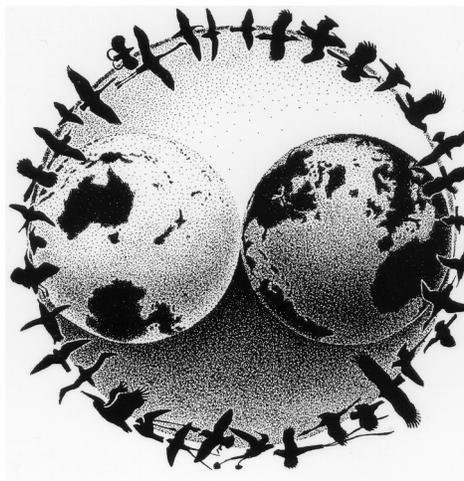

The Mist Netter's Bird Safety Handbook

A Bird Bander's Guide to Safe and Ethical Mist Netting and Banding Procedures



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Foreword and Acknowledgments

Note that the current version of this handbook addresses bird safety protocol for banders who mist net and band small landbirds. Large birds, waterbirds and other trapping methods are generally not addressed.

This handbook is designed to equip the bander with the information needed to operate his/her banding station(s) in the safest possible way. We have tried to make it user-friendly for all potential field personnel - from the biologist to the retired banker or high school student assisting him/her. Herein is a compilation of ideas gathered by many banders over the years, born of a collective desire to have the lowest possible negative impact on the birds we handle. Most tips were learned through field experience. Others were gleaned from professionals in avian health care. We hope that new banders will find this "essential reading" and that seasoned banders will find it a useful reference.

By bringing these ideas together in one document, we hope to garner contributions from others toward its inevitable refinement. A fresh interchange of ideas and information among banders and avian rehabilitators will move us toward the common goal of bird preservation with a greater sense of fellowship. Let the dialogue begin.



Sections I - III can be largely attributed to the combined knowledge of the staffs of The Institute for Bird Populations and the Long Point Bird Observatory. Also contributing insight were banders at the Point Reyes Bird Observatory, the Alaska Bird Observatory, C.J. Ralph of the Redwood Sciences Lab and many contributors to the MAPS program. We thank Ken Burton, Ken Convery, Susan Craig, Dan Froehlich, Ken and Sue Heselton, Diana Humple, Zed Ruhlen, Hannah Suthers, and Brett Walker for their efforts in the creation of these first three sections of the handbook.

Sections IV - VI can largely be attributed to the knowledge of those in avian health care. We thank the following people for patient and thoughtful answers to endless questions, and for keeping the dialogue open: Kit Chubb (Avian Rehabilitator, Avian Care and Research Foundation), Betsy Crozer (Bird Banding Committee Chair, N.W.R.A.), Lynne Frink (Director, Tri-State Bird Rescue & Research), Scott Haywood (former MAPS Biologist, IBP), Susan Heckley (Avian Rehabilitator, Lindsay Wildlife

Museum), Juanita Heinemann (Avian Rehabilitator), Paul Kyle (Bird Bander and Avian Rehabilitator, Driftwood Wildlife Association), Mike Murray (Avian Vet), Bea Orendorff (Board of Directors, N.W.R.A.), Hilary Pittel (Bird Bander and Avian Rehabilitator, Avicare Bird Rehabilitation Center) and Corinne Tastayre (Montreal Botanical Gardens).

In addition, a good portion of the text was adapted from *The Canadian Bander's Study Guide* (McCracken et. al 1994), a beautifully composed handbook put out by the Long Point Bird Observatory and The Canadian Wildlife Service.

Special thanks to Trevor L. Lloyd-Evans, Jerry Jackson, and Glen Woolfenden for reviewing this document.

We are grateful to Benjamin and Ruth Hammett for their gracious donations and to the National Fish and Wildlife Foundation which have helped support this publication.

We especially thank David F. DeSante, Executive Director of IBP, for understanding the relevance of this project and for permitting the senior author to leave her daily duties by the wayside to pursue this work.

Finally, we thank the dozens of anonymous banders whose experiences have indirectly contributed to this effort, and most of all, we thank the birds that have graced our lives with their presence.

This is contribution no. 68 of The Institute for Bird Populations.

THE BANDER'S CODE OF ETHICS

Bird banding is used around the world as a major research tool. When used properly and skillfully, it is a safe and effective means of collecting scientific data on birds. The safety of the birds we band depends on the proper use of equipment, and on the expertise, alertness and thoughtfulness of the bander. The Bander's Code of Ethics is consistent with the guidelines found in *Guidelines to the Use of Wild Birds in Research*, which were formulated with the consideration of animal welfare and research needs.

The most essential responsibility a bander has is to the welfare of the birds. Every bander must strive to minimize the stress placed upon birds and be prepared to accept advice or innovation which may help achieve this goal. The bander must do everything possible to ensure that data being collected are accurate and meaningful, and thus worth the intrusion into the lives of the birds. The primary researcher has the key responsibility of maintaining a well-trained field staff. We consider it unethical to allow untrained or under-trained people to operate a banding station.

Methods should be examined to ensure that handling time and data to be collected do not jeopardize the birds' welfare. Be prepared to streamline procedures in response to adverse weather conditions or to reduce a backlog of unprocessed birds. If necessary, birds should be released unbanded. Every injury or mortality should result in an assessment of your banding operation; action then needs to be taken to minimize the chances of repetition.

It is the responsibility of banders to ensure that their work is beyond reproach and to assist fellow banders in maintaining the same high standards. Every bander should help upgrade standards by advising the Banding Lab of difficulties encountered and by reporting innovations.

The Bird Banding Manual that is issued with a bander's permit identifies certain obligations of a bander. Banders have an obligation, as a condition of their permit, to submit data to the Banding Lab promptly, and to reply promptly to Banding Lab requests for information. Banders have an educational and scientific responsibility to ensure that banding operations are explained carefully and are justified. Finally, banders have a duty to ensure that if they are banding on private property, permission has been obtained and the wishes of the landowner are respected.

The Bander's Code of Ethics

1. ***Banders are primarily responsible for the safety and welfare of the birds they study so that stress and risks of injury or death are minimized.***
Some basic rules:
 - handle each bird carefully, gently, quietly, with respect, and in minimum time
 - capture and process only as many birds as you can safely handle
 - close traps or nets when predators are in the area
 - do not band in inclement weather
 - frequently assess the condition of traps and nets and repair them quickly
 - properly train and supervise students
 - check nets as frequently as conditions dictate
 - check traps as often as recommended for each trap type
 - properly close all traps and nets at the end of banding
 - do not leave traps or nets set and untended
 - use the correct band size and banding pliers for each bird
 - treat any bird injuries humanely
2. ***Continually assess your own work to ensure that it is beyond reproach.***
 - reassess methods if an injury or mortality occurs
 - ask for and accept constructive criticism from other banders
3. ***Offer honest and constructive assessment of the work of others to help maintain the highest standards possible.***
 - publish innovations in banding, capture, and handling techniques
 - educate prospective banders and trainers
 - report any mishandling of birds to the bander
 - if no improvement occurs, file a report with the Banding Office
4. ***Ensure that your data are accurate and complete.***
5. ***Obtain prior permission to band on private property and on public lands where authorization is required.***

I. EQUIPMENT SELECTION, MAINTENANCE AND USE

The selection of quality equipment and its proper maintenance and use is indispensable to a safety-conscious banding operation.

BIRD BAGS

Here are some things to consider when making (or buying) and using bird bags:

- Choose sturdy but lightweight, breathable materials.
- Choose easily noticed colors - no camo bags, please. Do not choose black or very dark colors that soak up the sun's heat.
- Do not make the bag loops so long that the bags swing like playground swings when wrapped around your wrist as you're walking. Loop size, when the bag is gathered, should be just long enough to cinch the bag's top end and fit around a large man's wrist comfortably.
- Keep bags turned inside-out, or trimmed free of loose threads at the seams. Birds can get their tongues or legs tangled in threads.
- Keep bags clean! They may be washed with a diluted solution of hot water, soap and bleach. Hot water should prevent the spread of avian pox, and bleach should eradicate bacterial germs (C. Tastayre pers. comm.). Do not overdo the soap or bleach, as residues can be harmful to birds. During the banding day, shake bird bags out frequently between net runs. *Bags that have transported seemingly sick or diseased individuals should be put out of commission until washed.*
- Try not to double bag birds. Close quarters can bring out the fighting instinct in many species. If you must, make *absolutely sure* they are non-aggressive species of the same bill type and relative size. This primarily includes the mild-tempered insectivores. *Never* double bag any of the finch-like species. Omnivore/frugivore bills can be powerful weapons! **The ideal solution is to have a plentiful supply of bags.** Also: see "Bird Buckets".

- Use small bags for small birds, large bags for large birds. (If the majority of birds you catch are warblers, it makes little sense to have all 9" x 11" bags, in which you must chase them with your groping hand to get them out.)
- When cinching bird bags, be aware that some birds like to attempt escape by scuttling towards the exit (wrens and chickadees are famous for this). If you hold the bag upside-down before you cinch it, the bird will usually scramble to the bottom, away from the opening.
- In hot weather: when hanging birds in bags to await processing, space them nicely so there's breathing room, yet not so randomly that one would be easily left unnoticed.
- In cold weather, bags can be clumped for added warmth. If very cold, keeping them in your coat (see "*Cold*" in the *Weather* section) can help to prevent cold stress.
- One suggested source for quantity "bird bags": cloth soil sample bags, sold by the 100, by *Forestry Suppliers, Inc.*, tel: 1-800-430-5566. Note: these bags tend to be a bit long - but folding over the bottoms and re-stitching is still faster (and probably cheaper) than making your own bags from scratch. To increase the longevity of these bags, re-thread the drawstring tops with a heavier string.
- If you decide to make your bags from scratch, here are two suggested patterns:

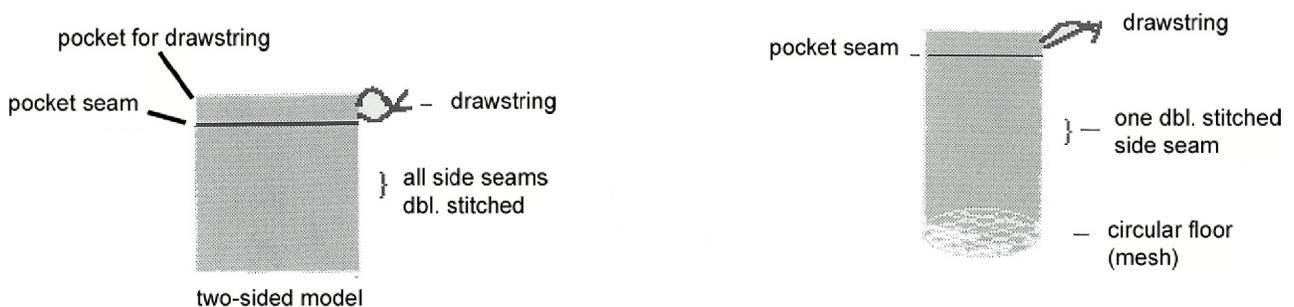


Figure 1. Two suggested patterns for making bird bags.

The two-sided model has the benefit of being faster and easier to make, while the cylindrical model provides a "floor" on which the bird can stand. When making the latter model, a sturdy mesh would best serve as the floor material,

since it would allow birds to hook in their toes for stability. **Suggested bag dimensions:** small (warbler-sized) - 5"w x 7"h, medium (thrush-sized) - 7"w x 9"h, large (flicker-sized) - 9"w x 11"h.

- **Accountability:** Continually keep track of how many full bird bags you are carrying on a net run - bags with birds in them can be accidentally dropped on the trail or left on trees. At the banding station, put bags in a single pile as you empty them of birds. At the end of each processing session, make sure that the # of empty bags in the pile equals the # of full bags you brought back. Birds have been "missed" with unfortunate end results.

BIRD BUCKETS

If you are in a situation where many birds are likely to be captured - for instance, during migration or juvenile dispersal - you may find the use of bird buckets very helpful.

The figure below, submitted by Ken and Sue Heselton, shows the construction of a bird bucket designed by Ralph Bell. Using a 2½ - 3 gallon bucket turned upside-down:

- 1) Create vent holes in a ring around the top of the upside-down bucket.
- 2) Relocate the bail, securing it in two of the vent holes.
- 3) Cut a round hole in the top, and secure to it a 15" - 20" length of old pant leg (heavy fabric is best).
- 4) Cover the bottom with vinyl coated wire mesh - ¼ x ¾ works well. Be sure to push the mesh bottom in about 1" from the lip of the bucket so that birds toes will not get crunched when the bucket is set down.

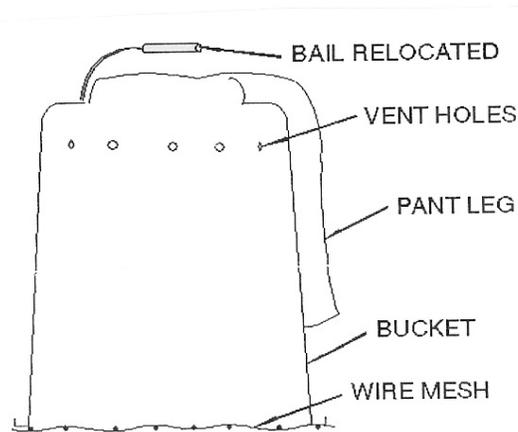


Figure 2. Bird bucket, as designed by Ralph Bell.

To place a bird in the bucket, hold the bird in the bander's grip and slide your hand down the pant leg. Use your other hand to maintain a fold in the pant leg so that birds already inside do not see light and attempt to exit.

A distinct advantage to the bird bucket is that an assistant can look in the bottom to select which bird to remove first, second, and so on. Another advantage is that bird dirt will drop through the wire mesh, helping to maintain sanitary conditions.

Be sure to avoid using bird buckets for aggressive species. They work wonderfully for warblers and can house perhaps a dozen or so. One disadvantage: if your study requires that you know which net each bird is from, one bird bucket will probably only serve well for one net per net run. However, since there are certainly scenarios where twenty or so dispersing or migrating warblers fly into a single net, a bird bucket (or indeed several) can prove useful.

