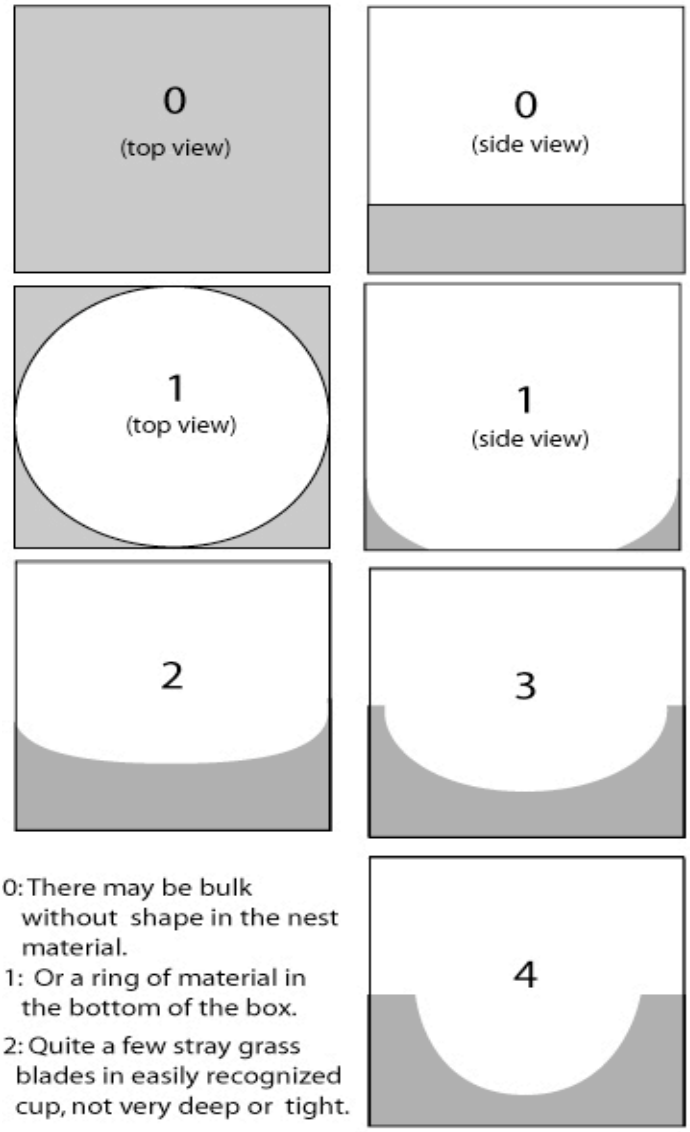
Once the chicks start to hatch, we record their number after the lower case letter "c". We count both eggs and chicks in the nest at the same time, noting both the number of eggs and the number of young. If you have been marking eggs, note which eggs remain, in the format $E2_{1,5}$. This indicates two eggs remain and they are marked 1 and 5. For chicks, write their number and put their age if you know it. For example, $c3_{1\text{-}2}$ = three chicks of 1 to 2 days in age. If this is the first visit to a hatched box, estimate the number of feathers in and out of the nest cup, so a record of "E2 c3 f25/5" is likely just in the process of hatching (remember that we record feathers at hatch!), but a nest that had that same code for more than a few days probably just had two eggs that are never going to hatch, and the best estimate for the nest's hatch date is somewhere between the last all-egg check for that nest and the day that chicks were first seen there—the conditions of the

chicks when they are first seen in the nest can sometimes help get a better estimate. On rare occasions, especially in the temperate zone, bad weather will cause the parents to abandon their nests temporarily. If any of the chicks you are checking look listless or weak, pick one up and see if it is cool to the touch. You can then write "cool" next to the chick number, and we will know that those chicks are having problems. On a day when cool chicks are encountered, you might also write "warm" for those that seem fine, but in all other cases we don't bother to estimate chick temperature. If you encounter dead chicks, record them in the book (the code is "cx" plus the number dead), and take them back to the lab freezer in a zip-lock bag with the species, nest number and date recorded in pencil on a slip of paper in the bag. If the chicks are cool and less than about 8 days old, be SURE that they are dead before collecting them. Chicks at this stage can have very low body temperatures and evidence no activity, but if the weather improves and the parents return to feed the chicks, they can recover completely and fledge successfully. To be sure cold young chicks are dead, just hold them sheltered in your warm hands for a few minutes and see if they start to move! In general, if in doubt, leave the chicks in the nest until warm weather returns.

It is very important that nests not be opened after the chicks in them have reached day 12. To note in the nest-check book that a nest should not be checked on a given day, you can put a simple "." in the nest-check column for that nest ahead of time. We also use "." to designate any nest that was not or should not be checked for any reason. If there has been nothing happening in a box for a long time, you can place these dots ahead of time and this can make nest checks much quicker if all you need to do is check the boxes without dots. *You need to be very careful, however, to be sure to check on all boxes at least once a week*, as birds can build a complete nest and start laying in that amount of time. So, don't get carried away with the little dots! Oh, and here are a few more symbols for the notebook. The code for an empty nest-box is simply a long dash, "–". An equals sign, "=", can be used if the condition of the nest hasn't changed. Entries for clutch initiation, incubation start, hatch date, mortalities, and fate date should be circled so they can be easily found and entered into the database without missing or forgetting any points. Once these landmark data have been entered into the database a check-mark (best with a colored pencil) should be placed next to it in the nest-check book to indicate that the data have been entered.

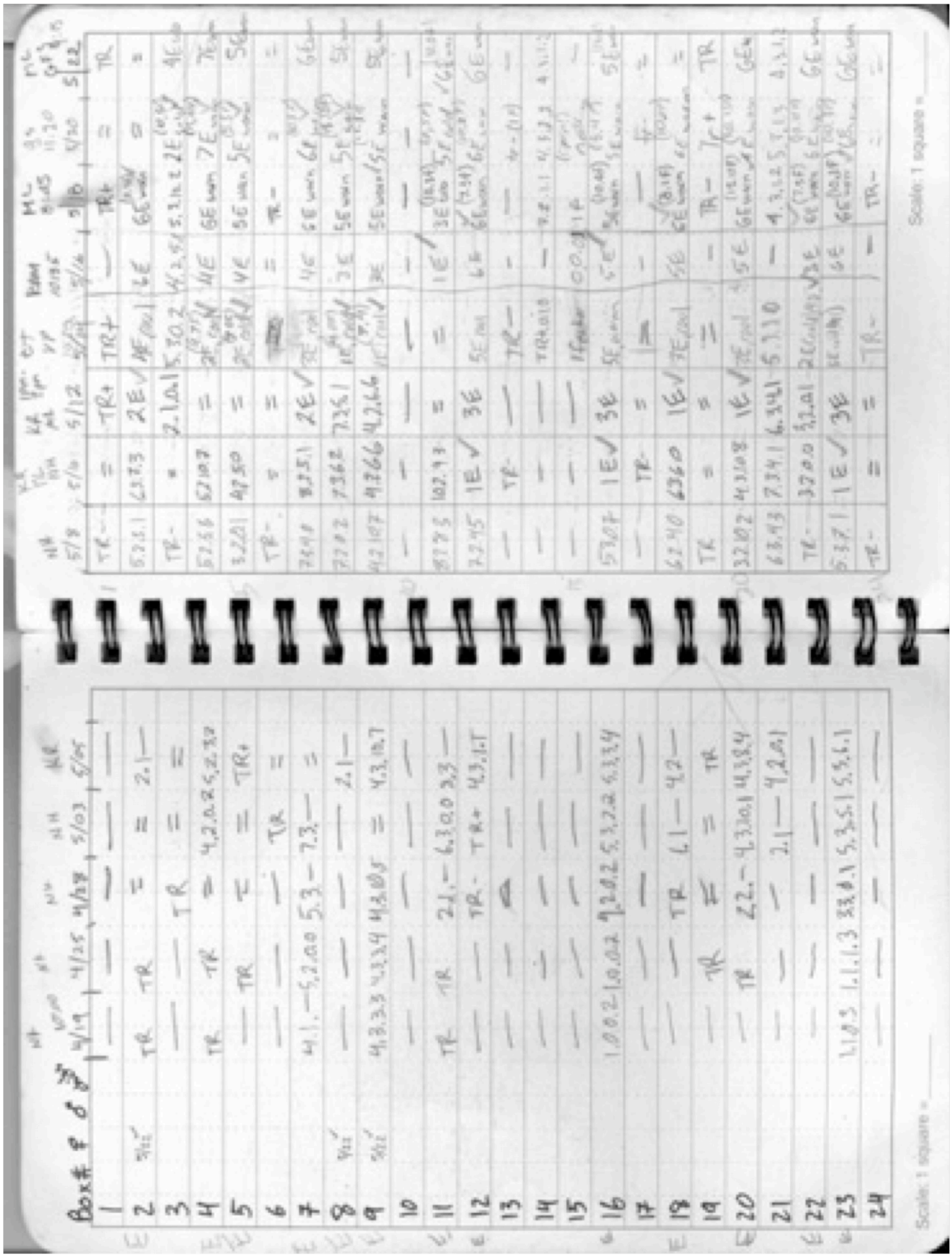
The following figure can be printed out and copied and pasted into your field book to help remember the codes.

Cup status and amount of material are independent.
"tr.0.1.1" and "tr.1.0.0" are not rare.



0: There may be bulk without shape in the nest material.
1: Or a ring of material in the bottom of the box.
2: Quite a few stray grass blades in easily recognized cup, not very deep or tight.
3: Only a stray grass or two in cup, deep but not tight.
4: Not a grass out of place in cup, deep and tight.

Example of Field Notebook Entries



Trapping and Processing Adults

The Nest Box as Bait

Being able to trap adult birds is crucial to the Golondrinas study: this is the basis of all mark-recapture methods of estimating return and survival rates, and it allows us to measure known birds and take various biological samples from them. Cavity-nesting birds are much easier to trap than open-cup nesting birds, since we can use the actual nest box as our "bait."

A nest box has the following advantages:

We know where the nests are.

The nest box gives us a physical mechanism to trap the bird safely. *Tachycineta* will move in and out of the box during the nesting cycle, making it easy for us to trap them.

The birds are very reliant on the nest-box resource. When out foraging or when disturbed, they generally want to get back to that nest and the eggs/chicks within as soon as possible.

How Do Birds React When Trapped?

Swallows, especially females, tend to crouch in the nest when trapped, and are very docile in the hand. Don't worry about the occasional noisy bird as a loudly calling bird is generally not one that is having serious physiological problems with being handled (it is not experiencing exhaustion or shock!). Band the bird as smoothly and efficiently as you can. However, remember that it is better to take a little longer and do the job right, than to try to be fast and have a problem such as an overlapped band. Also, the easiest way to injure a bird in the hand is to handle it too loosely, thus letting the bird break free. This would not harm the bird if it were not for the fact that many of us are inclined to grab at the bird to try to catch it before it completes its escape, and it is in the act of grabbing a bird about to fly that wings and legs can be injured. Avoid this potential problem by using a firm but gentle grip at all times. Most people are surprised to feel how robust and resilient swallows really are in the hand.

When an adult is picked up off the nest, it often "makes a fist" with its toes, commonly grabbing nest material and/or chicks when it does this. It is important to lift the bird straight up from the nest a few centimeters, and gently, with your other hand, replace nest materials and/or chicks in the nest before removing the adult from the box. Be gentle when you remove an adult from a box with young chicks as the toes can pierce the skin of the nestlings.

When to Trap

Females

For most *Tachycineta* species, the best time to trap adult females is during late incubation (after incubation day 8), the time when the female sits most tightly and can most easily be captured without the need for a trap. However if the weather is cold, be careful not to trap

too much earlier than the 7th or 8th day of incubation or some of your birds will abandon. We know this technique works well for *bicolor, thalassina* and *albilinea*, but it appears that it does NOT always work without abandonment for *leucorrhoa* and perhaps other species that are especially prone to desertion. For such species, and for any species for which information is lacking, it is probably safer to limit trapping of both males and females at first to the chick period. Even for the more disturbance-resistant species, *avoid disturbing the nest box during the laying period* and during the first couple of days of incubation. For the more tolerant species, once incubation is into the seventh or eighth day, it is usually safe to trap the females without risk of abandonment.

Careful nest-box monitoring will make it easier to schedule your trapping. By checking your nest boxes regularly, you will be able to determine the period when the female is laying and when she begins incubating.

For example:

You check a box on Saturday afternoon and find two eggs. Using the "songbirds-lay-one-egg-per-day" rule, you can assume that the clutch should be complete by Tuesday or Wednesday, given that a swallow clutch most commonly consists of 4-6 eggs. You check your box on Tuesday afternoon, and sure enough, there are 5 eggs. Female swallows usually begin to incubate the day before the last egg is laid.....but the female is nowhere in sight. Thus, it seems that the clutch might not yet be complete. Two days later you check the box in mid-afternoon, and the female flies out as you approach. You find six eggs in the nest. Since eggs are laid in the early morning hours, the presence of the female at this hour plus the fact that only one more egg was laid in the two days since the last check indicates that incubation has begun. If you give the female another six to seven days undisturbed, then you can trap her in the box with minimal risk of nest abandonment.