BIRD BANDS, RELATED TOOLS AND PRACTICES

- Make sure that all bands are properly strung and that sizes are *well-marked*. Make labels that do not fall or smear off. There must be no mystery as to what band size you are dealing with.
- When more than one band size choice is given by the Bird Banding Lab, use a leg gauge, or at least visually inspect the band against the leg. An unopened band may be held hole-side-up underneath the widest flat part of the tarsometatarsus (or tarsus) - there should be a space between the leg and the

band's rim on either side, but not so much that the band could slip over the top of the toes or above the metatarsal (ankle) joint, which could render perching impossible. When appropriate band sizes are used, there are few indications that the application of metal bands produces adverse effects on the subjects (Marion and Shamis 1977).

- **Be sure that you know the species *and* its proper band size before banding the bird.** It is imperative that bands of the correct size be used; bands too small for the species in question may cause serious injury to or even the loss of the banded leg (Gaunt and Oring 1999). In addition, band removal of too-small bands can be a harrowing experience - and in the worst-case scenario, may result in a broken leg. Have a quick-sheet of expected species and their band sizes at easy access at your banding station. Have apprentice banders routinely say the species' name and band size aloud before banding a bird.
- One or more colored leg bands are often applied to one or both legs of a bird. They provide a means of individually recognizing birds in the field without recapturing them. When used in combination with aluminum bands, plastic bands *must* be the same size. An alternative to celluloid color bands, that may fade within two to three years, is UV-stable color bands that remain bright for several years, excluding blue which fades quickly (Gaunt and Oring 1999).
- Take care not to overlap the butt ends of the band when closing it. To avoid this, you must ensure that the band is opened evenly and that it is not opened too far. A severely overlapped band is the most difficult kind to remove.
- Check to see that your banding pliers are in good shape. If the closing edges become rounded or the jaws become slack, there is a danger of overlap or crimping. In any such case, replace the pliers - do not file them down, as this will cause the band holes to become elliptical rather than round, as well as diminishing their size.
- Make sure the proper band hole on the pliers is used when applying a band. After closing seam-to-seam (the seam of the band in line with the seam of the pliers), turn the pliers 90 degrees and depress on the band once more. This will help prevent gaps in the seam of the band that might catch on the net and unduly stress the leg if the bird is captured again.

- Practice band removal on study skins - in a pinch you can improvise with a tiny stick "banded" and closed off at the ends with wads of clay. (To get a better simulation of a bird, fix one end of the stick into a pine cone with the clay.) Be sure to destroy any bands used for these practice sessions, so they will not be re-used on live birds (a weakened band will be more apt to overlap).

Band Removal

It is essential that all personnel practice the techniques described below on specimens before executing the process on live birds. Practice should mirror potential situations - from too-small bands to overlapped bands to larger, heavier bands.

Band removal using circlip-removal (or needle-nose) pliers

Circlip-removal pliers (which *open* when you squeeze the handles) can be a useful tool in band removal, but the prong-ends are usually too thick to be slipped between the band and the birds leg. Because of this, you will need to slip the prongs of the pliers into two wire loops that are linked through the band, as described below. Needle-nose pliers may be used as well, but one handle of the pliers must be held steady while the other is moved *outward*. While it is always better to remove a band with two people, one can execute this technique alone in some situations with skill and practice:

- 1) First take two thin lengths of wire (those that the bands come on are good), thread them through the band on either side of the seam and twist them *securely* shut (this will take a good 15 or so twists each). The loops you have made should be at 90 degree angles to the seam, one on each side. They should be very small - about 1/4 inch across. Another suggestion is to use piano wire. It is stronger and the possibility of broken legs during the procedure is diminished (T. Evans pers. comm.).
- 2) The bird is held in the bander's grip with the leg straightened and stabilized by gripping the metatarsal joint. It is important to keep the bird from fidgeting. With the prongs pointing downward, the circlip pliers are then slipped through each of the loops, which are repositioned at 90 degree angles to the seam and directly across from one another.

3) The pliers are carefully depressed, coaxing open the band via the wire loops. Once the band is open slightly, you may slip the pliers directly beneath the band to finish the job. As soon as the opening is large enough, slip the band off the leg with your fingers.

NOTE: One problem sometimes experienced with this method is that even with copious twists, the loops in the wires may come undone when pressure is applied with the circlip pliers. This is especially true with larger-sized, heavier bands or those made of a stronger metal, such as stainless steel. In these cases, it may be necessary to use *two pairs of needle-nose pliers*, clamping each pair down on the *twisted ends* of a loop (as opposed to linking them through the loops). Then, holding one side steady, the other is pulled away from the band with a slow, even pressure. In this method, one person should be holding the bird while another person works the pliers.

Circlip removal pliers may be purchased from the *British Trust for Ornithology (BTO)* in Great Britain. They can be reached by phone at 011-44-1842-750050 or by fax at 011-44-1842-750030.

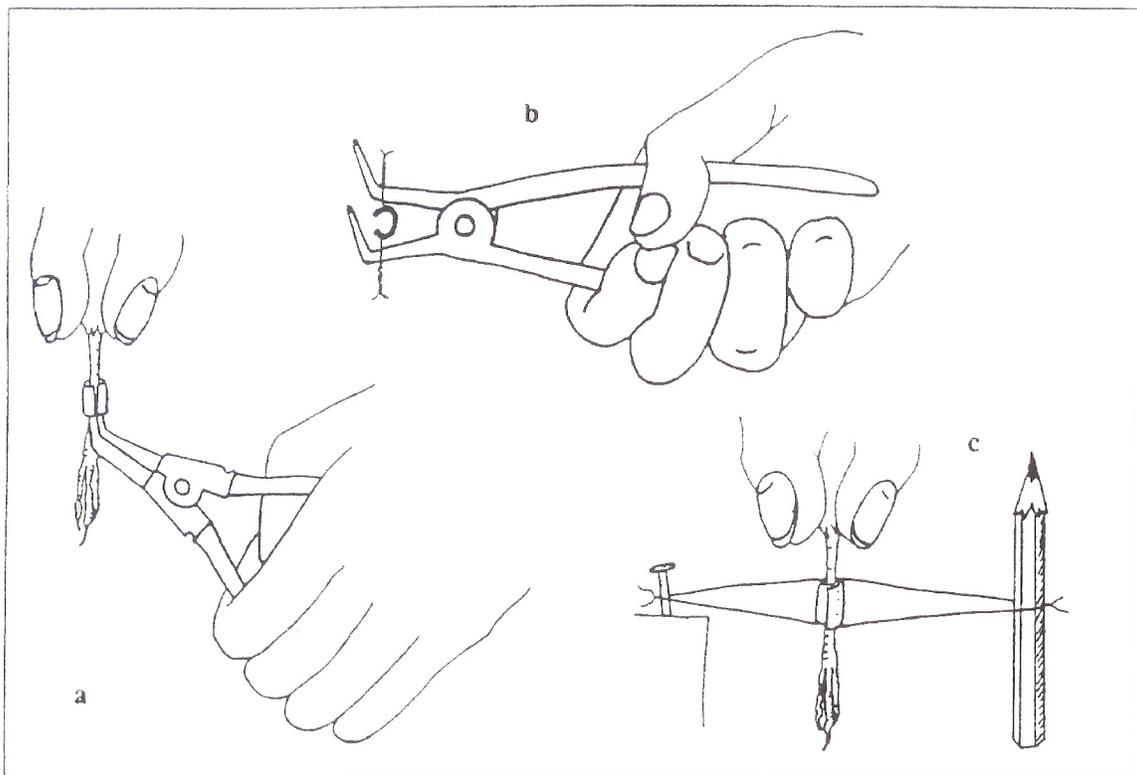


Figure 3: Band removal using a) circlip pliers, b) wire and circlip pliers (adapted from Lowe 1989), and c) wire, pencil and a nail (adapted from Spencer 1992).

Band removal using two pairs of 5-inch hemostats

The following method has been adapted from Wedeking et al. (1995).

Hemostats, which may be purchased from a medical supply store, provide an (albeit, more costly) alternative to pliers with some distinct advantages: no wire is needed, there is less chance of abrading a bird's leg, and they are small and easy to hold. Two people are necessary to perform this procedure. Once again, practice is needed in order to safely and successfully remove bands with hemostats:

- 1) One person holds the bird, his/her hand resting on a stable surface such as a table top, flat rock, or in the absence of these, their own leg.
- 2) The person removing the band rotates the band so that the closure seam is facing upward.
- 3) With the curved tips pointing down, the serrated tips of the hemostats are then used to grasp the butt-ends of the band span-wise, one pair on each side of the seam. (The hemostats should be held with the ring finger and thumb, as shown in the photograph.)
- 4) When both hemostats are securely holding the band, one hemostat is held immobile (by resting the hand holding it on the table top or other stable surface), while the other hemostat opens the band wide enough for removal by deliberately and slowly pulling and slightly rotating the hemostat away from the seam. This action should come from the wrist.

NOTE: The hemostats should not be locked on the band during this procedure - locking the hemostats can crush an aluminum band and possibly injure the bird's leg.

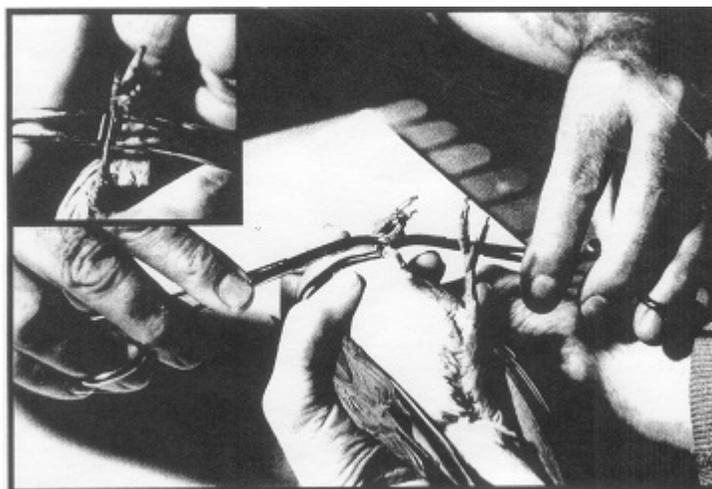


Figure 4. A Mourning Dove is held for band removal using two 5" hemostats. Inset: the band on a House Finch leg is opened by slowly pulling and slightly rotating one hemostat (left side of inset) while the other hemostat is kept stationary. Photo courtesy of Hannah Suthers.

Band removal using end cutters

A third method of band removal involves the use of end cutters, which can be purchased at a hobby shop or hardware store. This method, submitted by Ken and Sue Heselton, is attributed to Walter Fye, and is currently gaining in popularity as end cutters are inexpensive and easy to use. When purchasing end cutters, you must make sure that they are properly ground. They must be made with the cutting edge very close to the outer surface.

Removing a band with end cutters can be performed by a single individual. To remove the band, the bander first positions the band so that the butt ends will be opposite the cut. Holding the bird's leg by gripping the metatarsal joint and top of the tarsometatarsus allows for positioning the cutters so they attack the band and not the bird's leg. The cutters slice through the band, often leaving metal slightly thicker than aluminum foil which can be removed with the fingers.

The bander must be extremely careful that the end cutters bite into the top and bottom of the band before squeezing the handles. If careless, and the cutters slip from either end, it is possible to break the bird's leg. As with all of the above methods, this band removal technique requires practice on specimens before any attempt is made on a live bird.

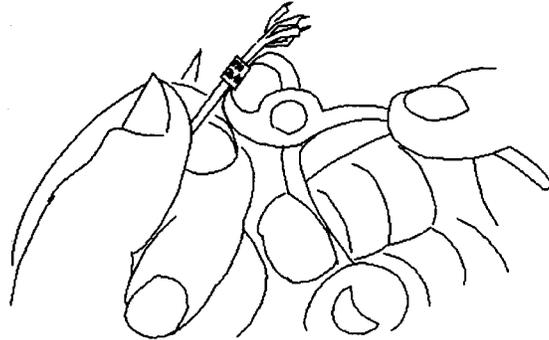


Figure 5. Band removal using a pair of end cutters.

A Special Note On Cardinals

All banders should know that cardinals (and possibly some of the other grosbeaks) fitted with regular aluminum size 1A bands may be at risk of mutilating themselves by crushing the band against their own leg in an attempt to remove it (S. Haywood pers. comm.). Moreover, some cardinals have been successful at removing their bands (M. Gustafson pers. comm.), a situation that is unacceptable in mark-recapture studies. Size 2 bands seem to be strong enough to resist grosbeak-type bills, but are too large for most cardinals. The way to solve this problem is to use stainless steel or monel 1A bands. **We recommend using these stronger alloy 1A bands for cardinals.**

MIST NETS

The proper selection, use and maintenance of mist nets needs to be of the highest priority at any banding station.

Selecting a Mist Net

Mist nets must be of the right mesh size, of good quality, in good condition, and monitored correctly. Mesh size is important. A small bird in a large mesh net (> 30 mm), particularly if left for any length of time, can get very tangled and requires considerable expertise in extracting. However, if your main target is jay-size and there

are very few smaller birds around, you would do better to use a slightly larger mesh size. Your catch will be a lot higher and you won't have birds flying along the bag, not only escaping, but also catching their bands (if re-traps) en route.

The quality of a mist net is likewise important. A main consideration is material; the choice is usually between nylon and polyester (or terylene as it is known in Europe). Polyester nets are a little more expensive than nylon nets (at least in the short term), but are finer, stronger, stretch less and are more resistant to damage by sunlight. Because of their durability, they are more resistant to holes and thus safer to use on birds and more cost-effective in the long-term. Avoid monofilament nets - they can too easily injure birds.

Other factors that affect the way netting behaves are the diameter (denier) of the component thread and the ply number (the number of threads that are braided into each strand). The bulkier the strand, the less tangled birds get and the easier they are to extract. As a rule of thumb, it is advisable to go with a heavier mesh (say 75 denier, 3-ply rather than 70 denier, 2-ply). The catching rate will be a little lower than for lighter weight material, but extraction will be quicker. For studies that are to be repeated, it is important to use nets of a consistent mesh size and weight, as both can have an impact on capture rates.

Problems Unique to Mist Nets

Here are some things to watch for:

- **Nets are notorious for catching on everything and then tearing.** Wear the simplest clothing with the fewest buttons, zippers and velcro possible. Do not wear any jewelry. Watch that hats, eye glasses, binoculars and boots do not become entangled in the mesh.
- **Nets can catch animals other than birds.** Bats can be caught in the evening and before sunrise. Since they are capable of inflicting a painful bite, and since bats can carry rabies, handle bats with gloves. Bats can often be removed from a net just by dumping them out of the pocket. If that doesn't work, then you'll have to grab the bat firmly by the back of the neck with one hand, while the other works to free the netting. Don't be intimidated by their snarling and horrific grimaces. Release bats away from the net site. Sanitize your hands after handling a bat.

- **Nets can catch humans too!** Caution the public coming to view your banding operation and post signs if necessary. Beware of people carrying umbrellas, walking sticks, fishing rods, etc.
- **Nets will catch large insects**, like June bugs and dragonflies, which cannot always be removed alive or unharmed because they get the mesh caught up in their mandibles or wings. In some instances, you may be able to release insects alive with the help of a toothpick. The best way to remove a badly entangled insect is to crush it first, quickly and humanely between two rocks, sticks or between your fingers.

General Guidelines for Proper Mist Net Operation

- **Make sure the net lanes are clear of vegetation.** When clearing net lanes, take care to consider how far the net will blow from side to side in a breeze. If a net gets snagged on a branch, it could create undue tension on a nearby-landing bird, potentially causing injury. Keep branches trimmed! A machete, grass whip, mower or other sharp implement will help cut vegetation under your nets. This enables you to set nets lower without them getting tangled in debris, and eliminates the risk of missing captured birds hidden in ground cover. Remember that it is important not to have the lower tier dragging on the ground.
- **Take care to ensure proper net tension.** Too much tension can cause shelf strings to break and birds to bounce out, while too little can result in double-tiered birds. The shelf strings should not sag in the middle. They should be parallel to each other and to the ground. Poles should be relatively straight up and down - if the tops lean back too far, the poles need to be spread farther apart to ensure equal tension for each tier. Guy lines (ropes tethered to the center of each pole and then cinched to stakes, trees, etc) can be used to help achieve proper net tension. When using guy lines, slip knots are recommended, so that net tension is adjustable.
- **Ensure proper tier spacing.** Each loop should be about 18 inches from the next one on the pole. This spacing ensures the appropriate amount of “pocket” to form in a tier - a wider spacing decreases the effectiveness with which a net can catch birds (causing “bounce-outs”) and a narrower spacing increases the risk of badly entangled birds. To facilitate achieving the ideal spacing, you may wish to tie cord of the exact specifications from one loop-base to the next, so

that you'll have automatic, 18-inch spacing when you raise the nets. This method works best with nets that are not taken down routinely, where the extra baggage of cord could create problems during set-up.

- **If there is standing water directly under a net lane, use the "4-1" approach** - that is, 4 loops above the guy line, 1 below (as opposed to the more common practice of 3 above, 2 below.) Pull the guy lines tight. If possible, put a board down over any really bad spots. Test the bottom pocket with your fist, simulating the weight of a robin, or the largest bird you are likely to catch. See that your fist (thus the bird) does not touch the water.
- If there are known ground predators in the area, use the 4-1 approach. (If an offending predator is seen stalking a net, however, the net should be closed.)
- **Keep nets free of debris and in good repair.** Small twigs, burrs and leaf stems can create huge problems if a bird happens to get tangled in the net with them. If such debris remains during the furling or taking down of a net, the net may tear when trying to reopen it.
- **Furl nets properly when not in use.** A good method of furling is to close the three lower tiers while leaving the upper (white-looped) tier open, then furling the closed section *into* the top tier with short, quick strokes as you simultaneously lower the top tier to meet the others. The top loop may then be tucked down over the three lower loops - this helps cinch the loops in place. String or flagging should be used to tie slip knots around the closed net at both looped ends and two or three spots in between (clothespins also work well for this). While it is rare for even an untied, furled net to open in the wind, it is possible and preventative measures need be taken.
- For those stations operating on public lands - where net sites go unmonitored in between visits - **it is best to take the nets down at the end of the banding day to prevent theft and illegal use.** A good method is depicted below (S. Craig pers. comm.)

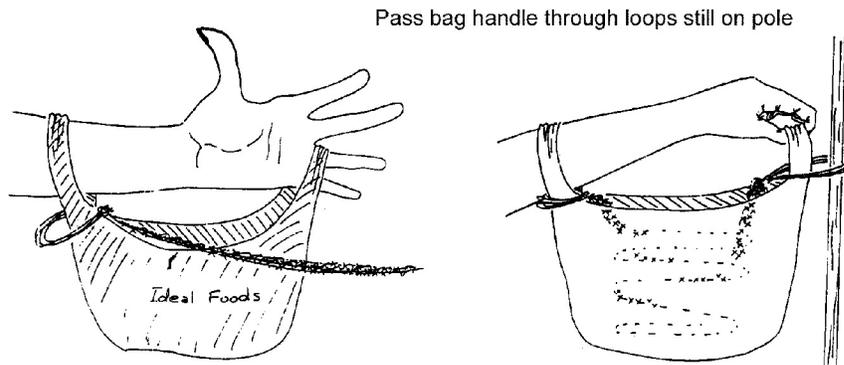


Figure 6. Taking down a net using a plastic grocery bag.

- **Accountability:** Make sure that on every net run, all nets are checked, and that on the last run all nets are closed. If you take your nets down at the end of the day, count them before you pack 'em up. There is truly nothing sadder than returning to a site where an open net was left forgotten.

Mist Net Maintenance

For the sake of bird safety, as well as science, banders need to make sure their mist nets are in good condition. Holes in mist nets can complicate extraction, thus endangering birds, and can bias capture rates. Responsible banders should ensure that mist nets are up to snuff before use.

- It is useful to salvage old nets for spare parts. End loops, trammel lines (a.k.a. shelf strings) and panel supports (a.k.a. side strings) can be replaced easily, and net mesh (if still of strong quality) can be used to patch large holes.
- If nets have to be taken down when they are wet, hang them to dry at your earliest convenience. This will prevent fungus from weakening the net.
- Old nets should be burned rather than thrown in the garbage. This ensures that no unauthorized person can ever work with them and also ensures that no animals will get entangled accidentally.

that have been exposed to a lot of sun or those that have been stored damp tend to be flimsy or moldy and should not be used for patches.) First cut off the loose ends of broken mesh on the net you are repairing. This should be done with the net open and the tier with the hole in it opened to full capacity, so as not to bag. Then, cut a patch from the salvaged net that will fit exactly into the missing piece of the net being repaired. To do this, count the number of missing "diamonds" for each row of mesh that needs replacing - try making a small diagram to help you get the proper configuration.

Now, tack the patch to the standing net by knotting the two together at each junction (each exposed corner in the "diamonds" of joining mesh). Make sure the knots are snug and that you cut them down to the nubs. Do not overlap the mesh of the two nets - join them so that each "diamond" of mesh is only one string thick. If the patch was cut too large, clip from it any overlapping strands of mesh as you work.

If the hole is immense (i.e., was perhaps plowed through by some large mammal), and you have a spare tier that is in better condition, it would be wise to replace the entire tier (E. Ruhlen pers. comm.). For huge holes, this is a far less exhaustive procedure than the above method. To replace the top or bottom tier of a mist net, you must first cut off the offending panel in its entirety, leaving no unkempt strands of netting and taking care not to clip any strands from the tier below. Next, the shelf string should be removed from the net being repaired, where the new tier is to be joined. The replacement tier also will need to have one of its two shelf strings removed. Finally, the replacement tier can be joined to the standing net by rethreading both alternately through the better of the two removed shelf strings. This will entail knotting the shelf string to one end of the net, then weaving it through an exposed diamond of mesh in first one tier, then the other, until the other end of the net is reached. Tie it off and you are finished. For either of the two middle panels, the shelf strings will need to be rethreaded above and below.

II. PROPER HANDLING TECHNIQUES

When handling birds a gentle yet firm, even approach is essential. During a banding session, banders and observers alike must maintain a calm, quiet, focused, attentive and sympathetic environment.

SOME THINGS TO REMEMBER:

- "Playing" with the birds is entirely unacceptable. To them we are nothing less than predators. How would you like to be "played with" by a huge beast 600 times your size, whose intentions you believed malevolent?
- If more than one person is working at a net, each needs to be aware of the other's general predicament. Take care not to yank the netting in ways that would affect the other person's efforts, or any bird's safety.
- When pulling strands of netting over the bird's head, lift the strands over the eye to avoid scraping the eye. Also practice putting your thumb on the tip of the beak (except cardinal/grosbeak) when pulling strands over the head to avoid neck strain.
- Always carry a seam ripper, Swiss army knife (complete with toothpick and scissors), or other thin prying and cutting tool on net runs. A tool is often necessary to aid in maneuvering threads around tricky areas, such as off the flanges of the tongue, and in removing very tight strands from around the carpal joint (bend of wing) or tibiotarsus (tibia). In some cases, it is necessary to cut the net (one to three strands is almost always enough), so the tool needs to have this capability as well. Seam rippers are useful for both functions, but should be "disarmed" - make sure the sharp end is dulled on a stone - so that a bird cannot be accidentally punctured.
- When moving birds in and out of bags, keep track of the position of the wings and also the *legs*. When removing a struggling bird, use the bander's grip, gather up the feet (using your thumb, ring finger and pinky) and slowly remove the bird from the bag. This will help to prevent broken legs. Take all the time you need to get a good, secure bander's grip before you take the bird from the bag. This will help minimize "escapes" (T. Evans pers. comm.). When placing a bird into a bag, don't drop it in. Set it into the bottom of the bag.

- During extraction, take special care not to yank the carpal joint back. Try to keep all movements of the wing close to the body, or extended only in such a way as is natural for the bird (e.g. normal fanning of the wing). Rough handling of the carpal joint will lead to "wing strain", any number of conditions which may temporarily (or permanently) render the bird incapable of flight. **The desire to avoid wing strain should be a constant preoccupation throughout the extraction process.**
- In order to access the underside of the wing (e.g., to blow on the underwing coverts to determine flight feather molt), fan out the wing naturally and bend your *wrist* back, *not* the birds *wing*.
- When using the leg hold, make sure that your index and middle fingers firmly sandwich the upper tibia close to the point where they join the body. The bird's belly may then rest on the tops of these fingers, while the extended ring and pinky fingers can create a flat little 'seat' for the bird's hindquarters. With this support system in place, the tarsometatarsi can be safely clamped by the fleshy part of your thumb. (Be sure to make contact with the tarsometatarsi close to the metatarsal joint, but extended far enough below the joint so that the bird cannot kick.)
- Use the leg hold with discretion. If the bird begins flapping its wings ceaselessly, put it in the bander's grip. Do not allow a bird to exhaust itself for the sake of a great photograph.
- While being processed in the bander's grip, a bird is often held belly up, head pointed down. When pausing to scribe or discuss some facet of the work with a partner, remember to shift to a vertical (head up) hold. The bird needs a break from the head rush it's getting.
- The forced loss of pin feathers on the head of a molting bird during skulling is painful to the bird. Try pushing up the skin from the back of the neck if this seems more apt not to 'pop pins', or use other ageing criteria when possible.
- When finished processing, smooth down skulled head feathers and any ruffled flight feathers. The bird should be set free with insulation and flight capabilities intact.

HOLDS

The Bander's Grip

The "bander's grip" (below) is the best and safest way of holding a small or medium-sized bird. Hold the bird with its neck between the two distal knuckles of your forefinger and middle finger. With these two fingers closed gently around the bird's neck, fingertips together, the wings can be contained against the palm of your hand. The remaining fingers and thumb are closed loosely around the bird's body, forming a kind of "cage." This hold leaves the bird's legs free for banding.

By clamping the tarsometatarsus at the metatarsal joint securely between your thumb and forefinger (or ring finger), the leg is secure for banding. Should the bird struggle, the hold will prevent any injury to the leg. You can safely measure the wing chord or check for fat by lifting your thumb away from the bird's body.

The key to the bander's grip is to hold the neck firm enough so that the head cannot slip back through your fingers. Your hand should cradle the body and restrain the bird from struggling so that it is not injured or expending energy trying to escape. If the bird struggles a great deal, and you are finished banding, the legs can be folded as if the bird was perched, and placed between its body and your ring finger. This will minimize struggling and allow you to proceed with other measurements.

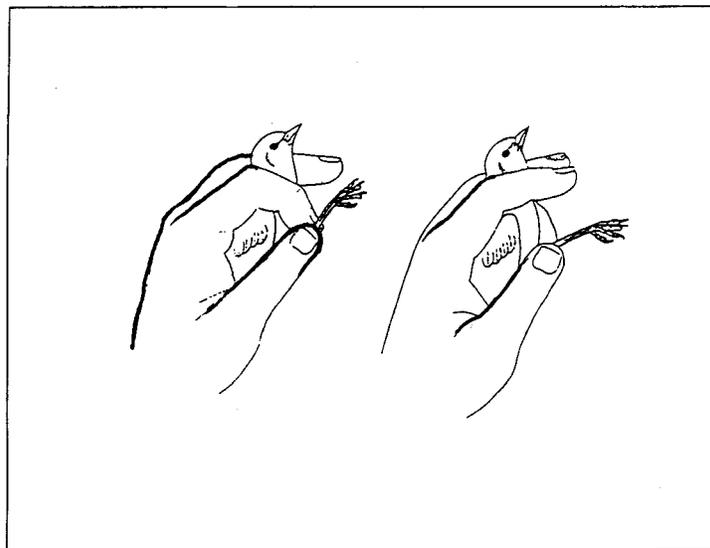


Figure 8. Aspects of the Bander's Grip showing how the tarsal joint can be held (from Lowe 1989).

Although this is the most basic of all banding grips, there are some things you should know about holding certain species:

- Most birds are usually docile, but some (e.g. sparrows, starlings, wrens, woodpeckers, blackbirds, grosbeaks and jays) will often kick or bite. Some species (e.g. Song Sparrow) lie calmly, then suddenly kick away and free themselves from your hand. Be prepared by keeping a firm grip throughout. Kicking can be minimized by positioning the leg not being banded between your ring finger and the body of the bird as described above. Bad biters can be handed a small twig for them to bite on, or their heads can be covered temporarily by a light piece of cloth. One clever contraption designed to temporarily calm and disarm bad biters is the modified toilet paper tube depicted below (S. Craig pers. comm.):

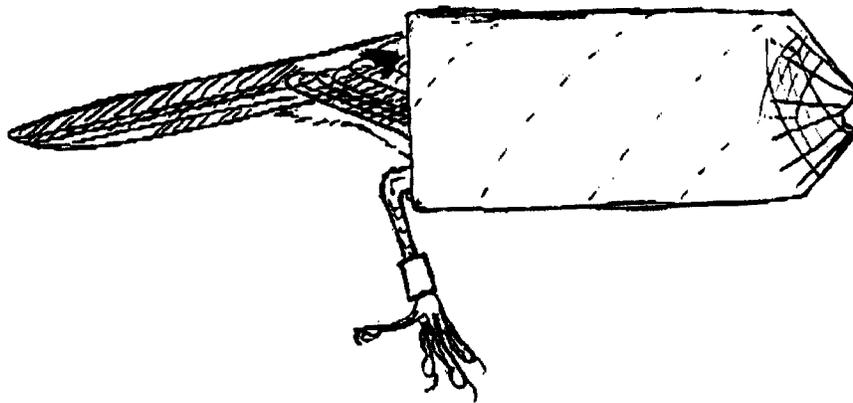


Figure 9. A toilet paper tube with v-shaped easements cut in one end, molded into a blunt cone shape and fixed with tape. Breeding characteristics and wing chord can be taken on the bird by sliding the tube up towards the head. Drawing courtesy of Susan Craig.