Once incubation is in full swing, the most efficient time to trap the females is early in the morning. They will be incubating the eggs all night, and near dawn many will not yet have left the nest box to feed. Even if you do not catch them before they have terminated their over-night incubation bout, the cool temperatures near dawn are a strong incentive for the female to spend most of her time on the eggs, making her easiest to trap at this time. If you have a particularly wary female, however, you may need to resort to one of the methods described for males. Getting to the nest boxes a little bit before dawn is a good idea for capturing because you may get a two-for-one deal, capturing the male as well (if they roost in the box, they tend to leave very early in the day). This could potentially save you hours of work trying to catch the male later on. You have a limited window during this time, so if you have multiple birds to capture, it is better to place birds in labeled bird bags before taking measurements, and just go on to the next box; you can then process all the birds at one time in one location at your leisure, without trying to rush before the other birds have left the nest. This also means multiple technicians can split up to capture birds and meet back together to have one person measuring and the other recording, in a spot with potentially better light, fewer bugs, drier land etc.

Males

In general, males of all species are warier than the females. Smooth and efficient trapping is required, for if you have a failed trapping attempt, the male will be that much more difficult to trap the next time you try.

All male *Tachycineta* can be trapped either when they are actively feathering the nest (most feathering is accomplished during incubation) or after the eggs have hatched and they are busy making trips to feed the young. About mid-way in the chick-feeding phase (chicks 5 to 10 days old) is best, since the feeding rate is higher at that time than when the chicks are younger. The males of some species (at least *albilinea* so far) roost in the nest with the female before laying, and we have had good success trapping both sexes at that time without abandonment.

When Not to Trap

If you haven't monitored your nest boxes on a regular basis, you should be able to predict when to leave your boxes alone with even one key date. Use these formulae to predict when it's too late to check a box:

Clutch Completion Date + 12 to 14 days = Hatch Date

Hatch Date + 13 Days = Chicks too old to disturb

When the chicks reach 13 days of age, it's time to leave the box alone. Any disturbance after this age could result in premature fledging. Once the chicks have left the box, even if they are too young, it is next to impossible to put them back in the box and make them stay put.

Complete your trapping activities at least two hours before sunset. The birds need time to re-adjust after being disturbed. This two-hour window should give them enough time to "smooth their feathers" and settle back into parental routines at the nest before dark.

How to Trap

Females

To trap the females, simply walk, or paddle, very quietly up to the nest box and cover the entrance hole with your hand. It helps to move downwind to minimize the sound of you approaching. Trapping on a windy day will also increase your success. A quiet approach is the key. Practice walking by putting your toe down first, followed by your heel. Once you have the bird trapped within the box, you can slowly open the box just enough to reach your hand in (don't open the box all the way), and quietly reach in and pick up the female. You will have to "feel" which direction the female is facing and gently pick her up so that her head is between your index and middle fingers. Typically, females don't try to fly out of the box; they crouch and flatten themselves on the nest to avoid being seen. Usually they can be picked up without fuss. This is by far the least stressful and easiest method for trapping females. Be careful not to damage any eggs in the nest when picking up a bird that is crouched down in the nest. If possible, keep the female from defecating on the eggs. You can do this by (1) removing the female as soon as possible and (2) attempting to orient her cloaca away from the eggs as you pick her up. The acidity of the feces can sometimes seep into eggs and reduce their hatchability. Very rarely, when reaching in to pick up a bird in the box, the bird will make an effort at escape by flying out between your hand or arm and the side of the nest box. Do not try to grab the bird on its way out of the box. This is how birds get hurt. If a bird starts to escape, let it go.

Many times when you suspect that a female is incubating, a male will be standing sentry nearby. If the male suspects something is up, he will give an alarm call, and the female

will leave the nest box, thus spoiling your capture attempt. If a male is around and you are trying to catch the female, a good way to trick the male is to pretend you aren't interested in the nest box or the birds at all. Look at the ground, walk nonchalantly (but quietly!), look at a flower, but don't look at them. Use a mirror so that you can look the other way and still see what's going on at the nest box. Sometimes you can deceive them and not raise their suspicions.

Males

Males, being generally warier than females, are more difficult to trap. Therefore, we have devised some methods to outsmart them; but if a trapping effort fails, the male will often be even harder to trap the next time. Once you have a male trapped in the nest box, the procedure is the same as for females: open the box just enough to slide your hand in, feel where the bird is and which direction it is facing, and gently pick him up with his head between your index and middle fingers. If the bird successfully squeezes past your hand to make an escape, let him go. Remember that the bird's welfare always comes first.

Nest-Box Traps

Nest-box traps are barriers that prevent a bird from leaving the box, and are an easy way to trap swallows. Self-triggering traps are available, and we sometimes use them when we are keen to catch either member of the pair in a box, but we generally recommend a manual trap that allows you to be more selective in which bird you trap.

Internal Traps

A variety of internal traps will work effectively for trapping adults. One family of traps is triggered by an observer pulling on fishing line; this is the best trap if you need to catch a particular individual (the male vs. the female). The other type is a trap that the bird itself triggers when entering the box, so you will catch the first bird that enters.

Observer-triggered internal traps. These traps are placed in the nest box by opening the box and carefully tucking the trap between the wall of the box and the nest, just under the entrance hole. Be careful not to disturb the nest itself. A piece of monofilament fishing line, which attaches to the trap on one end and has a small loop in the other end, is fed through the entrance hole. Attach another length of monofilament line to the loop of the internal trap with a snap swivel. You can use a triangular piece of ¼" foam that wedges in the entrance hole or a round disk that completely blocks it. A wallet-sized plastic card also works very well. The type of trap you use can be a matter of personal preference, depending on the available materials, but note that each trap needs to be attached to the fishing line in such a way that it reliably obstructs the nest-hole when the line is pulled.

To catch the bird, you will need to move away from the nest box a fair distance—30 to 40 meters is usually enough. Make sure you have adequate monofilament line to do this. You will want an easy way to carry the monofilament line. A fishing reel works well, as does a short stick with the line wrapped around two nails or a drink can or water bottle. Also good are the plastic spools on which fishing line is usually sold. For many of these types of line storage, a rubber band around the spool to keep the free end of the line from tangling in other gear is very helpful.

Now, quietly wait for the bird you want to trap to fly into the box. If you've already banded the female, so much the better. The male may watch the female fly in and out a few times, and he will usually overcome any suspicions raised by your presence. Patience may be in order; some males definitely play a waiting game. When the bird you are trying to trap enters the nest box, pull quickly and vigorously with a long arm stroke on the monofilament line, remembering that monofilament line can stretch quite a bit when it is pulled. Be sure you use strong enough line to resist breaking (we use 10-15 lb. test line in the States).The trap should obstruct the hole with the bird safely in the box. While walking up to the nest box, *keep tension on the line*. If the trap slips, the bird can escape.

If you have a trap set and a bird perches at the entrance hole looking in, then out, then in, it may be because you are sitting too close or he/she sees the trap or the monofilament line exiting the entrance hole. Make sure your trap is set in the nest box "discreetly," and back further away from the nest. In some cases, it makes sense to leave the line and go work on another box for a while before trying again.

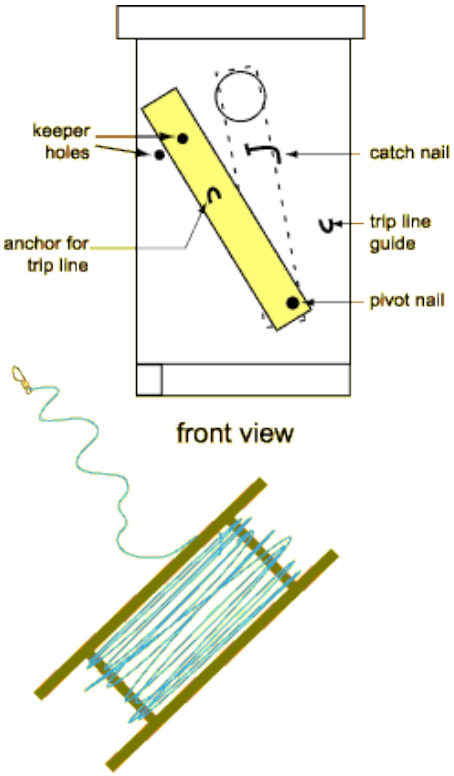
Caution: If the trap slips and the bird begins to fly out, LET THE BIRD GO! Putting tension on the line at this point could pin the bird halfway out of the entrance hole and result in serious injury to the bird. ***Never risk injuring a bird****.*

Bird-triggered internal traps. Another style of internal trap is a small hinged door that closes behind the bird when it enters the box to settle on the nest. The principle element

is a small (7 cm x 7cm) rigid, rectangular flap (plastic or Plexiglas) attached inside the box just above the entrance hole and propped open with a straight piece of dried grass stem. When the bird moves the grass, the door swings down and covers the entrance hole behind it. The flap can be attached with a strip of masking tape folded over the edge of the plastic and tacked into the wood above the hole.

Alternatively, you can create a springy hinge by using a rubber band with each end threaded through a hole at either end of the Plexiglas edge and hitched around the tacks.

A modification of the plastic flap where a central portion is cut out, leaving an upside-down 'U'-shape, can sometimes result in more than one bird caught, provided the opening is small enough not to allow passage out of the box. With this trap a second bird can peek in through the opening and enter the box, but not have a wide enough opening to leave (as the flap only swings inwards).



Using these traps can really speed up your catch rate as you can set up five traps in a row, then turn around and collect five birds without having to wait for any of them. BUT the drawback with this method is that it is not specific and you may catch the male when you mean to catch the female, **AND it is far too easy to leave a trap in a box, forgetting to retrieve it and dooming any parents trapped (and their offspring) to starvation**. Use of the hinge traps, or any style of trap that is left unattended, requires careful planning and recording. Without clear notes on the number of traps and where they are used, a trap may be forgotten and lead to the death of multiple birds. Flap traps can also be triggered by larger chicks, making this style less effective late in the nest attempt.

External Traps

An external trap, which resides on the outside of the nest box year round, is a good choice because the birds will already be habituated to the trap when you are ready to use it.

Sujay Kaushal, a former undergraduate in Wink's lab, developed a simple and very economic trap that we have mounted on all our boxes in Ithaca. This "wig-wag" Nest Box Trap is constructed of a strip of lathe wood and easily acquired and inexpensive hardware. Over time, the wood will weather to the same color as the nest box and become virtually unnoticeable. Install external traps before the breeding season begins. Once eggs are laid, it's best not to be hammering and drilling on the nest box!

As with observer-triggered internal traps, to operate the wig-wag trap you need to have a source of monofilament fishing line equipped with a snap swivel that allows you to sit 30-40 yards away from the nest box. The snap swivel is fed through a staple on the box and then hooked to a staple on the lathe wood. When the bird you want to catch enters the box, a quick tug on the line causes the lathe wood to cover the entrance hole. If properly installed, you do not need to keep constant tension on the line after closing the trap. The trap will stay closed until you reset it.

It is important that the trap never accidentally close and block the nest-box hole when not in use. If you decide to use wig-wag traps on your boxes, it is essential to install the safety keeper nail to prevent the trap from accidentally closing when you are not using it to trap birds. Excited trappers can also forget to open and secure the trap in place after catching the bird. Once you have the bird safely in hand, reset the trap open.

The Feather Trick

Bob Cohen first figured out that male *Tachycineta* can be trapped while the female is incubating by offering them a feather or two. *Tachycineta* nests are heavily lined with feathers, and most of these feathers are added during the incubation phase of nesting. Some males don't feed the chicks very often, leaving this task to the female. For this

reason, some males are best trapped with the feather trick during incubation. Females and males will both collect feathers for the nest. Feathers are a valuable resource, and "feather fights" by neighboring *Tachycineta* are not uncommon and very enjoyable to watch.

The feather trick is best used on a day with gentle winds. Select a short feather, 3 to 4 inches long. White or light-colored feathers with a small amount of down on one end, and a fairly stiff shaft seem to be preferred. The idea is to waft the feather on the breeze in such a way that the swallows can't help but notice it. Any self-respecting *Tachycineta* will not be able to resist it. Nine times out of ten, in areas with low nest densities, the target bird will grab the feather, fly directly to the box, and enter the box with the feather. When it does so, you can trip your trap. Unfortunately, this trick does not work so well where nests are at high density, as a feather grabbed in the bill by the bird you are trying to capture is very likely to change bills several times before it is finally taken into a nest by another swallow in the neighborhood.

Handling Adult Birds for Banding

Concern for the birds' well-being and effortless handling, including transfer from hand to hand, are the hallmarks of a good bander. These skills generally come with a fair amount of time and experience in the field. So here are some beginning guidelines that should help to insure the safety of birds in your care.

Temporarily Containing Birds

It is occasionally necessary to put the bird aside as you prepare to band it. Placing a captured bird in a bag immediately after catching it can allow you to prepare your banding and bleeding supplies with both hands, thus making the processing of the bird more efficient. One convenient way to temporarily contain a bird is with a bird bag. Bird bags are small, quart-sized cloth bags that have a drawstring or tie at one end. The bags are usually constructed of lightweight, breathable material to prevent the birds from overheating. Small brown paper bags also work well. Unlike cloth bags, which can be washed, paper bags can only be used a limited number of times. (It doesn't take long for bird bags, boxes, and holding cages to become soiled with fecal matter. Avian diseases can be spread through fecal matter, so be sure to wash bird bags or cages frequently. For many clean-up tasks, we find disposable wipes used for babies with diapers to be excellent). Another excellent and washable *Tachycineta*-containing "bag" is a knee high stocking. The stocking holds the bird snuggly and helps minimize struggling in a larger bag.