- Small, perky birds like wrens are especially able to wriggle out of the bander's grip in seconds. They use their feet to put pressure on the fingers around their necks, and quickly slip their heads from your grasp. Your grip must be sure, but not stifling.
- Caution is required when handling hummingbirds. They are fragile and can go into shock due to stress or lack of food. In addition to the bander's grip, they can be held for short periods of time by the base of their bill, or better yet, in the

pencil grip (very lightly holding the wings closed against the body between your thumb and forefinger). Never hold a hummingbird by its legs.

- Care must be taken when handling long-legged shorebirds. Leave their legs free for banding and never fold them up against their body (McCracken et al.1994).
- *Never* hold raptors in the bander's grip. If a raptor has recently fed, the bander's grip could cause the bones of the eaten prey to puncture the crop (B. Walker pers. comm.). Raptors should be held in the ice-cream cone grip.
- Some birds (e.g. flickers) are apt to scream a lot. This does not mean they are in pain, but it is certainly disturbing. Try covering a screamer's head with a piece of cloth - reduced stimuli may help. The best thing to do is to process and release screaming birds as quickly as possible.

The Leg Hold (Photographer's Grip)

Many passerines can be safely held by their legs for brief periods, but you must grasp the legs as close to the body as possible. Never hold hummingbirds, kingfishers or goatsuckers in this grip as their legs are too weak.

The leg hold, or photographer's grip (below), is used to hold birds while photographing them since it maximizes the amount of plumage in view; to transfer them from one bander's hand to another; or to examine features. For this hold, you "scissor" grip the bird's tibia between the fore and middle fingers (or between the ring and middle fingers if your hand is very small) and then clamp the bird's tarsometatarsi between your thumb and fore (or middle) finger. In this hold, the bird is securely gripped above and below the metatarsal joint, which is bent into an "L" shape. The bird will be able to flap its wings and rock backwards and forwards, but it should not be able to rock from side to side. Never hold a bird by the ends of its legs alone — they will break! Place your free hand over the bird's back to keep its wings from flapping until the photographer is ready to shoot.

Birds should not be held in this grip for longer than necessary, since they will be expending additional energy trying to escape. Still, it is an essential grip to master since it is often used while extracting birds from mist nets.

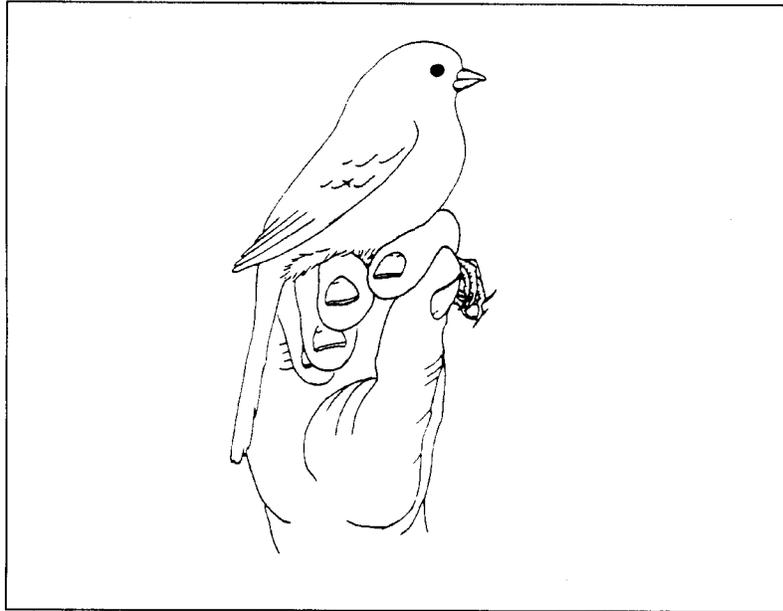


Figure 10. The leg hold (photographer's grip), (McCracken et al. 1994).

A modified version of the leg hold sometimes useful when handling small passerines, especially during extraction:

From behind, palm-side down, place your index finger between the bird's tibia, the thumb and middle finger on either side, clamping down.

The Ice-cream Cone Grip

This grip (below) works great on kingfishers, crows, jays and grackles and is particularly useful for many raptors. In this hold, the legs are fully extended down the tail, and the lower part of the bird (the upper part of the legs and tail, the lower part of the wings and body) is clenched in a fist as if you were holding an ice-cream cone. Because the feet are extended away from the hand holding the bird, they are non-threatening. Because the wings are held securely, birds which tend to struggle or flick their wings cannot do so. This decreases the risk of injury to the bird. The ice-cream cone grip is the preferred way to hold small raptors for banding. **Never use the bander's grip on raptors.**

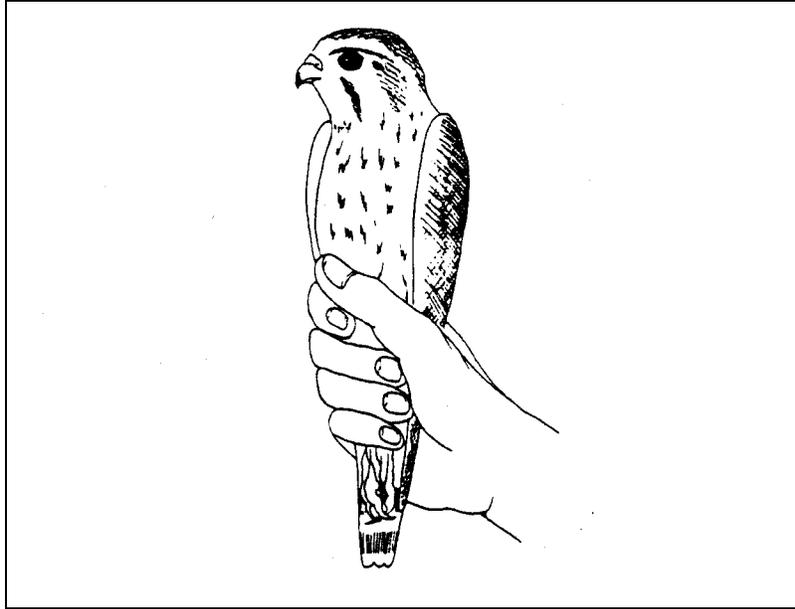


Figure 11. The ice-cream cone grip (McCracken et al. 1994).

EXTRACTION TECHNIQUES AND TROUBLESHOOTING

The following extraction tips include descriptions of both common practices and tricky situations. Two of the most valuable and indispensable tools to carry with you on a net run: a seam ripper (pocket knife or nail clippers) and a deep, focused patience.

Extracting a Bird from a Mist Net

Most birds will fly straight into a mist net and be so surprised that they will not immediately start to struggle. After a few minutes, the bird will begin to grasp with its feet and flutter its wings. The longer a bird is left in the net, the harder it will be to get out. This is particularly true of smaller birds which can fit part of their body through the mesh. For this reason, nets should be checked frequently. The longer a bird is left in a net, the greater risk there is of predation or for it suffering from exposure. Always minimize the risks to netted birds.

Removing a bird from a mist net is an art, though it's really mostly a matter of common sense and logic. Net extraction must be learned under the supervision of an experienced person. Much of what is described here will make more sense when you have seen it done a few times.

Removing a bird is normally a one-person proposition — two people trying to work together are seldom successful. Trainees should remember this and keep their hands off the bird and net unless specifically called upon by the person removing the bird.

Different banders frequently have slightly different ways of extracting birds. In all techniques, the key to good extractions is a light touch. Part of learning how to extract birds is learning their habits and getting familiar with how different species react and entangle themselves. It takes a lot of practice to master extraction techniques, but you'll eventually develop a "feel" for the process. If trainees have excessive difficulty in developing these skills within a reasonable amount of time, however, they should consider that their time might be better spent using traps only, or concentrating on helping out mostly as a scribe. Not everyone has the dexterity, eye-sight, patience and ability necessary to become proficient at mist net extractions.

What follows is a generalized account of how most extractions are performed. Since the bird is flying forward when it hits the net, its tail and legs should be the last things to enter the pocket. This is where the extraction begins. Extraction is easiest if you simply reverse the process of entry.

- **Approach the net quietly.** If many birds are caught, don't panic. Call for assistance if you require it. Assess the situation. First, look for birds that are in distress. Are any birds double-tiered, or caught by one leg only, or are there large and/or aggressive species lying next to small ones, or are any birds hanging on the ground? Begin by calmly and efficiently removing the high-risk birds first.

- **Determine from which side the bird entered.** This is done by seeing to which side of the shelf string the pocket hangs. Place the bird in the bander's grip or the leg hold, and look for a patch on the belly or undertail coverts that is free of mesh — a "clear belly." Check that mesh is not hidden underneath the body feathers. Work from this side of the net or you will worsen the situation. Throughout the extraction process, you'll find it helpful to occasionally blow on the bird's feathers to reveal strands of netting.

The body pluck (or body grasp) method (*adapted from Ralph et al.1993*)

If the bird has just been caught, it may be lying on its belly in the pocket of the net and can be extracted quickly by placing it in the bander's grip right away (see Figure 12) and removing it. As you pull the bird up and away from the net its metatarsal joints will straighten, often causing the feet to relax their grip. If the toes are caught, gently "massage" the strands of netting down off the toes. In some cases, you will need to first free the hallux (opposable toe) and bend it back away from the other toes, an action which causes the other three toes to extend and makes it easier to massage the netting off of them with light, repeated strokes.

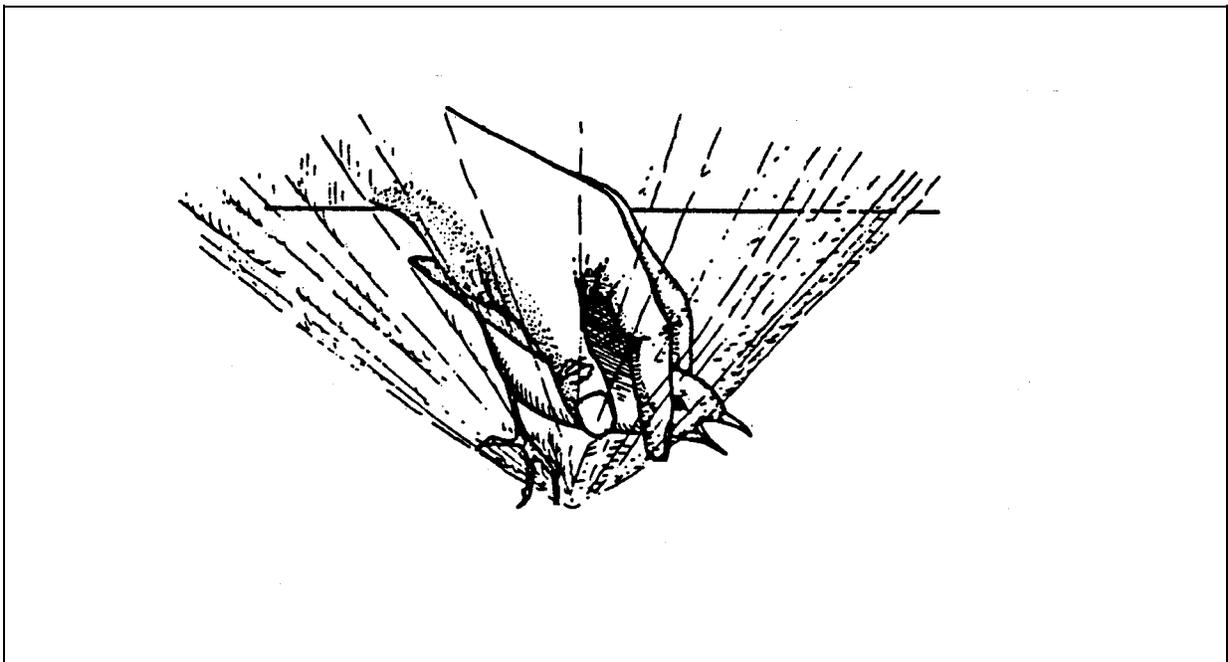


Figure 12. Removing a bird from a mist net using the bander's grip straight away (from Spencer 1992).

If the bird is caught by the head and wings, you will not be able to immediately put it in the bander's grip. Instead, slip your fingers over the body and *under* the wings.

Your thumb will wrap around to the front of the breast, while your palm and fingers curl around the other side gently. Slightly pull the bird away from the net so that you can access the bend of the wing (carpal joint.). Remove netting from the bend of the wing by sliding net strands from the underside of the wing over the carpal joint and off. To keep the carpal joint from stretching too much, you will need to anchor the edge of the wing with a free finger as you perform this task. Lightly blowing on the bird's feathers or gently pulling exposed strands of netting will help you determine if and where threads are still caught.

When one wing is free, adjust the hand holding the bird so that your thumb or fingers now clasp the free wing against the bird's body. Next, remove the netting from the head. To facilitate freeing the head, you may first need to work the mesh up the body to the neck and throat. Then, free the head by plucking net strands from the back of the neck forward, as in the manner of removing a turtle-neck sweater (see Figure 13). Wiggle the netting a bit from side to side as you edge it forward. Always anchor the bill with your thumb or finger to offer the neck support during this action. If the bird is large like a thrush, watch that you don't injure the eyes and that there are no pin feathers to catch on the net.

Now, remove netting off of the other wing, and readjust your hold, as described above. The bird has gradually been maneuvered into the bander's grip. The feet can be removed as described above.

Most birds can be removed via the body pluck method. However, if the body is too tangled to enable this technique, the feet first method should be used.