Birds in boxes, bags, and cages are unable to escape predators. They should never be left unattended unless the bander can be sure that there is no risk of harm by a cat, dog, rat, etc. Don't put birds in bags in places where they are likely to be stepped on or sat on! A brightly colored or patterned bag hanging from the drawstring (off the ground) helps to prevent this.

***Do not* leave birds in bags or boxes in the sun or inside a hot car.** Birds in this situation can expire in no time. Just a few minutes of confined conditions in the heat can cause extreme hyperthermia or death. When containing a bird, try to place bags in a cool, shaded area, and minimize the time you contain them.

Removing Birds from bags

When taking a bird from a bird bag or nest box, the whole bird should be grasped. Catching hold of a wing, a leg, or the tail feathers can lead to injury of the bird. Also, when an adult or nestling is picked up from a box or bag, it routinely "closes its toes," or makes a fist with its toes. It can grab material and/or chicks when it does this. It is important to gently remove whatever the bird may be grasping from its feet before lifting it out of the nest.

Holding Birds

Assuming that you are right handed, it usually makes best sense to hold the bird in the left hand and band and make measurements, take blood, etc. with the right hand. The safest default position for holding swallows is with the bird's back cradled in the palm, with the neck held between the index and middle fingers. This hold allows banding and the inspection of the ventral surface of the bird.

When measuring a bird, we rotate the bird so that its ventral surface is facing into the palm of the hand and the bird's body is aligned with the bases of the fingers. In this position, the swallow is held in place by the thumb held lightly on the bird's back and the ends of the wing feathers held by the ring and little fingers.

From this position, the bill+head measurement can be made by placing the thumb of the holding hand beneath the skull and lifting up slightly to raise the skull from the shoulders and create good access for the calipers to measure from the back of the skull to the bill tip. This same position can be used to hold the bird while measuring its flattened and straightened wing (see below). More detail is provided later about how to accurately measure bill+head.

Never directly squeeze or constrict the body or neck. The bird must be held firmly enough to prevent it from struggling, but care must be taken not to exert pressure on the body—excess pressures can interfere with a bird's breathing or cause internal injury. Gasping is generally a warning sign that the bird is being held too tightly or that the windpipe is being somehow restricted. From the start of their banding careers, banders should cultivate the habit of watching the breathing behavior of the bird in the hand. Death because of impaired breathing can occur with alarming swiftness but not before these danger signs have been exhibited.

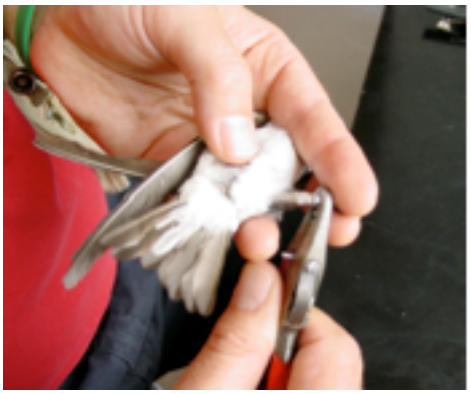
The tightness of grip must be learned by experience, but, even though we have emphasized the need to be gentle, most beginning banders err on the side of holding birds too loosely and birds can escape or nearly escape. It is easy for the bander to injure a bird with the quick reflexive movements associated with trying to secure an escaping bird. More birds are injured as a result of being held too loosely than too tightly. If banding is done indoors, escaped birds can injure or kill themselves by flying into windows.

Avoid applying pressure on the abdomen of females during the breeding season, when they may be carrying one or more quite well developed eggs in the oviduct.

In examining or measuring wings be particularly careful to not strain the wing-muscles or tendons of the wing joints. Spreading of the wing should be done with care, and any sudden jerk must be avoided. Swallows should *never* be held solely by the partially opened wings.

Immobilizing the Leg for Banding

To band the bird, immobilize a leg by gently grasping it with your thumb and third finger or thumb and pinky finger. Because swallows have such short tarsi, it is generally easier to hold the distal end of the tarsus (i.e. the "ankle" rather than the "knee"), either way the grip *must be gentle but firm.*

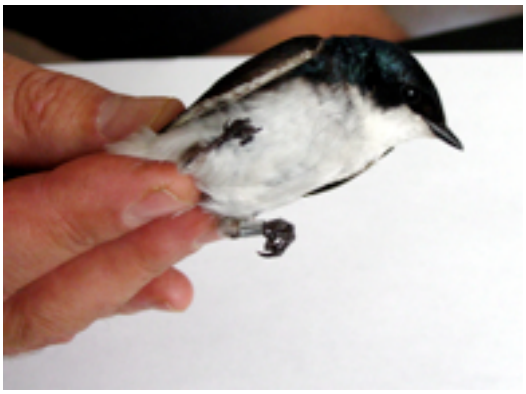


Beginning banders often concentrate so intensely on getting the band on the bird that they lose sight of how the bird is being held. *Always be conscious of how the bird is sitting in your hand*. Injury can easily occur when a bird's wing or leg is awkwardly positioned; the bird may struggle and get enough power to sprain or strain a limb. Make sure the wings are tucked behind the bird and lying in a normal position, and when manipulating the legs to band, maintain the legs in a natural position—not far out of line with the body and not pulled away from the body at a really awkward angle.

When banding birds, the hands should always be kept as dry as possible to avoid undue moistening or soiling of the feathers. Do not hold the bird in the hand for longer than is necessary and avoid prolonged handling, especially on hot days. If for any reason a bird has to be kept for longer than a few minutes, it should be placed in a darkened box or a bag.

Passing an Adult Bird between Two People

If it is necessary to pass a swallow from one person to another, the safest method is in a bird bag, but using the "ice-cream cone" hold can work well once you have begun to feel comfortable holding the birds. In this hold, all the fingers of the holding hand are placed in a circle around the belly, back and wings of the birds to securely hold the wings against the body and give the person taking the swallow a chance to get the neck and back cradled in the default hold before the person passing the bird on lets go.



Releasing a Bird

Never throw a small bird into the air to release it, for this allows it no opportunity to gather its senses. Open the hands and place the swallow on an open palm to allow it to take off on its own. Usually the bird will leave immediately.

Although most birds react minimally to handling and banding, occasionally when the time comes to release a banded bird it is reluctant to fly. This may happen for a variety of reasons. For example, some trapping methods, particularly during cold weather, are more likely to catch a bird when it is "out-of-sorts" or stressed than when it is healthy and alert, and the bird's lowered vitality may cause it to react adversely to being handled.

A bird that does not immediately fly when placed on an open palm may simply be "pulling itself together" and will soon leave the hand. If it is reluctant to fly, let it rest on the palm, and after a few seconds, it will usually take flight as soon as the palm is raised and lowered a bit. If, after a while, the bird doesn't fly away, it should be put in some sheltered place (for example, a tree branch or shrub), secure from predators, where it can rest for as long as it wishes before leaving. Usually the rest is a short one, and the bird disappears. If a note is kept of band numbers of birds behaving this way, one finds that recovery is complete and that on subsequent handling the bird generally exhibits absolutely no signs of stress.

Signs of Stress

A very small proportion of apparently normal healthy birds, which have been handled skillfully and carefully, may nevertheless react more acutely to handling and show signs of distress. The chances of shock arising are minimized by completing the banding routine as expeditiously as possible.

Banders should be watchful for symptoms of distress, whatever their causes. There are four telltale signs of stress:

-panting
-gasping
-closing eyes
-fluffing up of feathers

It is important to get in the habit of noting the bird's state when you first get it in your hand. Note the bird's level of alertness and calmness. These initial observations will give

you some baseline to which you can compare the bird's reaction as you handle and process it. It will allow you to notice any dramatic changes that may be stress-related in the bird's behavior.

Some individuals raise their crown feathers when held. This can be because they are stressed, or it can be because they are annoyed with you. If you notice the crown feathers rise, look at the bird's behavior more closely. If the bird is alert, and spunky, then all is well. If the bird is calm and quiet, it may be more difficult to determine whether it is feeling stressed. Often by gently stroking the bird on the head, smoothing down the crown feathers, you can assess the bird's level of alertness. If the bird does not seem alert or begins to exhibit other signs of stress, treat the bird as a stressed bird.

What Do I Do With a Stressed Bird?

If you notice a bird is stressed and you are almost finished banding the bird, quickly finish what you are doing and release the bird. If you aren't almost finished, just let the bird go. Remember that the welfare of the bird is of primary concern. We would rather lose an opportunity to band a bird than risk a dead bird.

Panting, gasping, closing eyes, and fluffing up feathers may all occur in perfectly healthy birds that fly normally on release. Nevertheless, you will occasionally have a bird that has shown one or more of these signs but is reluctant to fly upon release.

Chilling, even in mid-summer, may be a factor causing symptoms of distress, particularly in the smallest species. This may happen in the early morning before the air temperature has risen or if the birds have become damp in any way. Typically such birds will fluff their feathers and may close their eyes. Treatment is simple: Put the bird in a clean, dry bird bag out of the wind and preferably in a warm environment (in the car with the heater on for instance). Most birds will recover within twenty minutes or so and fly normally on release. If a car or heater is not available, warming the bird by gently breathing on it as it is held in the cupped hand may be effective. Also, holding the bird in a bag close to the warmth of your body may also work. If, after such treatment, a chilled bird is still reluctant to fly it should be settled on a sheltered perch in the sun.

In summary, by far the most important things to recognize are symptoms indicative of stress at the earliest possible stage and to avoid aggravating the condition by releasing the bird while its reactions are still slow. It would be wrong to give the impression that stress occurs commonly in swallows handled for banding, but banders must always be alert for symptoms and be aware that a very small proportion of susceptible birds may be adversely affected by handling.

Handling Chicks for Banding

Removing Chicks from Nest Boxes

Nestlings are soft and squishy. Pick them up, one at a time, very carefully, lifting the whole body from the bottom. Like the adults, nestlings have an automatic reflex of grabbing whatever is beneath them when they are picked up. Use the same procedure to take the nestlings out of the nest box that you would use for adults; pick the nestling a few inches off the nest and remove whatever is in its feet before removing it completely from the nest box. Be careful if you have long fingernails.

If you treat the nestlings like pieces of fine china, you won't have any problems! But, believe it or not, they are mostly cartilage at first and they are really tougher than they look.

Temporarily Containing Chicks

When banding nestlings, it is convenient to use a bird bag or a plastic left-over container lined with a few sheets of Kleenex. You should remove each nestling separately from the nest box, but you can place the entire brood inside the same bird bag or container. Nestlings are extremely sensitive to heat, so be sure to keep the brood out of the sun, and, if they are in a left-over container, it is good to cover them with a handkerchief to protect them from the sun and breezes.

Holding Chicks

Because there is no risk of chicks escaping from the hand, banders can use the gentlest of touches when handling chicks. Some degree of constraint is still necessary; although they are unable to fly, chicks can wiggle and struggle and make it difficult to band.

There is no conventional way that is used by all banders to hold chicks; the important thing is to find a way that is easiest for you. You can hold a chick as you would an adult. Keep the wings tucked close to its body and gently flip the chick around so that its head is held between your first and second finger and its belly is facing up from the palm of your hand. Now, the chick can't struggle much and the legs are exposed for banding.

If you monitor your nest boxes regularly, you should be able to calculate which days the young are at a bandable age. *Tachycineta* can usually be banded from about 7-13 days of age, but waiting until at least day 9 comes close to insuring that the chicks will be of bandable size. *Tachycineta* nestlings should be left alone after 13 days. Disturbing them this late in the nestling period may cause them to fledge prematurely.

Developmental landmarks are more useful than age in establishing the correct time to band, because many factors (weather, insect availability, parasite load, etc.) can affect the growth rate of the nestlings. Leg size and coloration are two characteristics that can be used to determine whether a chick is bandable. *Tachycineta* nestlings have fat, short legs that lengthen and slim down as they grow: the active areas of bone growth are thicker than the bone they are manufacturing, and because these areas of bone growth are at the tips of the bone, we are waiting for the leg bone (actually the "tarso-metatarsus") to grow long enough that the band will not impinge on these active growth areas. If we try to band a bird that is too young, the band will constrict the growth areas and the blood supply that feed them.

A good indicator of whether the nestling is old enough to band is the development of the feathers. A bird with no feathers showing from the "pinfeathers" or quills on the wings is likely too young to band; a nestling with feathers that are beginning to unfurl or extend about one quarter of an inch from the quills is probably just right.

If you are unsure whether the young are bandable, remember that we would much prefer unbanded, healthy nestlings to banded, injured nestlings. When in doubt, leave them alone *and come back in one or two days if the chicks seem too young to band.* Build your confidence at your own pace; use your good judgment and common sense to make decisions. Always keep the well being of the birds foremost in your mind. Removing botched bands is difficult and stressful for both you and the nestling.

Banding Chicks

The process of banding chicks is the same as it is for adults. ***Chicks take the same band size as the adults of the same species.***No matter which species or age is being banded, the rules for good band fit remain the same: the band should be the smallest available that, when placed and tightened on the bird's leg, it can be freely rotated without binding on the leg. Bands that are too large bear the risk of slipping down over the leg-toe joints and restricting movements and circulation in the toes. Here's a list of band sizes for *Tachycineta* species:

Species	**Band Size**
T. bicolor	1
T. thalassina	1/0
T. euchrysea	0
T. albilinea	0
T. cyaneoviridis	0
T. meyeni	1
T. albiventer	?
T. leucorrhoa	1
T. stolzmanni	?

As with the adults, the band can be placed on either of the chick's leg. If you start to close a band and decide the leg is too fat, immediately stop squeezing the pliers, make sure the band is not pinching the soft tissues of the leg and return the bird to the nest *with the partially closed band still on the leg.* If you do this, it is paramount that you return to this nest to finish the job and band the rest when the young are older. A half-closed band around a fledgling's leg is an invitation to disaster. *Don't forget to go back and finish the job a day or two later. Make a note in your notebook and circle it in red.*

Individually Marking Nestlings

To gather the most useful data on chick growth rates, it is critical that nestlings measured prior to the age of banding be given unique markings. The fastest way to do this is to use a small set of nail clippers to remove a small portion of the nail.

Numbering scheme

Bird claws are numbered starting with the lone back claw (the hallux) and then from inside to outside (the right toe on the left foot is 2, but the right toe on the right foot is 4). It is recommended that you have a consistent marking scheme that clips either one OR two claws on each individual rather than one on some and two on others. If you have 8 or fewer nestlings (which you should unless you conduct a brood manipulation), then clipping just one nail is easiest. If you clip nail two on the left foot, you would write 2/-. The 2 indicates the nail clipped, the / is a marker indicating the following value is related to the other leg, - = no clip. So the first nail clipped on the right foot would be -/1. 2/3 = nail 2 on the left foot, nail 3 on the right foot.

How to Clip

The goal is to clip enough of the nail that the mark is obvious until a numbered leg band is used, but short enough not to cut the quick (the portion fed by a blood vessel). Clip just a small portion of the nail. Check each time the nestling is re-measured and clip a small amount more if necessary. The nails grow pretty fast, so be prepared to cut right up to the quick each time to make sure that you retain the marks.

Reaction to being Handled

Chicks don't exhibit signs of stress from handling like the adults do. For the most part, the nestlings are too young to be affected by handling and banding. They are extremely sensitive to the elements, however. Always keep the nestlings out of the wind and sun. If you need to handle nestlings (or adults) on cold days, try to band them in a warm place, like in your car with the heater on. The same kind of containers mentioned earlier for holding eggs also work well for holding chicks (tupperware, nut cans, egg cartons, etc.- but you want to keep separate containers for eggs and chicks to prevent feces from getting on the eggs. And the lining of the chick container should be changed regularly). They keep nestlings in one spot, and protected from the wind. They can also be placed inside of one's shirt or jacket to keep the chicks warm and dry in the field without fear of crushing them.

The parents can become greatly distressed to see you at their nest box removing their young. Always work quickly, quietly, and efficiently, to minimize stress to the chicks and parents. *Minimize the amount of time that you have the chicks out of the nest box.*

Returning Chicks to the Nest Box

When nestlings are returned to the nest box, they usually just sit quietly. If they are active (flapping, cheeping, generally upset), it's a good idea to cover the entrance hole for a bit until they settle down, perhaps five minutes. Depart from the nest site quietly.

Gathering diet samples from adults

Gathering diet samples from swallows requires careful observation of the foraging behavior and nesting chronology of the birds. Diet sampling is feasible when the adults are regularly feeding older chicks, as they bring large numbers of insects to the nestbox in their bills un-swallowed. Ideally, the adult carrying a food bolus is trapped on its way into the box to feed the nestlings and the insect bolus is removed from the bird's beak and preserved in an alcohol-filled vial (70% ethanol is standard). We label insect samples with pencil on a slip of high-rag paper in the vial, and it is important to include the word "Diet" along with the nest number, species, sex of the adult from which the diet sample was collected, and the date and time of collection. The best way to capture adult swallows for diet samples while they are caring for nestlings, is to trap the bird in a tunnel trap (modified rodent trap fixed to the entry hole) before it gets to the nest and nestlings. These traps are difficult to work with, and they require a great deal of work getting the birds used to various dummy trap sections before the whole trap is deployed. If trapped in the nest with any other traps, the adult may either feed the nestlings or drop the insect bolus in the nest material, so if diet samples are being collected without a special trap, one wants to get to the nest as soon as possible after the trap is set to get as much of the insect sample from the adults as possible. Look through the nest material for any live insects after all insects have been taken from the adult's mouth (they are usually

still alive and may fly away if you don't hurry!). It is hard to be certain that you have gotten the full bolus when gathering samples from adults trapped in the box, and we add the word "Partial" to the vial data slips for such samples.

Measuring morphology

In the early years of the Ithaca study, we struggled with obtaining repeatable measurements of a classic ornithological measure, tarsus length. We finally abandoned the practice, and decided to use the Head+Bill measure described below as the best measure of body size in these short-legged birds. We strongly recommend that you take Head+Bill and Flattened and Straightened Wing on all swallows that you handle. Below the descriptions of these measurements, we provide some methods for other measures and procedures that you may wish to pursue with your studies. Also, you are welcome to modify the EXCEL file of our current banding sheet that we use in our Ithaca study. Let us know if you make any improvements that we might want to adopt!

The Head+Bill (HB) measurement is one that takes a fair amount of practice, but is unambiguously defined: you are measuring the maximum distance between a small knob on the back of the bird's skull (right above where the axial vertebra attaches to the skull) and the tip of the bill. It helps to get comfortable holding the swallow upright in your hand with the bird's ventral surface cradled in the bend of the fingers and your thumb pressing gently on the back of the bird's neck in order to raise the back of the skull and tilt the head slightly forward so that the calipers can access the rear edge of the skull. Because the bird's head is delicate and its bill is slightly flexible, we recommend the caliper be adjusted and then lowered over the head to see if it is a good fit. If the caliper passes up and down across the longest point of the skull-plus-bill's long axis without rubbing, then carefully adjust the calipers to a smaller gap until the point is reached where passing the calipers up and down results in the calipers just rubbing through the bill tip and skull back. If the bill is seen to slightly flex against one of the caliper jaws, then increase the caliper gap by about 0.1 mm or so and try again. To be accurate it is important that the bird's head is aligned squarely in the blades of the caliper. It is easy to take a precise reading that is not accurate because the long axis of the bill+head is not parallel to the long axis of the calipers in both the left-right and up-down plane. Also, the jaws on the calipers we use are tapered at their tip, and we find the head+bill measure much easier to take if the measurement is taken with the full-thickness part of the caliper-jaws, in from their tips.

The flattened and straightened wing (FSW) measure is similar to the "wing chord" measurement familiar to most bird banders. The bird is held as in the head+bill measurement, but the thumb of the holding hand rests instead on the ulnar-humeral joint of the wing to be measured. With the wing in its natural folded position a wing rule is held under the length of the primary feathers with the right angle stop of the rule butted up against the leading edge of the carpal joint. The natural arch of the wing is flattened and straightened against the rule: with your thumb (from the hand you are holding the

bird with) place slight pressure on the humerus –ulna joint. Use the index finger of your other hand to press the wing into a straight line along the rule while straightening out the wing along the wing rule with your other thumb. Be sure the wing is flat, straight and parallel to the bird's body when taking the measurement. One of the most interesting things about taking this measurement is that the wing measure increases the farther one lets the rule and wing wander away from the bird's body. Keep the rule up close and parallel… The reading is taken at the tip of the longest primary feather (or if the feather tip is broken or worn, where the tip would be if it were not broken). Outside the breeding season, be sure to check for primary molt before measuring the FSW, you won't get a good measurement if the longest feathers are missing. Be careful not to injure the bird, this process should not take a lot of force.

General Guidelines for Banding and Recording Measurements from Adults

The adult data sheet is always used to record data whenever an adult is trapped in a box or caught in a mist net. Use one line of the sheet for each adult unless you have comments about the bird. If there are extensive comments, write them on 1 or 2 lines of the data sheet below the data for the bird to which the comments refer.

Be sure that all possible columns in the data sheet are filled out, including your initials in the "Who measured" column. The line labeled 'Entered' is used later to denote when the data are entered in the computer. Each field of the record for a bird should have some notation in it even if it is just a line through it to indicate that data for the field was not recorded.

Nest. The nest to which the bird belongs if trapped at the box. If mist-netted, this field should be filled out "mist".

Time. The time the bird was trapped and processed. For mist-netted birds, it should be the approximate time the bird was caught.

Band No. The number from the bird's metal band. Band numbers are long and easy to transcribe incorrectly. **Get into the habit of double checking the band number you have written on the data sheet, and be sure to use binoculars backwards if there is any danger that you cannot accurately read the tiny numbers otherwise.** Don't be vain, be accurate!

Mass. Mass of bird to the nearest tenth of a gram. The black felt weighing bag and 50g Pesola scale is used for this measurement. Be sure to check the zero each time you weigh a bird since they can defecate in the weighing bag and mess up later measurements. Also be sure to use the clip on the scale to fold over and secure the open end of the weighing bag. Birds can escape from weighing bags if they are not closed properly.

Measuring Fat (this and mites only taken in some years, even in Ithaca!) When processing a bird, it is pretty easy to use water to mat and part feathers to see the fat bodies. Starting at the cloaca with the ischio-pubic fat body, you can work up the body on one side, around a leg, then up to the wing, assessing the following fat bodies in the following order:

ISCHIO-PUBIC: This is the area within a radius that extends 1/3 of the way from the cloaca to the posterior border of the sternum. In this area in some birds, the fat associated with the skin is spread thinly throughout the area, allowing one still to make out the muscle

and organs beneath. In this case, estimate the amount of area covered and subtract one from the score that you would otherwise record. Key:

0 = no fat present
1 = 1-25% of the area with opaque fat
2 = 25-50% of the area covered
3 = 50-75% of the area covered
4 = 75-100% of the area covered.

MEDIO-VENTRAL ABDOMINAL: This is in the center of the space between the cloaca and the sternum, the region occupying everything over the visible viscera that isn't covered by the ischio-pubic region. It can often be confusing whether the light areas one sees is fat associated with the area just under the skin or whether it is fat on the internal organs that are visible through the skin. Try to make sure that you are coding only the former. As in the ischio-pubic area, some birds have fat in this area that one can still see through. Once again, subtract one from the score for such birds. KEY AS FOR ISCHIO-PUBIC.

VISCERAL FAT: This is your chance to code all that fat that was confusing you in the previous two measures. KEY AS FOR ISCHIO-PUBIC.

TRANSVERSE ABDOMINAL: This is along the posterior border of the sternum. Code this fat with a special code:

0 = no fat present
1 = narrowest fat < 1 mm in width
2 = narrowest fat < 2 mm in width
3 = narrowest fat < 3 mm in width
4= narrowest fat > 3 mm in width.

LATERAL ABDOMINAL: This lies on the bird's side posterior to the point of emergence of the femur from the trunk musculature. To find it, moisten feathers and work at it until you can spread apart the feathers in a natural break between tracts. Key:

0 = no fat in the area
1 = less than 50% of the area covered
2 = over 50% of the area covered and fat thin and uniform in thickness
3 = over 75% of the area covered and fat thicker near the center of the fat body
4 = over 75% of the area covered, fat usually merging with fat in adjacent bodies, very little if any muscle appearing in the area, and fat visibly bulging under the skin surface.

FEMORAL: This lies in the "arm pit" of the leg and extends up the inner surface of the tibiotarsus and down a stripe of similar size and shape on the adjacent body wall. In assessing the fat in this region, it helps to bend and unbend the leg. KEY AS FOR LATERAL ABDOMINAL.

SARTORIAL: This lies on the front side of the femur, extends up the front of the femur and in a roughly semicircular area in front of the juncture of the femur with the body wall. Because the juncture of the femur with the body wall is well beneath the skin, one has to peer well through the loose skin to see much of the fat and again, it helps to move the leg when coding this region. KEY AS FOR LATERAL ABDOMINAL.

LATERAL THORACIC: This lies dorsally over the ribs and is roughly triangular in shape, being bordered by the pectoral muscle, the spine and the muscles of the leg. This is one of the largest fat bodies, and probably the toughest to code. KEY AS FOR LATERAL ABDOMINAL.

CLAVICULO-CORACOID: This is the furcular area often coded by other ornithologists. **It is very important that you code this fat deposit with the bird's neck held between your index finger and middle finger.** This insures that the neck is extended. If the neck is allowed to fold down toward the body, it will push down upon the furcular region, causing the fat to bulge and inflate the scores. This store uses a special five point code:

0 = no fat
1 = only a trace of fat in the bottom of the furcular depression (i.e. fat does not cover bottom of cavity)
2 = less than 25% of the furcula filled with fat
3 = 25-75% of the furcula filled with fat
4 = over 75% of the furcular cavity filled with fat
5 = fat bulging above the top of the furcular cavity.