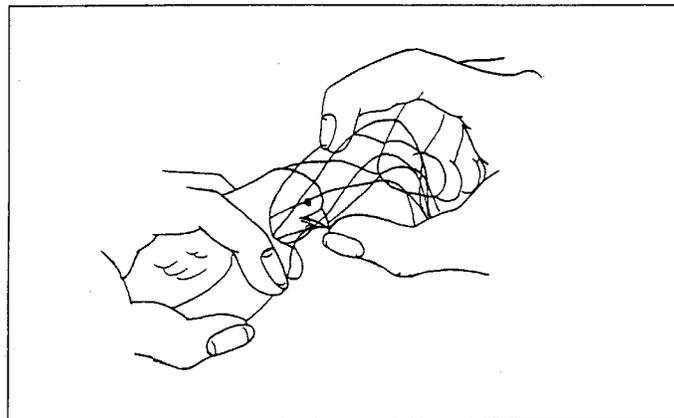


Figure 13. Removing mesh from around a bird's head (McCracken et al. 1994).

The feet first method

Securely grasp the bird by the legs in the leg hold (photographer's grip), letting the net support the rest of the bird. If possible, wrap your ring finger and pinky around the bird's back to offer greater support. If there are threads caught up on the bird's tibia, pull these down toward the foot, quickly slipping them under your fingers as you do so. If the threads are caught too tightly on the tibia, then leave them for now.

Bird legs are designed so that when they are folded during perching, the feet are locked in a closed position. When the legs are extended during "take off" the feet naturally relax and open. With the bird in the left hand (if you are right-handed) and in the leg hold, gently use your right-hand fingers to extend the legs and "massage" the net off the feet and toes with your fingers.

Once the legs are free, continue holding the bird in the leg hold and try to free the wings. As the bird strikes the net, it will fold its wings. Hence, it is the bend in the wing (the carpal joint) that often goes through the mesh, at least part way. Sometimes the mesh will ride down the primaries of the wing. In this case, it is often a good idea to pull the mesh farther down and off the primaries, then back up and over the carpal joint. Keep in mind that the tips of the primaries are quite flexible - you will not harm the bird if you bend them. The careful use of a seam ripper will be very helpful to lift away hard to reach strands of mesh. **Never** force the mesh over the joint or up the feather shafts. This can cause tissue or feather damage. If the net is lying loosely on the wing, or if it is a small bird, the net can simply be lifted over the carpal joint. Use your best judgement and disentangle the easiest wing first.

After freeing one wing, decide whether it will be easier to remove the net from the head or the other wing next. If the opposite wing is freed easily, then change your hold to the bander's grip so that more of the bird's body is supported when you start to work on the head. This will also minimize the bird's struggling and make extraction that much easier. Free the head as described in the body pluck method.

Tricky Extraction Situations

There are many variations of the procedures outlined above. Some of the most common situations are outlined below. If you run into any kind of difficulty, get help from a more experienced bander.

If the bird has spun in the net, unwind the spin with your fingers as you begin the extraction and continue unwinding as you work.

If at the very start you cannot seem to find the "bare belly" or decide from which side the bird entered, free the feet and legs to give you a clue. Sometimes a small bird will enter from one side, struggle and make it part way through the mesh, then flutter and re-enter from the opposite side. Freeing the legs and feet may make it easier to see the bare belly patch. Beware of mesh concealed under body feathers of the belly and be equally aware that if the mesh is caught high up on the bird's tibia, it may appear to be covering the belly.

If the bird is caught in one tier and weighs the net so that it hangs down to overlap another tier, it could become "double-tiered." That is, its head, legs and possibly wings could be entangled in two pockets. Remove the mesh from the outer pocket first, then deal with the pocket into which the bird actually flew.

If the bird has gone through the net at a hole in the mesh, be patient. It may have flipped up and around another shelf string, twisted, become double-tiered or any number of other twists and flutters. This can be the most dangerous extraction situation; after extracting a bird from a hole in the net you will realize the need for frequent net repairs.

During most extractions, switch to the bander's grip as soon as you can. When the bird feels itself being freed, it will begin to struggle and flap more. When extracting a raptor, grab the legs securely, being careful of the talons. Get it into the ice-cream cone grip as soon as possible. Because the toes are large and the raptor will grip at the mesh, the feet may be badly entangled and strands may have to be picked off one by one.

Some birds have strongly arrow-head shaped tongues. When a bird gets "tongued," it has bitten down on the net and the mesh has slipped around the fork at the back of the tongue. Hold the bird in the bander's grip, then pry the bill open with your fingers. At this point, a seam ripper is really handy to carefully pull the threads backward, off the fork of the bird's tongue, and out of its mouth. This can be a delicate situation and is often left as the last step in the extraction. Proceed slowly and be gentle, all the while keeping the net tension-free. It is sometimes helpful if one person holds the bird, while another frees the netting from the tongue.

All banders should carry around a seam ripper, plastic toothpick or nail clippers to help free up those hard to get at threads. A seam ripper (or similar object) should be considered an indispensable piece of your banding equipment. In an emergency, a thin stiff twig can be an adequate substitute (T. Evans pers. comm.). Similarly, growing out the thumbnail and the fingernails of the first two fingers of your "picking" hand will greatly assist you in extracting birds. A good bander rarely has to cut a bird out of a net. Holes can pose a risk to other birds that are subsequently captured. Cutting netting is used only as a last resort (e.g. when injury is occurring to the bird that will only worsen with more handling and/or when the most experienced bander on hand is unable to quickly free the bird). Even then, it is used judiciously and sparingly. If you do have to cut a few threads, make certain that no mesh is left hidden on the bird.

If extraction takes a long time (more than a few minutes) and the bird is exhausted, release it immediately unbanded. There's no point in putting it through additional stress. Again, trainees should get assistance from more experienced banders whenever possible if they are faced with extraction difficulties.

RELEASING BIRDS

Release birds low to the ground. Otherwise, a bird that cannot fly (due to stress or wing strain) will be injured by the fall. An excellent way to release birds is to set them into the bottom of a box (a "release box") that is 18" or so deep and wide enough for an adequate "take-off" (S. Haywood pers. comm.). If the bird can fly, it should be able to clear the box - if not, it can easily be transferred to a covered hospital box where it can rest safely for awhile. If releasing the bird from your hand, place it in your open palm or on an object near the ground - do not just loosen your hold on the bird while in the bander's grip or leg hold and let it take off from there, as this can cause injury to the bird.

III. PROTOCOL FOR NET CLOSURE

PREDATORS

It is not appropriate to treat predation at nets as an acceptable "natural phenomenon." The effects of predators on a mist netting operation are twofold: (1) birds may be injured or killed, and (2) the predator often damages the net, which unless repaired immediately, poses a threat to subsequent captures. As in other matters, anticipation, alertness and swift action by the bander minimizes the risk.

Birds

Banders must be continually on the lookout for avian predators. Should the presence of one be noticed, nets should be checked more frequently, but failing that, *nets should be closed*. If present, raptors will often attack birds caught in mist nets. Other species can be dangerous as well — e.g. jays, magpies, shrikes and grackles. No bander can prevent occasional predation by an itinerant raptor or jay, but if a predator learns what mist nets can provide, then there is no alternative but to close the nets until the problem has gone away. Sites that concentrate raptors at certain times of the year may regularly have days when mist netting for songbirds is precluded.

Mammals

A number of mammals can prey upon birds in nets (e.g. foxes, weasels, raccoons and skunks). Squirrels and chipmunks and even deer and porcupine have been known to eat birds. As with avian predators, banders must be alert to the presence of known or potential predators. If a problem occurs, steps must be taken to prevent its recurrence, such as making more frequent checks of nets, or by raising the nets higher so that captured birds are out of reach. If the problem cannot be contained, bird trapping should cease until the predator has lost interest. You may need to resort to trapping and relocating repeat offenders.

Snakes

Many snakes will prey upon trapped birds. Their reach can be surprisingly high, and they can climb poles. You should be alert to this possibility and take action. Make frequent net checks, raise nets well above the ground, and capture and relocate

offensive species seen near nets. Do not kill snakes.

Stinging and Biting Insects

Certain insects can kill birds hanging immobile in mist nets. Fire ants in the south have been known to attack birds in mist nets, especially where active mounds are close by and grasses below the nets are touching the bottom tier. The best mode of defense is to keep vegetation under the nets scalped and to destroy ant mounds near the nets. Yellow jackets have been reported attacking birds in nets, presumably in defense of a nearby hive. In such cases, the net should not be operated until the hive has been removed.

WEATHER

A constant awareness of the weather and a clear understanding of the conditions in which it is inappropriate to band are crucial skills for the responsible bander. Birds are sensitive to exposure to heat and cold, and consequently should not be left in nets longer than necessary (Gaunt and Oring 1999). Deaths and injuries caused by exposure to the elements are avoidable.

Rain

Avoid banding in the rain (McCracken et al. 1994 and Ralph et al. 1993). Birds' feathers lose insulating capabilities when drenched with water. In this state, birds may easily become hypothermic. Banding through a warm, light drizzle (that you anticipate will cease before long) is sometimes acceptable, depending on your station's size and the number and expertise of field assistants, but only if there is tree canopy sheltering the nets. If water droplets are collecting on the mesh of the mist nets, it is too wet out to band. If feathers are sticking to your hands during extraction, it is too wet out to band. Even in a light drizzle, if you know you cannot make net runs in at least twenty-minute intervals, do not band. If you do band in a drizzle, and it keeps up long enough to risk any of the above characteristics, call it quits. Never allow bird bags to get soaked - keep them in a plastic grocery bag during the net run and when not in use. For those banders working outside, a worthwhile endeavor is to string an overhead tarp at the banding station, and to keep the data and your field guides dry in a plastic tub. The best idea of all: **choose a different day.**

Wind

Close nets exposed to strong winds. Birds trapped in mist nets can be unduly yanked, stretched, or even strangled under these conditions. Strong winds decrease capture rates dramatically and bias standardized data. The general rule for closing due to wind is as follows: a steady wind exceeding 10 mph or strong gusts exceeding 15 mph are too strong to band in (Ralph et al. 1993). Realistically, most banders do not carry a wind gauge in the field, so try these criteria: **a light, billowing breeze is o.k., but winds or frequent gusts that arc the pockets of the mist nets into strong "half-moons" merit net closure.** It is important to realize that many of your nets may be aptly sheltered from a strong wind, while others need to be closed.

Heat

Close nets that are exposed to direct sunlight on hot days, especially when humidity is high or there is no breeze. Birds exposed to the hot sun can suffer from heat stress and die within several minutes when immobilized in a mist net! High humidity and/or the complete lack of a breeze will compound the problem. It cannot be stressed enough how important it is to keep a close watch on the sun. Carry a thermometer in your banding kit. Develop acceptable temperature guidelines for banding in your area and be sure that all personnel are informed of them. Consider each net location when assessing heat conditions - maintain an awareness during net runs. Conditions where *you* are in between runs (in a cush lab or on a tarp in the shade) may not reflect the strength of the sun's beat elsewhere at your station. Know and make all assistants aware of, your potential "sun nets" at different times of the day. In some geographic regions and/or habitats it will be necessary for some or all nets at a station to be routinely closed early.

Cold

Do not open nets in very cold temperatures. Develop acceptable temperature guidelines for banding in your area and be sure that all personnel are informed of them. Birds exposed to the cold are subject to cold stress and hypothermia. Days that are damp and overcast as well as cold are especially detrimental, and seem to greatly increase the chances for cold stress. Wind can exacerbate cold temperatures and lead to increased hypothermia. Compounding all of this is the fact that one cannot wear gloves when extracting birds from mist nets. If your fingers are too frigid and

immobilized to be able to adequately extract a bird, that's a sure cue to wait awhile longer for the sun to warm things up.

When working in borderline (or actually any) conditions, do not neglect the importance of the concept *dry*. Wet vegetation is bound to create its own "rain" as you amble through it. Be conscientious about keeping bird bags dry - keeping empty bags in a weatherproof pocket or plastic grocery bag is a good idea. One thing to try that will guard birds en route to the banding station from both the wet and the cold: wear a "necklace" of rope, measured to about the dip where the clavicles meet. On this necklace, fasten a strong clip or carabineer (that thing rock climbers use). Make sure the latch mechanism is sturdy and snaps strongly in place. When on a net run, you can clip the loops of all your bird bags onto the carabineer, and tuck the bags themselves *loosely* inside the top of your jacket. Birds stay toasty and dry. Caution: if you try this, make sure you don't fall forward or ram into trees chest-first (some banding stations are nature's obstacle courses, after all), and do not use this method in warm weather, as birds could easily overheat.

The most important piece of field equipment for a banding operation that encounters cold weather is a **heated hospital box**. (Refer to "*Cold Stress*" and "*Making and Using a Hospital Box*" in the *Stress, Injuries and Field Treatments* section).

BIRD NUMBERS AND PEOPLE ON HAND

When deciding how many nets to open, you should balance the number of birds you anticipate catching against the number and skill-levels of people on hand. You should be especially cautious when operating at a new site, particularly if it is one likely to concentrate migrants or groups of dispersing juveniles. Some or all nets and traps must be closed in response to large numbers of birds. You should **not** be out to set records. Whenever you encounter a situation where you cannot safely band the number of birds you are catching, you should let some go unbanded and close down some or all of the nets.

IV. STRESS, INJURIES AND FIELD TREATMENTS

Anyone who bands for any good length of time will experience the down side of mist netting and banding birds - casualties. A responsible bander must have a sense of what the best course of action is for a wide variety of possible scenarios...and have a well-provisioned banding operation that can effectively deal with crisis situations. Good banders will do anything and everything to prevent casualties at their stations. The goal is always zero when it comes to injured/dead birds.

Note: The treatment or euthanasia of injured birds may be covered by various federal, state, and provincial regulations. Banders should consult their appropriate law enforcement authorities to be informed of any and all such regulations.

This section is addressed to the majority of banders, who may not have access to a licensed avian rehabilitator qualified in dealing with small landbirds. Indeed, though qualified people do exist, they are few and far between. The treatments listed, therefore, are generally simple ones that can be administered by any bander in the field. Please refer to the following section, *Avian Rehabilitation*, for information on locating the best avian rehabilitator in your area.

SIGNS OF STRESS

It is instinctive behavior for songbirds, as prey species, to do their best to hide pain and stress (Orendorff 1995). A bird may appear normal when, suddenly, the progressive symptoms of stress avail themselves to the surprised bander. Never take the bird's condition for granted; maintain a continued awareness of its disposition.