Now that you've coded the claviculo-coracoid, take a deep breath, because there's another bird waiting to be coded!!

Wing Mites. Count of mites and mite holes on wing feathers. This should not be recorded for birds that have had feathers clipped.

Tail Mites. Count of mites and mite holes on tail feathers. This should not be recorded for birds that have had feathers clipped.

Sexing and Aging Birds

As far as we know, only female *Tachycineta*s incubate. Thus, swallows can be sexed during the breeding season by the presence or absence of a brood patch.

In *T. bicolor,* the sequence of the aspects of birds provides further possibilities for sexing and aging. The following is what we know, and we encourage other Golondrinas researchers to pay close attention to the appearances of their birds (taking lots of photographs of known-aged birds will certainly help) to see if any similar hints to age and sex can be gleaned from the plumages of other *Tachycineta* species.

The biggest gift of *T. bicolor* plumages is that females in their first breeding year wear a distinctive plumage with considerable amounts of brown in the dorsal feather tips. If a bird is unbanded and, when held at arm's length, there is any visible brown in the back plumage, it is a female in the first year of life. In North America, the Bird Banding Lab requires that all birds in the year of hatching (i.e., "Hatch-Year" or "HY" birds) be increased one year of age on 1 January. Thus, a bird hatched in June of 2005 would be a HY bird until 31 December, but if it were captured in April of 2006, it would then be a "Second-Year" or "SY" bird. The same logic can be

used to extend to birds of older ages: SY birds become TY (Third-Year) birds, etc. Of course, most of the time, these older age-classes cannot be recognized by plumage, and even in *T. bicolor,* TY birds can only occasionally be distinguished from plumage characters with experience. TY birds often have a little rim of brown feathers on the forehead just above the bill, but it appears that birds older than TY can retain this trait. Until these more refined possibilities for aging females by plumage are evaluated, birds that have only the brown rim above the bill should be recorded as ASY ("After Second Year") females.

Note that the presence of any brown at all in the plumage during the breeding season is a reliable indicator that the bird in question is a female, since all males molt into a full-blue dorsal plumage in their first fall during a complete post-juvenile molt. So, Tree Swallows go from a plumage where the sexes cannot be distinguished (the juvenile plumage in which they fledge from the nest) to one in which the sexes can be distinguished (the plumage worn the first year), to a set of later plumages in which they again cannot be reliably distinguished (once the females have molted into an all-iridescent blue-green plumage).

These different sequences of plumage appearances on the two sexes engender different rules for coding the ages and sexes of birds. In the non-breeding season, if a bird has all-blue dorsal plumage and nothing else is known about it, it is an AHY (after hatch year) bird of unknown sex. During the breeding season (from the time of egg-laying on), if an all-blue (and/or green) bird is caught with a well-developed brood patch, we know that bird is an ASY (after second year) female. (It would be brownish plumaged if it were a SY female.) During the breeding season, females cannot be coded as AHY, as their age should be known as either SY or ASY.

If an all-blue bird is caught at a nest where there are eggs or chicks and it lacks a bare patch on the belly and breast, we can assume the bird is an AHY male.

Bleeding

Blood samples can be used for many different valuable observations. Hematocrit, stress and hormone levels, blood-born parasites, and genetic parentage are just a few of the useful measures we are interested in. Taking blood samples requires careful attention to detail to ensure the safety of the birds. It is important to get all necessary materials (sample tube, capillary tube, microscope slides, preservative (alcohol, EDTA or lysis buffer), clean unused needles, Q-tips, Vaseline, cotton swabs, bands, wing rule, calipers, scale, data sheets, etc.) prepared and ready to use in a clean (preferably enclosed) work space (remember you will only have one free hand to work with once you get started).

HINT: Keeping all of your gear in a fishing tackle box allows you to keep everything you need in one place, protected, organized, and ready to use. You can put a piece of foam in one of the small compartments in the tray and cut a few small slits in them. You can slide

opened centrifuge tubes with lysis buffer, syringes opened and resting in their safety caps, capillary tubes etc. standing up, opened up, and ready to grab and use right away.

1. First, using the free hand and two or three fingers of the holding hand, remove a clean needle from its wrapper and pull it out of its plastic cover (when you do this, be sure to use a continuous movement—make sure that your hand doesn't bounce back with the needle and jab your other hand!). Place the needle loosely back in the plastic cover so the tip stays clean and you can grab it easily in a moment.

2. With the bird's back in the palm of the holding hand, and the thumb holding the bird's chest, pull the wing out with the free hand until it is about two-thirds of the way to fully extended. Hold the wing there between the index and middle fingers of the holding hand.

3. Use the Q-tip and a little bit of Vaseline to part the feathers covering the ulna near its joint with the humerus. Many vessels and tendons run along parallel to the ulna and radius, but one vein, the brachial vein, runs diagonally across the radius and ulna near the joint with the humerus. This is where we normally collect blood.

4. The goal is to insert the hypodermic needle (we find that size 27G1/2 work well) into the vein but not through the other side. If one punctures both walls of the vein, much of the blood is lost to a hematoma from bleeding on the internal wall of the vessel. Hypodermic needles have an inclined face on them, and we rotate the needle before pricking the vein so that the inclined face is facing up. When pricking the vein, insert the needle into the vein until the inclined face just disappears, no farther, and to reduce the risk of hematoma, try to insert the needle into the vein as nearly as parallel to the vein as possible.

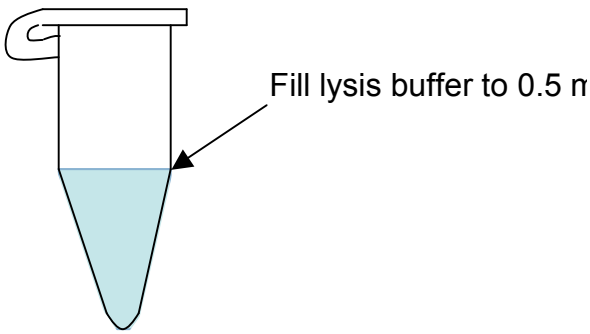
5. Pull the needle out as soon as you have gone in far enough. Now you can use the capillary tube to collect the blood from the droplet that wells up around the point of insertion. Blood will flow most readily into the tube if it is held near to parallel to the wing.

6. As soon as the required volume of blood has been collected, stop the bleeding by applying a small bit of cotton to the wound and applying pressure by squeezing lightly with one finger and thumb on either side of the wing at the site of the wound. You'll want to close the wing around the cotton swab and hold it closed for a few minutes to be sure the bleeding has stopped and that the bird is in good condition before releasing it. While

the bird is resting in a bag, finish up processing the blood sample. (Note: the reason for working in an enclosed space if possible is to avoid accidentally releasing a bird before it can be confirmed that it is in good condition (alert and energetic)).

7. If you are taking a blood smear, be sure to do so before doing anything else with the blood. The best smears are made with four very small drops along one end of the slide, produced by just touching the blood-filled end of the tube to the slide four times across its end. Using another slide to collect these four drops into a bar of blood, push that bar across the rest of the slide, producing a nice very thin sheet of cells for later examination.

8. Next, either blow the blood into the buffer-filled sample tube or cap the capillary tube with clay. Most samples are stored in eppendorff tubes filled with lysis buffer. Eppendorff tubes should be pre-filled with buffer before heading into the field. Fill to the 0.5 milliliter mark (to the top of the conical bottom part of the tube). Only one capillary tube of blood or less should be put in each Eppendorff tube. Once you have blown the blood in, re-cap the Eppendorff tube and gently shake it a few times. Store at room temperature.



9. **Dispose of the needle in a safe container** in which you can convey them to an approved medical sharps disposal box.

What if the birds don't bleed enough?: One of the frustrations of collecting blood samples is that the birds sometimes (especially in cool weather) do not bleed enough for the desired blood volume (usually, researchers need at least a half of a 60 microliter capillary tube). If blood flowed but is slowing down sooner than you would like, you can sometimes get more blood from the same puncture if you spread and close the wing a few times or apply a small amount of pressure (sometimes it works better if it is applied intermittently in half-second pulses) to the pectoral muscle and base of the wing between the puncture site and the bird's heart. This tends to impede the back-flow into the heart from the brachial vein and increase the flow rate from the puncture. If one cannot get the required volume from one wing, the bird can be turned around and a sample taken from the other wing. We find this easiest of if the wing is still held with the holding hand but the bird is held with the head turned toward the researcher, not in the preferred head-away posture.

Wing photos

Standardized digital photos are valuable for measuring wing-loading and recording many details on the lengths of individual feathers, etc. We have developed methods for taking such pictures, but have not yet written those methods up. Please let us know if you are interested, and that will help us get this done. We are working on methods for photographing the plumages of *Tachycineta*s in standardized ways so we can gather a comparative collection of images.

Insects

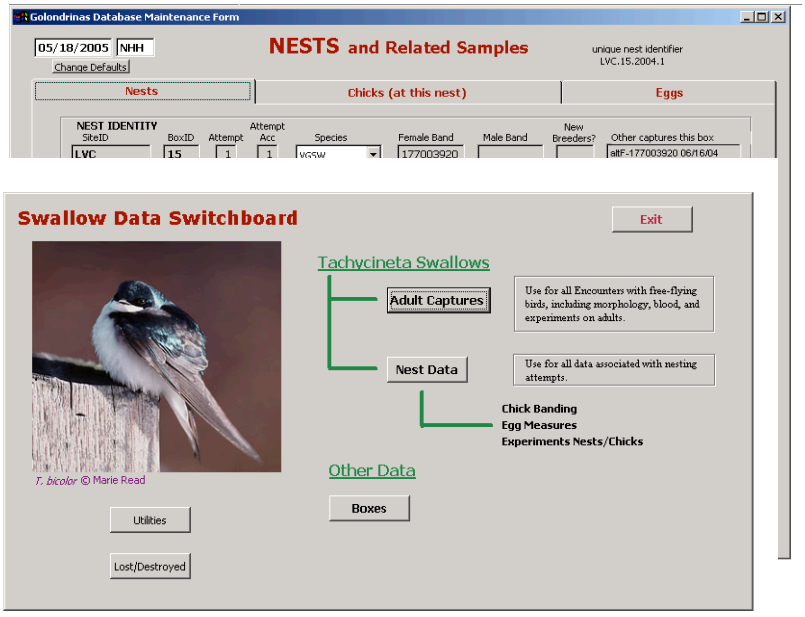
Insect sampling is accomplished through a motor driven fan, which sucks air (and bugs) in at a specified altitude through a vertical tube. A conical stainless mesh filter funnels all insects into an alcohol solution in a small nalgene bottle modified such that it screws into the tip of the filter and has a screened vent in the top side to allow air (and rain water) to flow through. The fan is run daily from approximately sunrise until an hour before sunset so that samples can be taken every day of the breeding season from the arrival of the swallows until well after the last nestlings have fledged. No matter what times the trap is run, it is important to record the on and off times from the fan so that the numbers of insects in the samples can be related o the total sampling time. The nalgene bottle should be replaced every day, any time the fan is not running, either at the end of the day or the following day before sunrise. Remove the nalgene bottle with the insects and replace it with another bottle filled 1/3 (1/2 in warm days) with 70% ethanol. Filter the sample through a screen small enough in mesh size to catch the smallest insects (< 0.5 mm), making sure no insects are left in the bottle. Remove the insects from the screen and place them in a small vial filled with fresh 70% ethanol. You should be extremely gentle when removing the insects, use tweezers and be sure not to squeeze the insects nor scrape them across the mesh, but rely mostly on the surface tension from the alcohol surrounding the insects to gather the insects and place them in the storage vial. Vials should contain an inside label (in pencil!) with the site and sampler name and date. If you replace the sample bottle in the early morning before the trap goes on, remember that the date for the sample is actually from the previous day. Start and stop times for the sampler, as well as notes on sampler operation can be kept in a dedicated data table, accessible from the welcome screen in the Golondrinas Data Entry program.

Golondrinas Data Entry

Entering nest-check data into the Golondrinas database is crucial to our goals of sharing and interpreting all our field observations. There will, of course, be some exceptions to the rules outlined here but the following guidelines should get you started with a good framework for data entry. All official Golondrinas sites will be supplied with a stand-alone data-entry program based on the relational database model used in Microsoft Visual FoxPro.

The main page of the opened program shows a welcome screen with many buttons, some of which are labeled *Utilities, Lost/ Destroyed, Boxes, Nest Data*, and *Adult Captures*. The last two buttons link to two different data entry windows designed to incorporate nest-check observations and adult banding data respectively.

The *Nest Data* entry page shows three tabs: *Nests*, *Chicks*, and *Eggs*. Each of these pages is organized in such a way that it will accept values only if it is activated in the *Add* or *Edit* mode and when in those modes, it will only accept values in a logical order. For example, you cannot enter the clutch size without first entering the clutch initiation date. This function safeguards against many data entry errors and omissions but can be rather frustrating until you get accustomed to the proper order. *Just remember that, throughout Golondrinas Data Entry, you need to push the* Save *and* Add *buttons until the rectangles to receive the data you wish to enter change from gray to white. Your goal as you enter data is to fill as many white data rectangles as you can before proceeding to* Save. *If you have more data to add for that screen, just push* Add *again, and enter data in any new white rectangles that become available.*



Nest-check data entry

We will use the following nest chronology example to guide you through the nest-check data entry process:

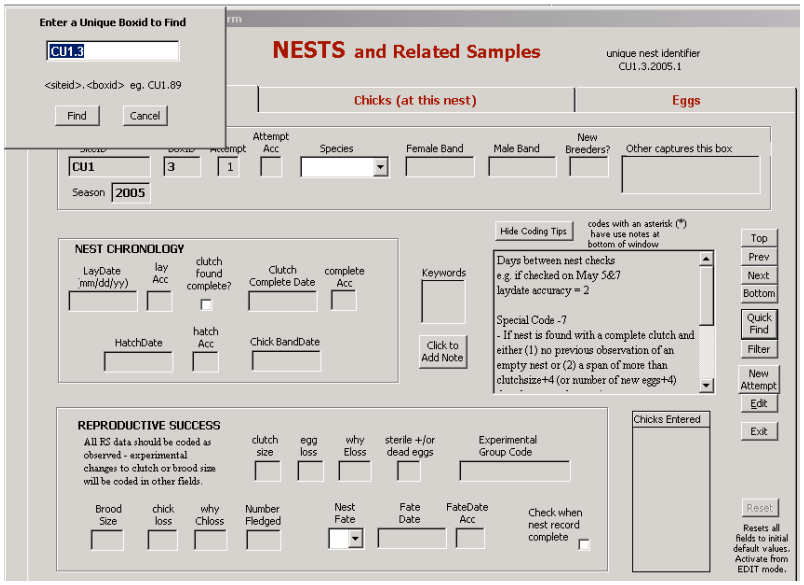
Box #	11-May	13-May	15-May	17-May	19-May	21-May	23-May	25-May	27-May	29-May
3	2.1.2.3	3.2.7.4	E1	E3	E5	E6	E6	E6	E5	E5

31-May	2-Jun	4-Jun	6-Jun	8-Jun	10-Jun	16-Jun	19-Jun	22-Jun	25-Jun
E5	E5	c3, E2	c4, E1	c4, E1	c4, E1	c4	c4	c4	F

(E: eggs, c: chicks, F: fledged)

As soon as the first egg is laid, you should start entering the data for this nest record. DO NOT wait until the end of the breeding season to do this; entering the data gradually will help you keep track of each nest and will make it possible for you to use many utilities to schedule nest duties once your season gets underway. Click on the *Nest Data* button of the main page and go to the *Nests* tab page. Click on the *Quick find* button. A second window will pop-up (Fig. A). Type in the site and box number for which you are entering the data (in this example, site CU1 and Box #3) and press the *Find* button.

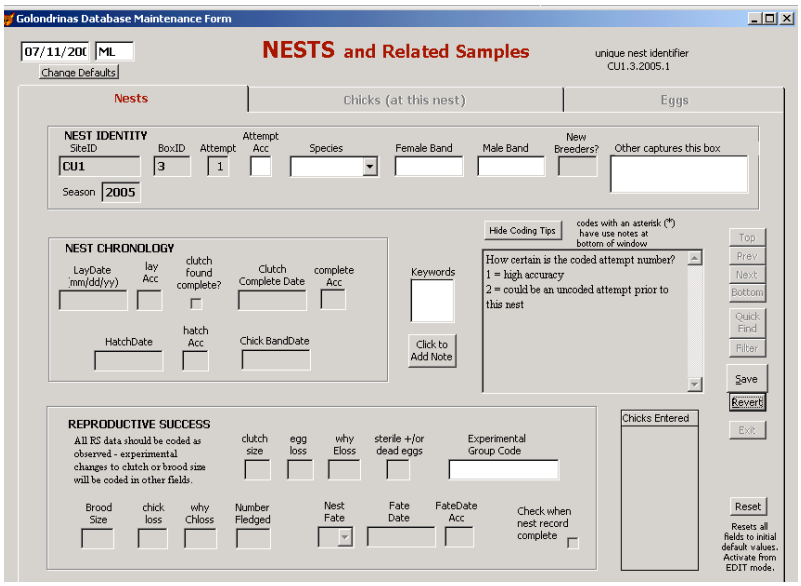
Fig. A.



The *Nests* page for the specified site and nest box will show up (Fig. B). Press the *Edit* button in order to activate this page. Boxes that can be filled in will turn white and as you enter the values for each box and press enter on the keyboard, new boxes will activate. Also, for each box, a brief explanation in the form of "Coding Tips" will show up in a mini-screen on the right side of the page. If at any time during data entry, the next white

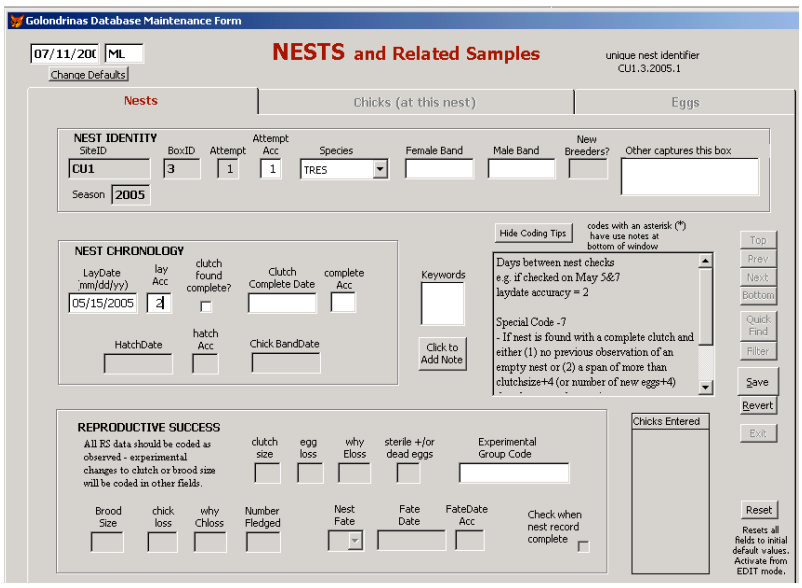
boxes that you need do not appear, make sure there are none remaining white that you cannot fill, then push *Save* and then *Add* buttons to see if you can enter the rest.

Fig.B.



After entering the values for the *Nest Identity*, go ahead and fill in the *Lay Date* (day the first egg was laid) and *Lay Accuracy* (days between the two last nest checks) in the *Nest Chronology* box (Fig. C). Every time you are done entering data, press the *Save* button and then *Exit*. **Note**: If you find that two or more eggs were laid between nest visits, calculate the lay date as you would normally in the nests tab, but under the egg tab, enter the actual date that the eggs were found and measured. For example, if you find two new eggs on 6/3, in the eggs tab enter 6/3 as the date that the eggs were found and measured but in the nests tab enter 6/1 as the lay date.

Fig. C.



The clutch is considered to be complete whenever you find the same number of eggs on two consecutive nest checks and the eggs are warm (May 21 and 23 in our example). You will then go back to the *Nests* page (remember to activate the page by pressing *Edit*) and enter the values for *Clutch Complete Date*, *Complete Acc* and *Clutch Size* (Fig. D). Then *Save* and *Exit*.

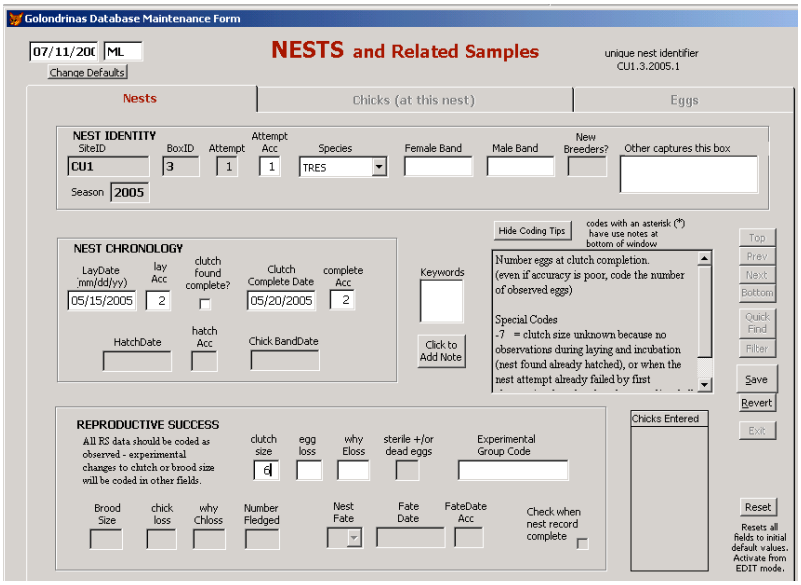
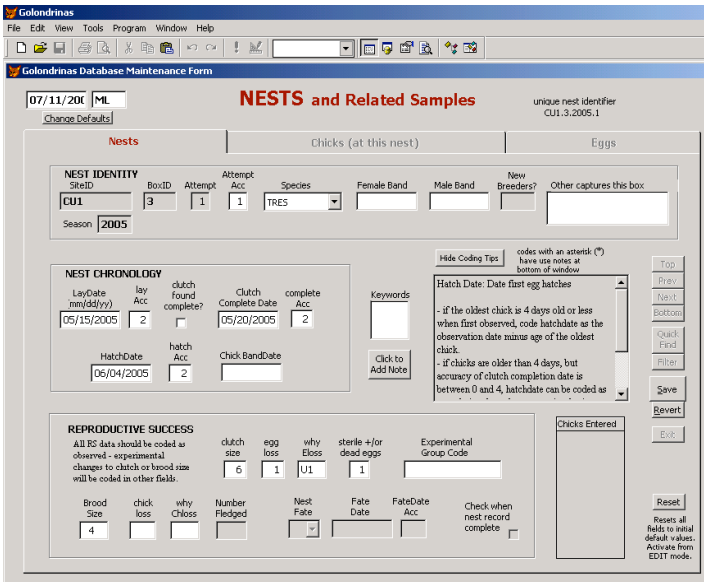


Fig. D.

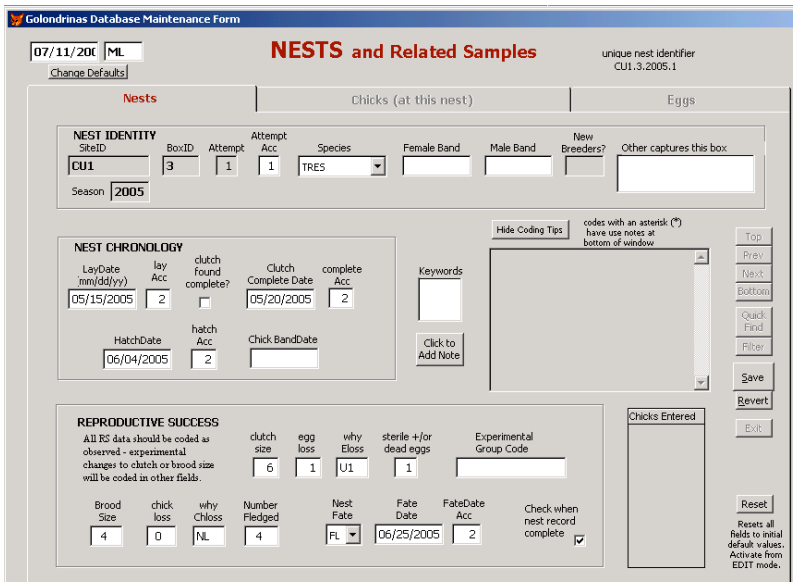
Once the first egg hatches, go back to the *Nests* page and continue entering the values for *HatchDate* and *hatch Acc*. If there were any egg loses during the clutch completion and hatching dates, or any sterile eggs be sure to enter this data in the *Reproductive Success* section of the *Nests* page (Fig. E). Again, *Save* and *Exit*.

Fig. E.



After all nestlings have fledged, you'll be able to enter the values for the rest of the white data entry boxes in the *Reproductive Success* section: *chick loss* (if any), *Number Fledged, Nest Fate, Fate Date, Fate Date Acc* (Fig. F). If the female or male this nest were captured, also enter their band data in the corresponding boxes.

Fig. F.