The following are some overt indications of stress in birds, along with appropriate treatment protocols:

Closed/Closing Eyes

First look to see if *both* eyes are closed. The bird may just not want to look at you - the eye not facing you may be wide open. Such cases are usually not a concern, but keep a close watch. If both eyes are closed, put the bird in the leg hold and *gently* bounce it up and down. In most cases, this will stimulate the bird back in to a state

of open-eyed awareness. If it does not, or if closing of the eyes is accompanied by another sign of stress, such as limpness, the bird may be in acute distress, and will require an undisturbed interval in the hospital box (see *Making and Using a Hospital Box*, below). Do not disturb or check on the bird for at least twenty minutes, unless you can hear it scuttling around inside, which likely means it's ready for release. Activate the heat source if it is cool or cold out. If hot, put the box in deep shade. Be especially quiet around the stressed bird, and resist the temptation to peek into the box more frequently than every twenty or thirty minutes. Note: if it is hot out, the bird may benefit from a few drops of water or Gatorade - but if not taken readily, do not force the bird to drink.

Mouth-breathing (Panting or Gaping)

Some passerines (such as jays) typically gape at you open-mouthed while being handled. Although this may not be anything to worry about, expedient processing is recommended. If, however, the bill is moving up and down as in a panting gesture, or the gaping is accompanied by another sign of stress, such as limpness, the bird is in acute distress. Follow the above protocol.

Limpness

The bird appears listless or limp - it lacks normal body tension. First try delicately bouncing the bird, as above. If the bird does not perk up immediately (barring hummingbirds - see *Torpor*), it is in a serious stage of stress. Follow the above protocol.

Fluffing Up Feathers

This is usually seen in combination with limpness, and is often a serious indication of stress. Follow the above protocol.

Convulsions

A bird stressed to the "edge" may become so agitated that it begins going through convulsions. While this is rare, and most traumatic for the bird and the viewer, it does not necessarily indicate a sure and imminent death. If the bird is placed in a warm hospital box and left undisturbed, it may fully recover and fly away.

Hemorrhage

Birds have a higher blood pressure than mammals. Extreme nervous excitement induced by excessive handling may be sufficient to produce hemorrhaging (McCracken et al. 1994). There are even reports of birds dying from ruptured blood vessels when involved in prolonged territorial disputes. Although a hemorrhage is rare in a banding operation, it may be manifested as traces of blood seen in the mouth or as a slight wheezing, an indication of a lung hemorrhage. If symptoms are detected, handling must cease immediately and the bird put in a hospital box until the situation improves. Subsequent re-trapping indicates that some birds behaving this way suffer no lasting impairment.

Torpor

Hummingbirds, because of their size and metabolic needs, frequently react to stress by going into a mild torpor. They will often lie belly down on your open palm after being extracted, apparently unaware that freedom awaits them. Hummers need to be "bounced" gently and repeatedly in a cupped hand to entice flight (this is just a mild nudging - as if you were patting a dog under the chin). If this doesn't work, try slowly swinging down the arm with the hummer (like your gearing up to throw a softball underhanded), and then slowly swinging it back up. The hummer may continue upward off the runway. Sometimes, blowing on the back of the head quickly and lightly will also help.

TYPES OF STRESS

Heat Exhaustion

It takes little time (as little as ten minutes) for a bird to suffer from heat exhaustion in certain conditions (see "*Heat*", *Weather Considerations*). Small birds can overheat in mist nets and bird bags. However, this is easily avoided with forethought and alertness. Don't open nets in direct afternoon sunlight on hot days. On very hot days, *particularly if combined with high humidity*, monitor the captures closely and be prepared to close nets, release birds waiting to be processed, or reduce the processing time.

Never leave occupied bird bags or holding boxes in full sun and always space out bags at the banding location to allow air to circulate among them. Keep bags clean and dry so that air can circulate through them. If birds have had to be doubled up in bags,

transfer them to empty bags as soon as possible, so that they don't heat each other up.

Heat exhaustion can also occur when processing in a heated building on very cold days with cold-adapted species such as Snow Buntings. Consideration should be given to minimize the time these birds spend in a warm banding lab.

Treatments

- **Prevention is by far the best "cure" when it comes to heat stress.** Follow the closing guidelines under *Heat* in the *Weather* section, and make sure that anyone who is going to band at your station knows them. If necessary, post closing temperatures and the net numbers of "sun nets" in an obvious place for emphasis.

- **If you get a heat-stressed bird, here is a good home remedy - *hydration*: with an eye-dropper, feed the bird full-strength Gatorade (or water), one drop at a time, at the tip of the bill.** The electrolytes in Gatorade make it similar to solutions used by songbird rehabilitators (P. Kyle pers. comm.). There is no need to pry the bill open, as the fluid will begin to drain in and the bird will "smack its lips" to catch the rest. In lieu of an eye-dropper, you can pour the liquid into a bottle cap and poke the *tip* of the bill in. Be sure to keep the bird upright as you do this, and never immerse the nares - you could drown the bird. Never force the bird to drink - if it won't take it, then leave it be. Gatorade comes in powdered packets - great for the field. It should be mixed up fresh for use - old solutions should not lay to waste at the bottom of the banding kit. Note: The juice from a squeezed grape has also met with success in rehydrating heat-stressed birds.

- **If you have a hummingbird that refuses to "awaken", sweetwater may help.** To make sweetwater, use 4 parts water to 1 part cane sugar. As with the Gatorade solution, always make fresh - you can keep a couple of small packets of sugar (compliments of your local diner) in the banding kit. **Do not use honey** - it is notorious for causing candida which may actually be fatal to hummers. (P. Kyle pers. comm.) A cool way to feed hummers: take the needle off of a syringe, paint the syringe-tip red and fill with sweetwater. Feed *one drop* at a time.

- **Spritz a heat-stressed bird lightly with cool water from a spray-mist bottle** (S. Heckley pers. comm.). Keep the bird at an arms length and *mist* (never *stream*). Small spray-misters can be found at any major drug store or "everything" store (e.g. Walmart).
- **Dab cold water on the bottoms of a heat-stressed bird's feet.**

Remember that less is often more - in other words, do not be too gung-ho to administer all of the above at once, or you may risk causing further stress from over-handling. If you have a bird that seems close to the edge, it is probably best to briefly hydrate the bird and then place it in a hospital box in the deep shade for twenty minutes or so.

Cold Exhaustion

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

Birds with wet or even damp feathers are prone to cold exhaustion at any time. For this reason, mist netting in rain or even a heavy mist is not advised (see *Rain* in the *Weather* section). Following overnight dew, nets should be shaken as dry as possible before starting to capture. If a bird gets wet, keep it in a warm, dry place until dry.

Treatments

- **Prevention is by far the best "cure" when it comes to cold exhaustion.** Follow the closing guidelines under "*Cold*" in the *Weather* section, and make sure that anyone who is going to band at your station knows them. If necessary, post closing temperatures for cold weather in an obvious place for emphasis.
- **It may be desirable to rehydrate the bird with Gatorade, as described in Heat Exhaustion, above.**

- **Place the bird in a heated hospital box, or "hot box".** This is by far the most important first aid accessory in any field kit, especially in cooler climates. A banding lab that has electricity can be outfitted with an electric model: a small wooden cubicle with a few air holes, lined with a heating pad and covered by an old t-shirt or flannel pillowcase (see Type A below). Otherwise, a small igloo cooler can be used, lined with a couple of hand-warmers (available at ski shops and sporting good stores) and covered with a pillowcase (see Type B below.) Lacking an available hot box, if you band close to your vehicle you can stick the bird in a bird bag, get in, and crank up the heat as high as it will go. An even more organic solution is to place the bird (in bag) loosely under your armpit.

Red Flag Species

Certain species have become known as “red flag” species, because they tend to exhibit extreme signs of stress more readily than others. This, of course, can vary from region to region, and even from year to year. Generally, this list includes small birds with rapid metabolic rates and a few larger species. In addition, although all juvenile birds are more delicate than the adults, some species are especially so, and fall into the 'red flag' category even when adults of the same species do not.

At this printing, the following species or species groups (with corresponding ages) have been known to fall into the red flag category:

- 1) hummingbirds - any age
- 2) kinglets - any age, but especially juveniles
- 3) juncos - juveniles
- 4) Spotted/Rufous-sided Towhees - any age
- 5) small flycatchers - any age
- 6) Brown Creepers - juveniles
- 7) MacGillivray's Warbler - any age (this may be unique to the Pacific Northwest)
- 8) House and Winter wrens - any age
- 9) any small juvenile passerine in heavy body molt

It is possible that you will discover others that qualify to be on this list, or, conversely, that none of the above will prove overly prone to stress at your banding station. At any rate, it is important to identify red flag species (if there are any) at your station, and to make them widely known amongst all who band there. It is a good idea to post the

names of those species in an obvious place, for emphasis.

MAKING AND USING A HOSPITAL BOX

A hospital box ("hot box", when heat device is implemented,) is indispensable to a good banding operation, and should be used for birds suffering from cold exhaustion or severe stress or injury.

Type A (Electric Model)

Suggested Materials: four 10" x 12", and two 12" x 12" pieces of ½" plywood, one 6" diameter circular piece of thick rubber inner tube (or a 7" - 8" length of blue-jean calf leg), 24 industrial staples, 48 1" nails, one 12" piano hinge (w/screws), one cupboard catch, one transparency sheet, duct tape, one 12" diameter electric heating pad, one dark-colored piece of lightweight cloth (~ 2 ½" square). Optional: felt and glue.

Tools Needed: hand drill w/1/4" drill bit, hammer, small cross-cut saw, phillips head screwdriver.

Construction:

Note: Lining each of the panels with felt adds shock absorption, in case a recuperated captive begins to flutter about in its cell.

- 1) You will need a "sleeve" through which a bird can easily be inserted or retrieved from the "hot box", but from which it cannot escape. Making the "sleeve": Cut a 4 ½" diameter circular opening into one panel of plywood (making the 10" side the height), about 2 ½" from the bottom and centered from both sides. Next, cut an "asterisk" of about 4" in diameter into the center of the rubber inner tubing, center over the opening and hammer on securely with industrial staples. Alternately, a blue jean leg may be used as a sleeve - just make sure that enough drapes down over the opening to prevent the bird's escape.
- 2) Take another plywood panel. Cut a small hole in the bottom, just large enough to accommodate the heating pad cord. Then drill about 6 1/4" breathing holes. Note: limit breathing holes to one panel to avoid drafts.
- 3) Nail or screw the panels together, leaving one side open.

- 4) In the last panel, cut a viewing window, and seal with the transparency sheet (or thin plexiglass) and duct tape. Attach the last panel with the piano hinge, and affix catch securely at top. This hinged panel will allow you to clean the hot box.
- 5) Line the bottom of hot box with heating pad, cover with an old t-shirt, and plug in.
- 6) Cover box with dark but lightweight, breathable cloth.

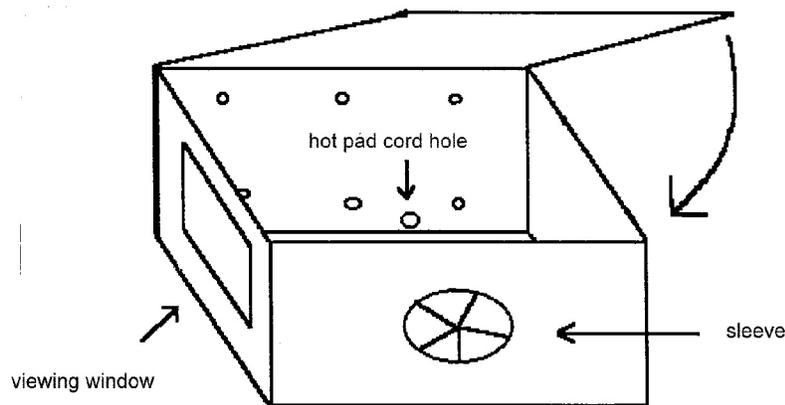


Figure 14. Diagram of a type A hot box

Type B (Field Model)

Obviously, those of us whose "banding lab" is the great outdoors do not have access to electricity. Because outdoor banders are not in a warm lab, and electric appliances are not an option, the "hot box" needs to have greater self-insulating qualities. For this reason, a small cooler may be the best housing. Cardboard shoe boxes and the like do not seem to be insulating enough, even with the heating device, and they also get trashed very quickly.

Assemble:

- 1) A small (six-pack sized) styrofoam cooler.
- 2) 2 hand warmers (small plastic packets filled with warming chemicals, usually activated by squeezing).
- 3) 1 thick piece of corrugated cardboard, or styrofoam, cut to fit, self-standing, inside cooler.
- 4) A cardboard box, cut to fit as a top flap.
- 5) An old flannel pillowcase, or other soft, tightly-woven fabric.

Drill a small breathing hole in each side of the cooler. Don't drill into the top lid, as heat rises, and we want as little to escape as possible. Line the bottom of the cooler with the flannel pillow case. Arrange the cardboard or styrofoam partition inside to create two small cells. This will double your "hot box" capacity, as well as concentrate the warmed area for a single bird. Cut up a piece of cardboard so that it covers the cells, cut a slit about halfway through that is even with the top edge of the cell wall and crease each side, creating two "cell flaps" (see diagram). This will allow you to remove the cooler lid and access a bird from one cell without disturbing the other.

To use:

For a single bird in need of treatment - activate one of the hand warmers and place *under* the pillowcase in one of the partitions. Place the bird carefully in the cell. Do the same in the other cell if another bird becomes in need of treatment. To minimize heat loss from this type of "hot box", you do not want to cut a viewing window or a sleeve. Allow any seriously stressed bird a good twenty minutes before checking it for the first time. If it has not recuperated, continue to check at twenty-to-thirty minute intervals. You must open the cell flap *very carefully* to check the bird or take it out. You do not want unintended escapes if the bird is not yet well.

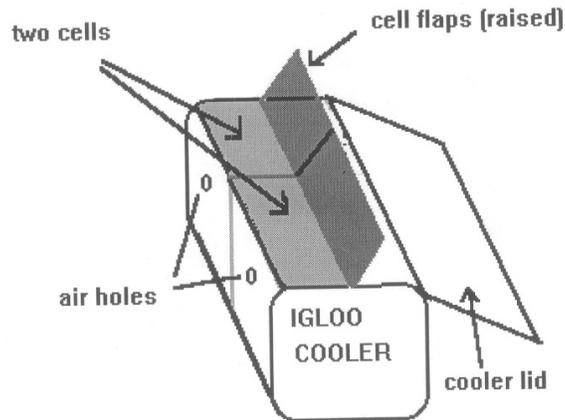


Figure 15. Diagram of a type B hot box

INJURIES - ASSESSMENT AND TREATMENT

Please refer to Appendix D, "Internal Diagrams of Birds", for any needed clarification of bird structure. Also, Appendix C, "A Field Technique for Measuring Relative Body Fitness in Birds" may prove of interest when considering the overall health of birds.

Abrasions and Lacerations

Abrasions usually result from a bird struggling or getting rough treatment in the net during extraction. They often occur around the carpals and tibia, where unseen strands of netting get caught up, and they can pose a mild risk of infection. Mainly, they cause the bird discomfort. Banders must try to avoid causing abrasions during extraction - watch for those tense threads. The use of an antibiotic ointment (such as neosporin) on an abrasion is not recommended, however, as the heavy oils will be distributed throughout the feathers during preening, possibly doing more harm than good.

Lacerations, or deep cuts, may need doctoring if the skin has puckered open, revealing soft tissue or muscle. One field remedy is to hold the skin together with tweezers (not your fingers!) and apply *one drop* of super glue at the seam (M. Murray pers. comm.). Hold for as long as the instructions indicate, and definitely until dry. This process is more widely acclaimed than you may think (vets and rehabbers do it), and apparently works remarkably well. It is recommended, of course, for serious lacerations only and not for shallow or superficial cuts. Note: to stop bleeding in superficial cuts, try using

a couple contour feathers from the bird as a styptic (McKinney pers. comm.).

Air Bumps (Ruptured Air Sacs/Subcutaneous Emphysema)

Birds have a series of air sacs in the body that supplement the lungs and help to fill the extraordinary oxygen demands placed upon them in ordinary life (please refer to *The National Audubon Society Encyclopedia to North American Birds* page 763 for an excellent drawing of the positioning of the air sacs). Occasionally, one of these air sacs punctures. This can happen from an impact trauma - as in a bird hitting a window, or even from a sharp husk in the crop of a seed-eater poking into the clavicular air sac.

When an air sac is ruptured, the air within leaks into the outer skin, like a balloon being slowly filled with helium. What you see is the appearance of an air bump on the neck or belly area of the bird. It is unlikely that this could occur from any facet of the mist netting and banding process, but individuals with this condition have been caught in nets from time to time. Most cases are mild (the air bump is marble-sized) and should be self-resolving. In extreme cases, where it looks like the bird's behavior is impaired, causing restriction of movement, you can puncture the air bump with a sterile needle (D.Froehlich, M. Murray, and H. Pittel pers. comm.). These would include situations where the neck is so stiff with air that the bird is unable to move the head at all; air in the axillary area causes the wing to be out of place and rest abnormally; or the bird appears to be using the leg badly due to a ruptured air sac in the lower abdominal region (H. Pittel pers. comm.). Once the air has leaked out, you will need to hold the skin closed momentarily to complete the procedure.



Figure 16. A juvenal American Robin with subcutaneous emphysema. Photo courtesy of Hilary Pittel.

Tongue Damage

All passerines have flanges at the back of their tongue. When a bird gets caught in a mist net, netting can sometimes get caught around one or both flanges (in bander lingo, the bird has been "tongued"). This is particularly true for the larger species of thrush. In most cases, the netting can easily be lifted behind the flanges, then up and over the tongue, and finally out of the mouth. This requires the use of a thin, delicate tool, such as a toothpick or dull-tipped seam-ripper. Occasionally, a strand may have to be cut to speed release. Never leave cut strands of netting on the tongue.

Tongue lacerations usually result from a lack of awareness - the bander extracting the bird is unaware that it is "tongued", and proceeds to pull netting off of other parts of the body, unduly pulling the sharp, hidden strands into the base of the tongue. The discovery of the bird's tongued disposition isn't noticed until blood is coming out of its mouth. Tongue lacerations may also occur from the bird struggling in the net. Although *extremely* rare, it is even possible for a large thrush to lose its tongue in a mist net. This may happen when a tongued bird flaps so hard that the only thing remaining caught is the tongue, which then severs.

Treatment: any blood should be mopped gently from the bird's mouth (use your shirt), to prevent its choking. Bleeding will probably stop quickly. As soon as it does, our best general advice is to release the bird immediately, unless in shock, whereby it should be placed in a hospital box until it recovers.

Note: There is no survivability data on small birds with no tongues, but the consensus among vets and rehabbers seems to be that it "has a chance." If the bird can still manage to eat berries or other needed foods and fluids, it could survive. Taking the bird to a rehabber may help to determine whether a bird with no tongue can still manage to feed itself, although it won't really help the bird much (tongues cannot be made to grow back).

Tail Loss and Feather Damage

As part of a bird's strategy to avoid predation, tail feathers are not firmly anchored. Tail loss is probably the most common kind of "injury." It most often happens when an inexperienced bander tries to grab at an escaping bird, although it can also occur when placing birds in bags and not ensuring that the bird is in the bottom of the bag before tightening and looping the draw-string. The appearance is worse than the condition, since healthy birds are often seen with little or no tail as a result of a predator attack or very rapid molt. Still, it places additional energetic stress on a bird and is easily minimized with careful handling.

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

Leg Injuries

Very rarely, a bird will be found with a broken leg in a net. This is usually caused by some external force being applied to the net, effectively stressing the leg at the wrong angle until it breaks. The external force can originate from high wind or from another (usually larger) bird that is caught in the same panel of the net. Less often, it is a result of a banded bird being "hung up" by its band in a net due to a mist net strand slipping under the band. The latter can be eliminated by making sure that bands are properly closed. Frequently inspect your banding pliers to make sure that they are not so badly worn as to prevent full band closure. If they are worn, they must be replaced. Broken

legs can also occur during mist net extraction if the tarsometatarsi are held too low; these occurrences are entirely avoidable.

Broken tarsometatarsus

If a bird's tarsometatarsus (the unfeathered portion of the leg) is broken, it must be decided whether to release the bird without further ado, attempt to re-fuse the leg, or snip the leg off at the break. Many a bird has survived a broken leg in the wild - we have probably all encountered a bird at one time or another with one leg wildly akimbo, yet fused in place, the bird performing its bird tasks apparently unhampered.

Here are our best suggestions:

- 1) If the break is shallow, a small "bend" or crack, release the bird without further ado.
- 2) If the break is causing the tarsometatarsus to bend at an askew angle, but is not "hanging from a thread", you can attempt to re-fuse the leg.

If you decide to re-fuse the leg, there are several ways to accomplish this. You can hold the tarsometatarsus straight firmly but gently with tweezers or two small sticks, and apply a small dot of SuperGlue to fuse the leg (M. Murray pers. comm.). Some have successfully made "scotch tape splints" by wrapping a small piece around the break. "Magic" scotch tape has been suggested for use, because it is a little less sticky than cheaper brands, and should fall off on its own and not gunk up too much (H. Pittel pers. comm.). Another creative solution - you can try splinting the broken tarsometatarsus with a split section of hollow rachis from a gull (or other large bird's) feather (D. Froehlich pers. comm.). Similarly, a soda straw section can be used for larger birds (J. Jackson, pers. comm.).

- 3) If the broken tarsometatarsus is "hanging by a thread", snip the leg at the break cleanly with a small, sharp pair of scissors. Blot the drop or two of blood with a cotton ball or your shirt.

Release the bird as soon as any of the above methods have been employed, unless it shows severe signs of stress (in which case it can be placed in a hospital box for some recovery time). If possible, band the bird on the uninjured leg so that its progress may be monitored.

Broken tibiotarsus

A broken tibiotarsus (“tibia” - the feathered portion of the leg) is far less common than a broken tarsometatarsus, but may happen when a bird has thin strands of netting tightly wrapped around the uppermost tibia, and the person doing the extraction does not notice, proceeding to exert pressure on the area. Care must be taken to frequently blow the feathers aside in these areas during extraction to ensure no missed strands. In situations where the netting on the tibia area is very tight, and the bander cannot find a way to release the tension, the net must be cut!

Fortunately, a tibia fracture is one of the more self-healing kinds of fractures, as there is a good deal of supporting tissue surrounding the bone. Birds have been known to heal from this injury without any special medical treatment, although they may end up with diminished use of the leg (Kit Chubb, pers. comm.). Hence, unless it is a very severe fracture, with the bone sticking out of the flesh, releasing it may be the best course of action. If the break *is* severe enough to merit amputation, then snip the leg cleanly at the break. Be sure to pinch the end closed as long as is needed to stop the flow of blood.

Dislocation

Leg dislocation is rare, but can happen if a bird caught in a mist net is buffeted by strong winds or is simply a master struggler. Most dislocations can be treated quickly by straightening the leg and then popping the joint back into its socket (McCracken et al. 1994 and H.Suthers, M. Murray and H. Pittel pers. comm.).

Broken toes

It is possible, when working an entangled mass of netting off the toes of a grabber, to remove a segment of the toe with the net if you're not watchful! The netting catches on the scales of the feet and toes, and if you exert too much pressure, a tight, fine strand can just clip the toe off. You should always watch for these tight strands. If possible, release the feet last on a grabber (use the "body pluck" method). While a broken toe is undesirable, it should not hinder the bird's survival.

Wing Injuries

Occasionally, on release, some small birds (up to thrush size) appear to be incapable of flight, preferring to flutter along the ground. Such symptoms are commonly referred to as "wing strain." Although there are a variety of possibilities, the condition is popularly believed to result from slight muscular strain or bruise. It is probably caused while the bird is in the net when one wing is free but the other is tangled and exerting a lot of pressure against the net. It can also occur during the extraction process, when the carpal joint is inappropriately manipulated. X-rays of some cases have shown a fracture of the coracoid bone. In all likelihood, however, this fracture is caused during the release process when wing-strained birds are released from too high an aspect over hard ground (H. Pittel pers. comm.). A flightless bird is prone to landing on its sternum. For this reason, all small birds must be released carefully and from a low height in case they are unable to fly (see *Releasing Birds*).

Small birds seem most susceptible to wing strain. All banders and trainees should be aware of the anatomy of birds' wings (see Appendix D) and how they may and may not be manipulated. Any bird that is caught up primarily by one wing should be immediately restrained in the bander's grip.

Most cases of wing-strain are temporary, and the bird will usually recover its capacity for flight within an hour. Be sure to test flight capabilities in such a way that you will be able to recapture an unsuccessful flier - as in placing the bird in the bottom of a "release box" (a large, high-sided cardboard box). Because of the increased risk of predation, wing-strained birds should be held in a hospital (or hot) box for awhile until they recover.

Below are some other possible diagnoses, when a bird has apparent "wing strain".

Fractures

A bird with a wing fracture will exhibit a postural abnormality (the "shoulders" will often look uneven). Unfortunately, fractures can take several weeks to heal. Therefore, if you have access to one, treatment from a competent, licensed avian rehabilitator is recommended.

By far, the greatest percentage of wing fractures occur on the **coracoid** bone. The coracoid leads from the shoulder to the sternum, and lends support to the entire wing. If the coracoid has been fractured, it is usually evidenced by one wingtip being higher than the other on a bird at rest. There may also be asymmetry in the carpal joints, but check the wingtips for certain. With this type of injury, the bird will not be able to achieve a lift of higher than 3 feet. A fractured coracoid normally takes from 17 - 21 days to heal (H. Pittel pers. comm.).



Figure 17. The Cedar Waxwing on the left has a fractured coracoid, as evidenced by the left wingtip tilting upward. Photo courtesy of Hilary Pittel.

A bird with a fractured **scapula** (the shoulder bone) may never fly again (H. Pittel pers. comm.). Such a bird should exhibit extreme postural abnormalities - the wing will not “sit right” at all. To detect a fractured scapula, blow on the scapular feathers and look for a hemorrhage spot.

The **humerus** is the bone between the shoulder (scapula) and elbow (radius/ulna). A fractured humerus is very serious, and can generally not be repaired in songbirds, as they are too small for the pin that the treatment requires (H. Pittel pers. comm.).

Soft tissue damage and injury to the brachial plexus

Birds have extremely little soft tissue (muscles, nerves, cartilage, etc.) surrounding the delicate carpal joint. For this reason, extra care must be taken when manipulating strands of netting from it during extraction. The brachial plexus is the major bundle of nerves that directly links the spinal cord with the musculature of the wing. This nerve

trunk can easily be damaged by even light stretching or twisting, particularly in the axillary ("wingpit") area (B. Crozer pers. comm.). When removing birds from the net, take care not to stretch the wing towards the bird's head or over its back. Even minor strain can render the bird temporarily incapable of sustained flight. **Don't overstretch the carpal joint, there is little soft tissue to support it!**

Euthanasia

If a bird is badly injured, and rehabilitation is neither feasible nor likely to succeed, one must consider euthanizing the bird. It is important to remember that the primary purpose of euthanasia is to terminate suffering (Gaunt and Oring 1999). Important points to assess when considering euthanasia are: (1) what are the chances that the bird will survive if left alone and (2) is the bird suffering and in pain? If the answer to the first question is "none" and the answer to the second question is "yes", then the only recourse is to euthanize the bird quickly and painlessly. This is always a difficult decision and always a heart-rending task. Yet, all banders should receive instruction on how to euthanize birds humanely.

The most humane form of field euthanasia currently known for birds is described below:

Cervical dislocation

The bird is held firmly in the bander's grip, while the other hand grasps the head firmly between the index and middle fingers (in an overhand gesture) and, with great force, pulls (not twisting) the head straight up. This will sever the brain from the spinal cord, causing instant death.

Never drown a bird; it is a slow and inhumane death.

A once-popular method of euthanasia for songbirds was thoracic compression, commonly referred to as 'squeezing'. In this technique, the bird's heart is stopped by applying direct pressure to the breast with the thumbs and fingers. The most recent assessment of this method (Gaunt and Oring 1999) is as follows:

"The traditional technique of cardiac (thoracic) compression approaches the limits of present standards of speed and minimal stress and may not be accepted by an investigator's IACUC. Thus, although the technique is permissible for field use, we

recommend use of an alternative whenever practical. A mechanical alternative is cervical dislocation, in which the neck is quickly stretched (not twisted) until the spinal cord snaps. This technique is easily learned and can be used on birds as large as pheasants or small geese.”

Specimens

If a bird dies as a result of a banding incident, it is imperative that every effort be taken to salvage the specimen. Effort should be taken not only to preserve skins but also carcasses, skeletons, and DNA samples (Gaunt et al., 1999).