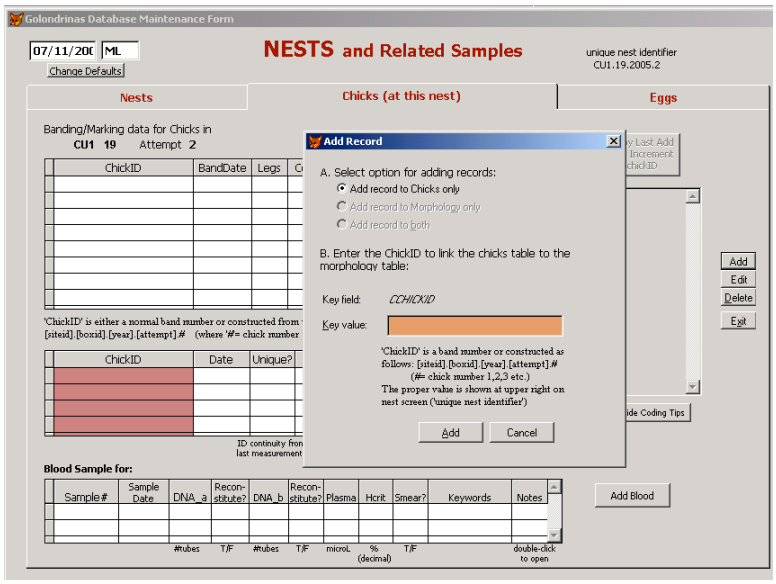


Chick-banding data entry

The first steps are the same as for the nest-check data entry: click on the *Nest Data* button of the main page and go to the *Nests* tab page. Click on the *Quick find* button. A second window will pop-up. Type in the site and box number for which you have banded the chicks and press the *Find* button. The *Nests* page for the specified site and next box will show up. Press the *Edit* button in order to activate this page. After entering the *Chick Band Date*, press the *Save* button and go to the *Chicks (at this nest)* page. Press the *Add* button and an *Add Record* window will show up (Fig. G). Select the "Add record to Chicks only" option, type in the first chick's band number in the *Key value* box and press the *Enter* button. The chick ID (band number) and band date will show up in the upper table of the *Chicks* page. Press *Add* and follow the same steps until the band numbers for all chicks at the nest are entered.

For adding morphology data for the chicks (Head + bill, flat wing, mass): on the upper table of the *Chicks* page, highlight the chick ID you are entering the data for by clicking on it. Press the *Add* button and the *Add Record* window will show up. Select the "Add record to Morphology only" option and press the *Add* button. The chick ID (band number) and band date will show up in the middle table of the *Chicks* page. Enter the morphology data for this chick and then press *Save*. Follow the same steps for entering the morphology values of the rest of the chicks.

Fig. G.



This is a *very* quick look at the Golondrinas Data Entry program, and we will be providing much more information here as we get the program out to more collaborators. But we must emphasize that this program is designed to enter data as they are collected, not once the season is past. This will help you a great deal to make sure that the data you collect is accurate and that you collect the entire core Golondrinas data for every nest. If you would like to obtain a copy of the Golondrinas Data Entry program, please just get in touch with Wink at <dww4@cornell.edu>.

Golondrinas Database Codes

The following tables list the basic data that will be collected and incorporated in analysis databases associated with the "*Golondrinas de las Americas*" program as well as the ongoing tree swallow research program directed by David Winkler and centered in Ithaca New York. Not all research programs will collect data relevant to all of these tables, at least not in all years.

- Note that some variables are generated by the database manager, based on variables coded by participants in the study.

- The Base Data Collection Protocol for all participating sites will include the tables titled Nests, Boxes, and Encounters. Nearly all participants will also use the tables Ad_morph and Ch_morph.

General note about codes: In order to avoid ambiguity, a number of special codes are used consistently throughout each database. Although the specific meaning may vary slightly from variable to variable, the sense or type of context is consistent.

-99 *Often used as a place-holder to indicate that these data have not been coded. This will be seen most commonly in the context of data-entry forms written for a stand-alone application (still being developed!). Participants using spreadsheets or equivalent data forms are strongly advised to copy the model layout observation before entering data for a specific case.*

-9 *Data unknown*

-8 *Not applicable; usually because the code for some other variable makes coding this variable nonsensical.*

-7 *Partial knowledge, but not sufficiently accurate for the preferred code. E.g. For the variable 'fledgenum', if a nest is known to have produced fledglings, but the actual number is not known.*

NESTS

The core dataset coding data relevant to each nesting attempt, the identity of the breeders, timing of laying and basic information on reproductive success.

NEWBIRD [txt]	Was the second (or third, etc.) nesting attempt initiated by <u>a different</u> pair of breeders (one or both individuals) than in the previous attempt? – This variable is only coded if 'ATTEMPT' >1 – The code (4 characters) signifies whether or not either or both sexes are different, and the confidence in that assessment. Format: F__M__ the first and third characters are fixed. Each sex can get one of four possible values, as follows **Y** = Sex indicated is a different individual than that of the previous attempt; requires positive information (*e.g.* banded birds, clearly distinguishing plumage characters, *etc*) **P** = Sex indicated is probably a different individual than from the previous attempt (*i.e.* there is some evidence indicating a change, but not enough to reach the standard of using 'Y') **N** = That sex is <u>not</u> a different individual from the previous attempt **U** = Unknown; absence of sufficient data to make a more useful determination *Example:* FNMY = *the female is the same bird as present in previous nesting attempt, the male is positively different.*
EXPMTGRP [txt]	Code to indicate experimental group(s) in which the nest is included. This set of codes will expand over time, as new experiments are conceived and implemented. Standard codes will be used by all participants. **C** = Control; the default value [additional codes will be assigned as needed]
BANDM [txt]	Band # of male bird for that nest attempt. **-7** = Default value for unbanded breeders **-9** = Male at the nest is banded, but the number has not been confirmed through capture [NOTE: this field declared as type 'text' in order to be compatible with assigning dummy unique identifiers to chicks or unbanded adults for which link ability is necessary into other datasets]
BANDF [txt]	Band # of female bird for that nest attempt. [See note under 'BANDM']. **-7** = Default value for unbanded breeders **-9** = Female at the nest is banded, but the number has not been confirmed through capture
LAYDATE [date]	Date of first egg's presumed presence (*mm*/*dd*/*yyyy*). If the nest is visited during laying, code LAYDATE by counting back from the number of eggs first observed (assuming no skips in laying). If the clutch is started and completed between checks, count back from the observation date one day for each egg in the clutch, then take the midpoint of the remaining interval to your last check as the estimated laydate.
LAYACC [int]	Number of days between nest visits bracketing LAYDATE. *e.g.* If the nest is checked on day *X* (no eggs present) and then checked again on day *X*+3, when two eggs are found in the nest, 'LAYACC' = 3; 'LAYDATE'=day *X*+2 (implying possible error of one day).

COMPDATE [date]	Clutch completion date. Presumed laydate of last egg in clutch (*mm/dd/yyyy*). NOTE: clutch complete box should only be checked if the clutch had already been completed at the time of first nest check; LAYDATE and COMPDATEs are therefore unknown.
COMPACC [int]	Number of days between the visits framing COMPDATE. This code will be used to identify cases of skipped days during the laying sequence.
CLUTCH [int]	Number of eggs at clutch completion. **#** = Clutch size **-8** = Not applicable (*e.g.* if human disruption appeared to cause abandonment of the nesting attempt) **-9** = Clutch size unknown; use this code if more than 6 days elapsed between the estimated clutch completion date ('COMPDATE') and the next nest check.
EGGLOSS [int]	Number of <u>individual</u> eggs lost. *Examples: If all eggs are lost in one go, this variable would be equal to* CLUTCH. *If one egg was damaged during incubation, and two eggs did not hatch, this variable would be coded '1' (unhatched eggs have their own variable).*
WHYELOSS [txt]	Code for causes of individual egg loss. Each letter code is followed by a numeral to indicate the number of eggs lost to that cause, *e.g.* 'P2' would indicate two eggs lost to predation. This order must be strictly maintained. **NL** = No partial clutch losses; the default value **P** = Predation (only used when there is tangible evidence of a predator) **A** = Parental abandonment, defined as a nest that was previously incubated but subsequently cold for four or more nest checks. Nests that were not incubated cannot be abandoned. **X** = Human caused loss **U** = Unknown cause
HATCHDAT [date]	Date of first hatching in nest (*mm/dd/yyyy*).
HATCHACC [int]	Number of days between visits framing HATCHDAT.
BROODSIZ [int]	Number of chicks that hatch. **#** = Initial brood size ('0' if nest failed before hatching) **-7** = Some chicks hatched, but the number was not known **-8** = Not applicable (*e.g.* human induced failure) **-9** = Not known whether eggs hatched or not
NOHATCH [int]	Number of eggs that fail to hatch. Eggs remaining more than three days after the last chick hatches should be coded here. Note that 'EGGLOSS' + 'BROODSIZ' + 'NOHATCH' = 'CLUTCH'
CHIKLOSS [int]	Number of <u>individual</u> chicks lost between hatching and fledging. *Examples: If two nestlings starve while the rest successfully fledge,* CHIKLOSS *= 2.*

CHIKLOSS [int]	Number of <u>individual</u> chicks lost between hatching and fledging. *Examples: If two nestlings starve while the rest successfully fledge,* CHIKLOSS = *2.* *If the entire brood is preyed upon,* CHIKLOSS = BROODSIZ.
WHYCLOSS [txt]	Code for causes of individual chick loss. Each letter code is followed by a numeral to indicate the number of chicks lost to that cause, *e.g*. 'P2' would indicate two chicks lost to predation. This order MUST be strictly maintained. **NL** = No losses; the default value **P** = Predation (again, some tangible evidence of predation required) **X** = Human caused loss **S** = Starvation; if one or more chicks die before any chick/s later fledge, then chicks are considered to be starved. Evidence of gradual deterioration in this or other chicks in the brood should be observed (*e.g.* small size relative to broodmates). Also, the carcass should be in the nest. **A** = Parental abandonment. (If one or more chicks fledge while one or more chicks do not and later die, those chicks' individual fates are termed 'Abandoned.' Fate of the entire nest is still 'Fledged,' as described below). **U** = Cause unknown (*e.g.* chick dead in nest, but no previous or subsequent evidence of food stress)
BANDDATE	Date of chick banding (*mm*/*dd*/*yyyy*).
FLEDGNUM [int]	Total number of chicks that fledge from that nest attempt. **0** = Known to have failed naturally without young fledging **#** = Number of chicks fledging (if less than HATCHNUM, then CHIKLOSS must be coded >0) **-7** = Some chicks fledged (one or more), but number unknown **-8** = Human caused failure (*e.g.* if the nest was compromised through experimental manipulation, or if the nest was abandoned following unusually long human activity at the nest during banding, *etc*) **-9** = Unknown if nest fledged any young or not
FATE [txt]	Code for the overall outcome of the nesting attempt. (If at least one chick fledges while others die, the nest is termed fledged. Individual fates of chicks can be coded in the CHICKS page; this process is described later in this guide.) **FL** = At least one or more chicks known to fledge **P** = Nest failed due to predation of the eggs or chicks **A** = Nest failed due to parental abandonment

BOXES

Submitted on yearly basis.

It is <u>extremely</u> important that we know what potential nesting locations were available to the swallow population each year. To this end, a variable in this dataset will be used to substantiate the status of every box.

In the first year that a box location is discontinued, it must be included in the

dataset, with the appropriate code for discontinued use. That location can then be deleted from the dataset in subsequent years.

All relocated boxes in Golondrinas sites must be given <u>new numbers</u>.
Mist net locations must also be entered here using 'mist' for the field 'BOXID'. This can be done once per research site (use coordinates for approximate center of site), or for specific netting locations if these are a substantial distance from the research site.

FIELD	**Description, operational definitions and values**
SITEID [txt]	Research site identifier (*e.g*. 'hillbank').
BOXID [txt]	Box identifier – unique for each site. 'mist' entered if mist nests used at this site, or 'mistxx', where 'xx' is a value identifying multiple netting sites uniquely.
YEAR [int]	Four-digit year (*i.e*. 1989).
USECODE [txt]	Code for the availability of the box during the current breeding season. **Open** = Available for nesting **New** = A new nest box location, available for nesting **Closed** = Location *not* available for nesting, but is not discontinued **Remove** = Location (box) removed
LAT [double]	Latitude coordinates of box or netting site, in decimal degrees to six digits of accuracy for the fractional portion.
LONG [double]	Longitude coordinates of box or netting site, in decimal degrees to six digits of accuracy for the fractional portion.
ACCURACY [int]	Code for accuracy of latitude and longitude coordinates. **1** = Topographic, by hand **3** = GPS (preferred method) **4** = Low quality (street map, *etc.*) **5** = Topographic, online

EGGS

This dataset is designed for use when data about specific eggs is obtained. Generally, nonspecific egg losses due to predation, or failure to hatch, will be coded with the nest data rather than here.
There should never be an entry in this dataset unless there is also an entry in 'Nests'.

FIELD	**Description, operational definitions and values**
SITEID [txt]	Research site identifier (*e.g.* 'hillbank', 'fairbanks').
BOXID [txt]	Box identifier – unique for each site.
ATTEMPT [int]	Number of the nesting attempt for this box, this year.

DATE [date]	Date of egg measurement (*mm/dd/yyyy*). **Note**: If you find that two or more eggs were laid between nest visits, calculate the lay date as you would normally in the nests tab, but under the egg tab, enter the actual date that the eggs were found and measured. For example, if you find two new eggs on 6/3, in the eggs tab enter 6/3 as the date that the eggs were found and measured but in the nests tab enter 6/1 as the lay date.
LAYORDER [int]	If the first egg is laid on day 1, then LAYORDER is the day on which each egg in the clutch was laid. If there are multiple eggs on the first visit, then use an average value. For example, if two eggs were found in a nest on May 15, and one additional egg was found on each succeeding day until five were laid in total, then these five eggs would have LAYORDER values of 1.5, 1.5, 3, 4, and 5. **#** = Day number **-9** = Not known (variable 'ORDERACC' must be coded'0') **-99** = Not coded
LENGTH [double]	Long axis measurement (mm).
WIDTH [double]	Widest distance across short axis (*mm*).
MASS [double]	Mass of egg (*gm*).
FATE [txt]	Code for what happens to egg. **H** =Successful hatch **P** =Egg preyed upon **A** =Egg abandoned **X** =Human caused loss **U** =Unknown fate **E** =Experimental cause
OBSERVER [txt]	Name abbreviation of field research person responsible for this measurement.

CHICKS

This dataset is designed primarily for nests where detailed observations are made on the fate of individual nestlings. In general, each nestling will be individually identified.

FIELD	**Description, operational definitions and values**
SITEID [txt]	Research site identifier (*e.g.* 'hillbank', 'fairbanks').
BOXID [txt]	Box identifier – unique for each site.
ATTEMPT [int]	Number of the nesting attempt for this box, this year.
CHICKID [txt]	Unique identifier for chicks in same nest. Normally this value would be the band number. Dummy values are generated initially for any nestlings on which data are gathered before banding age, and these become permanent if the chick dies before banding.

	Temporary/Dummy values for multiple chicks in a brood should have numbers that differentiate them from other chicks at that site that year. In such cases, this value must agree with BIRDID in the MORPHOLOGY database.
HATCHDAT [date]	Date this chick hatches (*mm*/*dd*/*yyyy*).
HATCHACC [int]	Number of days between visits bracketing HDATE.
FATE [txt]	The fate code for what happens to this chick. **FL** = Fledge **P** = Preyed upon **X** = Human caused **S** = Starvation; if one or more chicks die before any chick/s later fledge, then chicks are considered starved. Evidence of gradual deterioration in this or other chicks in the brood should be observed (*e.g.* small size relative to broodmates). Also, the carcass should be in the nest. **A** = Parental abandonment; if one or more chicks fledge while one or more chicks do not and later die, those chicks are termed 'Abandoned.' **U** = Cause unknown (*e.g.* chick dead in nest, but no previous or subsequent evidence of food stress)
FATEDAT [date]	Date of this chick's fledging or loss (*mm*/*dd*/*yyyy*).
FATEDACC [int]	Number of days between visits bracketing FATEDATE.
OBSERVER [txt]	Name abbreviation of field research person responsible for this measurement.

ENCOUNTERS

Only birds captured and banded enter this dataset. All captures get a record, including nestlings banded in the nest that subsequently die in the nest or disappear.

FIELD	**Description, operational definitions and values**
SITEID [txt]	Research site identifier (*e.g.* 'hillbank').
BOXID [txt]	Box identifier – unique for each site.
BAND [txt]	Permanent band #. [note: this field declared as type 'text' in order to be compatible with assigning dummy unique identifiers to chicks or unbanded adults for which link ability is necessary into other datasets]
DATE [date]	Date of banding/capture event (*mm*/*dd*/*yyyy*).
SEX [txt]	Sex of captured bird. **M** = Male (to be used only if designation is certain) **F** = Female (to be used only if designation is certain)

	U = Unknown
AGE [txt]	Age of captured bird. **L** = Nestling **HY** = Hatch year **AHY** = After hatch year **SY** = Second year **ASY** = After second year **TY** = Third year *Etc.*
LEGS [txt]	Code for color and metal bands on bird. The metal numbered band is symbolized by an 'M'. The sequence of bands is read in the following way: The color of the band on the bird's left leg, then a dash (used to indicate move to the other leg), then the color of the band on the bird's right leg. Birds with no color bands and simply a metal band are either "M-." or ".-M"

TRAPCODE [int]	Code for type of trap used in capture. **0** = Mist net **7** = Nest-box trap **8** = Chick banding **13** = Band lost **14** = Band destroyed **15** = Missing records
STATUS [int]	Code for status of bird/band at time of encounter. **1** = Banded and released (adults only) **2** = Recapture (adults only) **3** = Found dead outside of box (adults only) **4** = Other (adults only – requires comment in 'notes' field) **5** = Found dead in box (adults only**)** **11** = Presumed fledged (chick) **12** = Dead in nest (chick) **13** = Preyed upon (chick) **14** = Disappeared before fledging (chick) – reported as band destroyed under TRAPCODE **15** = Found dead after fledging (chick) **17** = Unknown (chick) – report as band destroyed **18** = Some chicks known dead, some known fledged, but not which ones (chick) – reported as fledged **19** = Status unknown but report as fledged (chick) **91** = Band lost **92** = Band destroyed **93** = Missing records
OBSERVER [txt]	Name abbreviation of field research person responsible for this capture and banding.

MORPHOLOGY

This dataset contains morphological data for adults and chicks. For chicks, it parallels the 'eggs' dataset, with one observation for each chick, each time nestlings are measured in that nest. Therefore, multiple observations per attempt are likely.

FIELD	**Description, operational definitions and values**
BIRDID [txt]	Unique identifier for each individual measured. Usually this would be coded as the band number (or a temporary value updated when a chick is banded, provided known continuity). Temporary/Dummy values for multiple chicks in a brood should have numbers that differentiate them from other chicks at that site, that year. In such cases, this value must agree with CHICKID in the CHICKS database.
DATE [date]	Date of measurement (*mm*/*dd*/*yyyy*).

UNIQUE [logic]	Is the individual identity of this individual known? (*i.e.* If there are repeat measurements for chicks in this nest, can the same individuals be identified?) **0** = Not known **1** = Known
HEADBILL [double]	Head plus culmen length (*mm*).
FLATWING [double]	Straightened and flattened wing length (*mm*).
MASS [double]	Mass of chick (*gm*).
TARSUS [double]	Tarsus length (*mm*), from joint to joint.
OBSERVER [txt]	Name abbreviation of field research person responsible for this capture and banding.

FEATHERS

FIELD	**Description, operational definitions and values**
BOXID [txt]	Box identifier – unique for each site.
ATTEMPT [int]	Number of the nesting attempt for this box, this year.
DATE [date]	Date of measurement (*mm/dd/yyyy*).
FRCLIDAT [int]	Number of feathers in nest on the date of the first egg (LAYDATE).
FRCLCDAT [int]	Number of feathers in nest on the date of clutch completion (COMPDATE).
FRHCHDAT [int]	Number of feathers in nest on the hatch date (HDATE).
FRBNDDAT [int]	Number of feathers in nest on the date of chick banding (BANDDATE).
OBSERVER [txt]	Name abbreviation of field research person responsible for this capture and banding.

BLOOD

FIELD	**Description, operational definitions and values**

SITEID [txt]	Unique location identifier.
BAND [txt]	Individual bird identifier (usually band number).
SAMPLE [txt]	Blood sample number.
DATE [date]	Date blood sample was collected (*mm*/*dd*/*yyyy*).
OBSERVER [txt]	Name abbreviation of field research person responsible for this capture and banding.

Minimum Golondrinas Field Season Requirements

These are the minimum goals to fulfill at any given Golondrinas site. Refer to the Golondrinas Handbook for a complete description of each data collection goal.

1. Monitor nest construction *every other day*. Code and record nest construction every check until laying.

2. When egg laying begins, count feathers on first day and check nest *every day*.

3. After the clutch is complete, count feathers and then check nest *every other day* until hatching begins.

4. Count and record feathers on hatchday. During hatching, check nest *every day* until all nestlings have hatched or until nestling day 3 (hatch = 0).

5. Measure nestlings on *the following days*. Nestlings can be individually marked using nail clipping.

In order of priority if time only allows for fewer measurements:

Day 12 (band)
Day 3
Day 9
Day 6

From each nestling:

-Record mass, head-bill, and flattened-straightened wing length
-Take a small blood sample (<50ul) stored in lysis buffer
-Feather sample (6-8 feathers) plucked from breast

6. Catch and band adults at each nest

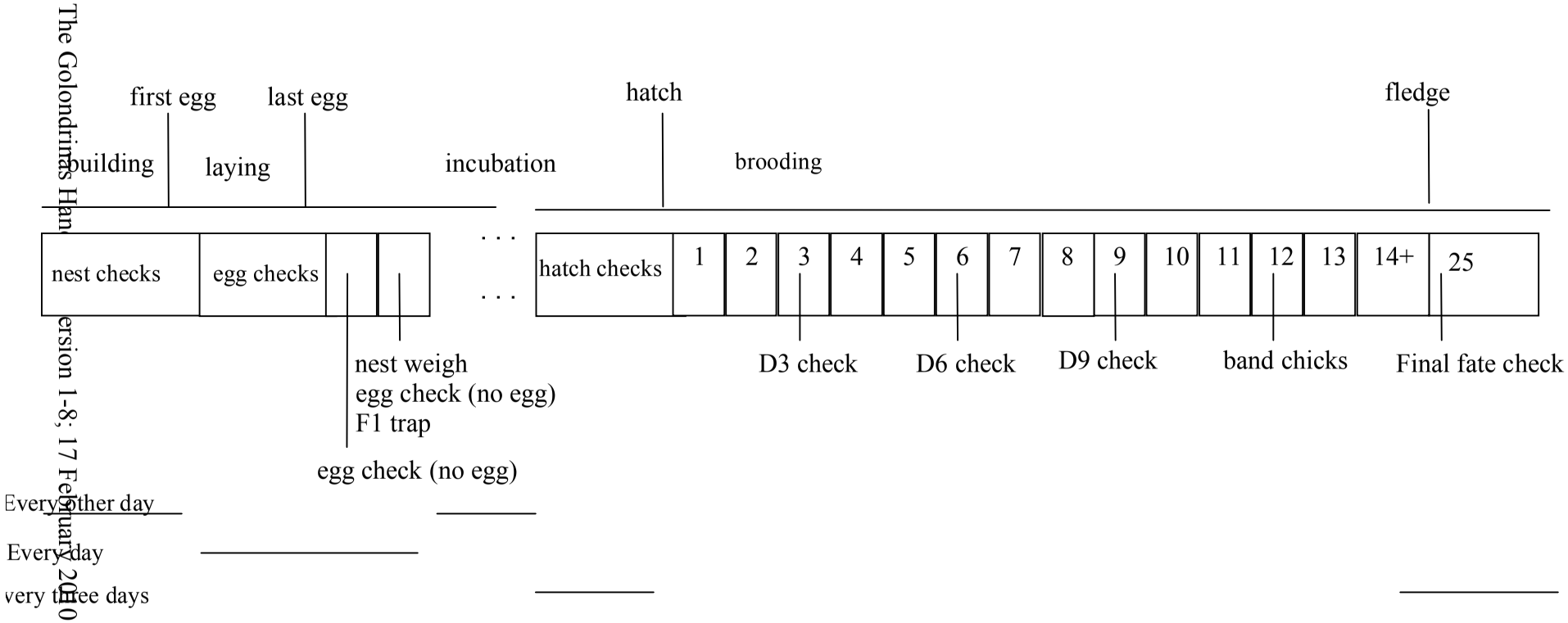
Females are often caught from incubation day 8 onward
Males can be caught while feeding nestlings

From each parent:

-Record mass, head-bill, flattened-straightened wing length

7. Check for final nest fate at chick day 25

Timeline for a nest for Minimum Golondrinas Season



Full Golondrinas PIRE Field Season Requirements

This is a summary of the goals to fulfill at any fully operational Golondrinas site, *in addition to* the goals outlined in the Minimum Golondrinas Field Season.

1. Collect insects captured by the bug sucker *daily*. Clearly label a vial with each day's contents, and record in your notebook.

2. Search for natural nests if they could occur near the study site. If natural nests are found, they should be monitored in a manner analogous to nest boxes, but inferring phases based on parental behavior during their visits to the nests. If nest entrances can be reached, technicians should use telescoping mechanic's mirrors to view inside cavities, if possible.

3. Take ovolux photographs on LD/LD+1 for all nests.

4. On all parents and nestlings, once per season:
   -Take a small blood sample (<50ul) stored in lysis buffer
   -Feather samples: (1) 6-8 feathers plucked from breast and (2) a single tail feather.

5. Conduct nestling cooling thermoregulation experiments.

Focal nests

The following information should be collected from a set of 20 focal nests. **It is important that the nests selected to be part of the focal 20 have laying dates that span the breeding season.** Given the expected number of nests at a site (e.g., 60), field technicians should include nests at the appropriate interval (e.g., every 3rd nest as it is initiated) to yield 20 temporally spaced focal nests. If in doubt, err on the side of more nests than 20, in case the expected 60 nests aren't all successful.

1. Feeding observations *at nestling age 7 and 10*. Mark first adult trapped the day before with white-out (or sharpie on white rump) for easy identification and note sex of marked individual. Use Feeding Observation Data Sheet.

2. Diet samples *whenever adults are captured with a food delivery*. Always carry a few vials filled with alcohol for this purpose, blank-card cut to fit vials, and a pencil to label samples with sex of parent, band number, nest code (including site) and date of sample.

3. iButton data loggers *every 2nd day (or 68 hrs) during laying period, every 3rd day during nestling stage until day 12, and then after chicks fledge*. Collect data from laying until all chicks have fledged, with iButtons programmed to sample every 2 minutes

during laying and incubation and every 4 minutes until day 12 and every 10 minutes until after fledging.

4. Number eggs in laying order – *every day during laying*.

5. Take ovolux photographs *every day once incubation has begun*, in addition to the initial photographs taken on LD+1.