All federal banding permits also allow you to salvage birds that have died during your banding operation. However, there may be additional state specific permits with time lines that must be recognized. To salvage a bird, attach a tag to it indicating that it is a salvage specimen and note the collector, date, location, species, age and sex. Dead birds should be placed in plastic bags and refrigerated as soon as possible. If you are unable to get to a proper handling facility within 24 hours you should double bag the specimen and freeze it. Plumage should be neatly arranged before placing in bag (J. Jackson, pers. Comm.). If specimens need to be mailed they should be sent using Federal Express on dry ice (M. Gustafson pers comm.). A good idea is to look for an appropriate natural history museum or university in your area and contact them before the banding season begins.

A TROUBLESHOOTING GUIDE FOR STRESS AND INJURY

Perhaps the two most important things to remember when dealing with a stressed or injured bird are the following:

- 1. minimize handling*
- 2. reduce stimuli*

Below is a brief summary of stress-related problems or injuries and their possible solutions.

<u>Conditions/Symptoms:</u>	<u>Problem:</u>	<u>Treatments:</u>
hummer, not moving	in torpor	"bounce" in palm of hand; blow lightly on back of head; recharge w/sweetwater.

bird lethargic, panting, eyes dry	heat stress/dehydration	rehydrate w/full-strength Gatorade or water one drop at a time; mist lightly with water; light dab of cold water on bottoms of feet; hospital box in deep shade.
bird limp, eyes closing, fluffing feathers	cold exhaustion/severe shock	rehydrate briefly, if you think the bird can undergo more handling; place in hot box - don't disturb for at least 20 minutes.
traces of blood in the mouth, wheezing	hemorrhage	cease handling immediately - put bird in hospital/ hot box.
blood spouting from mouth	tongue laceration	mop blood; release unless in shock (in shock - put in hospital/ hot box)
bird unable to fly away, no noticeable asymmetry in carpal joint or wingtips	"wing strain"	spell in hospital/ hot box; if still grounded, place in safe cover outside. Evaluate extraction and release techniques.
one wingtip higher than the other; carpal asymmetry	fracture	Rehab, if poss. Evaluate extraction and release techniques.
leg broken below ankle joint	broken tarsus	small crack - do nothing; leg askew - super glue, scotch tape, gull feather splint; "hanging by a thread" - snip at the break. Evaluate extraction techniques.

leg broken above ankle joint	broken tibiotarsus	Mild fracture -release bird; severe - snip leg at break. Evaluate extraction techniques.
carpal joint or tibia area looks like "skinned knee"	abrasion	No treatment. Evaluate extraction techniques.
superficial bleeding	small cut	use a couple contour feathers as a styptic.
deep, gaping cut	laceration	one drop of super glue.

Emergency First Aid Kit

Here is a small list of things to assemble for your field kit. They can easily fit inside a small first-aid box:

powdered Gatorade (or other electrolyte solution), sugar packets, eye dropper, tweezers, super glue, antibacterial hand towelettes, needle, small sharp scissors, small vial or bottle (for fluids). Other optional items: hollow gull feather (for tarsometatarsus splint) and/or scotch tape.

V. AVIAN REHABILITATION

Banders should attempt to locate a competent, licensed avian rehabilitator in their area before the field season begins.

Note: It is important to narrow the search to rehabilitators specializing in small birds (many are strictly raptor rehabbers), and alas, to realize that none may be available in your area.

WHEN TO GO TO REHAB

After the field treatments outlined in this handbook have been administered to an injured bird without success, you can consider taking it to a competent, licensed avian rehabilitator, if one is available to you. We feel these instances should only include those in which you feel the bird's life is most surely threatened. The breeding condition of the bird (thus possible brood), the distance and road conditions from the site to your rehab, the likelihood of transport/relocation stress and the probability of successful rehabilitation all need sober and thoughtful consideration when making the decision to go or not to go.

LEGAL ISSUES

Without a special permit, it is **illegal** to hold a bird in captivity for more than 24 hours.

The wildlife rehabilitator that you choose must hold a wildlife rehabilitation permit from the state you're in, and be federally licensed to rehab migratory birds.

Do not attempt "self-rehabilitation", unless you yourself are licensed and well-trained in the treatment of small bird injuries. Aside from breaking the law, well-intended, untrained people can often do more harm than good.

TRANSPORTATION OF WILD BIRDS

If it becomes necessary for a bird to be removed from the study site for rehabilitation, there are very specific requirements that must be followed. Rules pertaining to the transport of birds can be found in the Code of Federal Regulations Title 9, Subchapter A, Part 3, Subpart F, and in 50 CFR Ch. 1, Part 14. USDA has an Internet site

containing current information, and a Voice Response Service (1-800-345-USDA) concerning regulations by state. Information is also available on disc from the Animal Welfare Information Center (301-504-6212; National Agricultural Library, 10301 Baltimore Bldg., Beltsville, MD 20705) and on the Washington University, St. Louis Web site (<http://netvet.wustl.edu/e-zoo.htm>) (Gaunt and Oring 1999).

When transporting an injured bird to a rehabilitation facility, place the bird in a ventilated container adequate for the species being transported. The container should not be too large so that the bird may cause further injury to itself by thrashing about. It should be placed in a well-ventilated area, protected from direct sunlight, and visually isolated from passengers and views from the windows. Long trips should be broken up by rest periods during which the birds may feed and drink uninterrupted. Please refer to Bocetti (1994) for specific techniques for confining and transporting small insectivorous passerines and for evaluating their condition by periodic examination of feces. Transporting birds between states requires federal and state authorization for the state of origin, destination, and states traversed in passage as well as an animal health certificate (Gaunt and Oring 1999).

LOCATING A REHABILITATOR

If you are "starting from scratch" in locating a competent, qualified avian rehabilitator, you can do one of the following to get the ball rolling:

- 1) Call the State Fish and Game Office in your state. States differ in their administration of rehabilitation permits, but you will most likely need to speak with someone in the Law Enforcement division. Alternately, you may be transferred to the Wildlife Department or the Permits Office. In any case, one of these departments should have information about rehabilitators for the entire state. They will often be able to tell you the person's "specialties" (raccoons, skunks, possums, small birds, etc.), which will help you narrow down the list of who to call.

- 2) Many states have a regional or county-by-county corps of "conservation officers", (known as game wardens in some states) that can refer you to local, licensed individuals or organizations. Because going through the county is a more local approach, the conservation officer you speak to may know the rehabilitator he/she recommends, and could be familiar with their operation. To get the names and numbers of your local conservation officers, try the government pages in your local phone book, or call the State Fish and Game and ask for their number.

3) You can phone either of the two major wildlife rehabilitation organizations in North America for advice on who to call. They are:

The National Wildlife Rehabilitators Association (N.W.R.A.)

14 North 7th Avenue
St. Cloud, MN 56303
phone: 320-259-4086
e-mail: nwra@cloudnet.com

The International Wildlife Rehabilitators Council (I. W. R. C.)

4437 Central Place
Suite B4
Suisun, CA 94585
phone: 707-864-1761

Some Questions to Ask Prospective Rehabilitators

As in every field, there are people in rehabilitation who are good at what they do, and those who are not. Additionally, there are those who may exhibit a proficiency for dealing with, say, owls, but who have little knowledge when it comes to dealing with songbirds. Thus, you may wish to (tactfully) conduct some sort of "interview" when seeking a good rehab facility. A good rehabber will probably appreciate the concern you show for quality care. Below is a suggested list of questions that can help you find out if the person/organization in question is an appropriate resource:

- 1) Are you licensed to work on small birds? How many birds, generally, do you get in a summer?
- 2) Are you a member of the N.W.R.A. or the I.W.R.C.? (Note: a negative response should not necessarily preclude using the rehabber, it just gives one a sense of their level of involvement. Likewise, simply because one *is* a member does not ensure competence.)
- 3) How long have you been involved in rehabilitation? Where did you get your training? What got you started?
- 4) Do you have access to an avian vet?

- 5) Do you have a large enclosure for birds for testing flight capabilities?
- 6) What is your capacity? Are you usually swamped?
- 7) Would you mind if I came for a brief visit and checked out your operation?

Visiting the Premises

If you get a chance, visiting the premises is recommended. It will allow you to see firsthand if the person/group's facilities seem appropriate for small bird rehabilitation. Keep in mind that a respectful operation will ensure reduced stimuli and stressors for its patients. Small birds should be housed in areas free from predator species that would threaten them, human voices should be kept at a minimum (likewise no loud music or radios), and personnel should avoid making excessive eye contact with or “petting” the patients. Do be sure to respect the protocols of any rehab operation that you visit - rules no doubt exist to protect the animals from stress and over excitement.

VI. AVIAN PARASITES, DISEASES AND ZOOSES

The following section is adapted from McCracken et al.(1994) and supplemented through extensive personal communication with avian rehabilitator Hilary Pittel and avian vet Mike Murray.

AVIAN PARASITES

Encounters with parasites should be anticipated when working with birds. This is particularly important when reaching into nests above your head to retrieve nestlings for banding. Blow fly larvae can be the most obvious and disgusting of these parasites, but flat flies, lice and mites are also common. Most bird parasites are harmless to humans.

Flat flies (Hippoboscidae) are able to slip in and out among body feathers. They generally only fly when the bird is handled and its feathers are ruffled. They give birth to live young. The larva is deposited on the feathers of the bird, drops to the soil or nest where it pupates into an adult and attempts to find a host. When flying from host to host, flat flies can carry feather lice and mites and act as dispersal agents.

Feather lice (Mallophaga) are small, soft-bodied, wingless insects which have specially developed claws for hanging on to feathers and skin. They feed on feather scales, blood and lymph. Entomologists suspect that these organisms carry infectious agents for birds. Healthy birds can usually cope with a few lice by preening, whereas sick or weak birds often seem to be infested with them.

Soft-bodied, wingless, **blood-sucking lice (Anoplura)** can also be found on birds. Their heads are pointed or tapered rather than rounded as in the Mallophaga and are known vectors of *Typus rickettsiae* of mammals and birds.

Blow fly (Diptera) larvae will attach themselves to any part of a nestling including the inside of the nostrils and ears. The larvae hang on the birds until they have taken enough blood to become a sufficient size, then they drop off and pupate. Their populations cycle, so that when the flies are at their population peak, an individual nestling can be covered with them and die from loss of blood.

The most common **mites and ticks (Acarina)** found on birds are very tiny feather mites that live (presumably harmlessly) among the feather tracts and feed on feather

scales and detritus. Ticks are larger than mites. They are eight-legged as adults, and six-legged as nymphs. As adults, they must take a blood meal before dropping off their host and laying eggs in the soil. They are vectors of tick typhus and Lyme Disease.

Internal parasites of birds can invade the gastrointestinal system, the respiratory tract or the blood system. Gastrointestinal parasites include **tapeworms (Cestodes)** and **roundworms (Nematodes)**. Tapeworms require an intermediate host (earthworm, snail, fish) which is then consumed by the bird. They may be found in the feces or hanging from the bird's vent. The most common internal parasites are found in the phylum Nematoda. This includes gapeworms, threadworms, caecal and filarial worms. While light infestations of these worms are usually non-threatening, heavy infestations can be debilitating or even fatal. In most cases, these parasites can only be detected by microscopic examination of the feces.

Parasites of the respiratory tract include **flukes (Trematodes)**, **gapeworms (Nematodes)** and **air sac mites**. Heavy infestations of these parasites can sometimes be fatal, especially in the case of air sac mites, where manifestations include audible respirations and open-mouthed breathing. These signs will be exacerbated by handling and/or stress.

AVIAN DISEASES AND ZONOSSES

Zoonoses are infectious diseases that are communicable from animal to human. Several of the most common zoonoses are described below, although the list is by no means definitive. While all zoonoses are diseases, not all diseases are zoonoses. To avoid confusion, zoonoses will be labeled after the name with and a (z).

Types of Avian Diseases and Zoonoses

Chlamydiosis (Ornithosis and Psittacosis) (z)

While Chlamydiosis is generally associated with imported cage birds, it is widespread in wild birds in some regions. It can be communicated to humans, especially through the ingestion or inhalation of dried feces. (Careful when shaking out bird bags.) One vet (Mike Murray) described the human symptoms of chlamydiosis as "the mother of all flus" - fever, chills, profuse sweating, muscle aches, horrible headache, profuse perspiration, etc. Chlamydiosis can be diagnosed with a blood test and is easily treated

with antibiotics. If left untreated, it can be fatal to humans in extreme cases. Chlamydiosis can also be fatal to birds, especially when transmitted between dissimilar species (e.g. heron to songbird).

Salmonellosis (z)

Salmonellosis is a bacterial infection, common in reptiles, mammals and birds. In humans, it is most likely to be contracted from the feces of birds frequenting garbage dumps, feed lots and bird feeders. Since it is commonly found in dead birds that are simply "found dead," personal hygiene is especially important after handling dead birds. Symptoms are acute enteritis and diarrhea. Salmonellosis can be fatal to humans in unusual cases, or miserably degenerative (as our man Dr. Murray puts it - "a hard way to lose weight"). Salmonellosis can also be fatal to birds, although there is a great degree of species variability in the acuteness of the disease.

Tuberculosis (z)

Tuberculosis affects all avian species, and birds can be carriers of a human form of the disease. In wild birds, the highest prevalence is among species that live in close contact with domestic stock, such as starlings, blackbirds and sparrows, or with scavenger species such as gulls. As with many of the zoonoses, transmission of the disease can occur through fecal contamination.

Polio and tetanus

Any field worker should be immunized against polio and tetanus, the more so if they are working with birds near garbage dumps, sewage plants or potentially polluted water.

Lyme disease (z)

Lyme disease is caused by a bacterial spirochaete that is transmitted by a bite from an *Ixodes* tick. Banders operating in an area known to harbor the disease should be aware of the danger and alert to the first signs of an infected *Ixodes* tick bite. Any sign of a bull's-eye rash around a tick bite should be immediately investigated as the sooner the disease is confirmed and treated, the greater the chances of a complete recovery. The Public Health office in your county, state or province should be able to provide you with the most recent literature on the subject of Lyme disease. Tick checks and

removal should become an automatic part of the bander's post-field session routine.

Rabies (z)

Rabies is potentially communicable, not via birds, but from bats caught incidentally during netting. Any bander suffering a bite from a bat is advised to seek medical treatment immediately. In high risk areas, banders may be advised to get immunized against rabies.

Grackle pox

Grackle Pox is a rare affliction which is essentially a case of subcutaneous poison ivy or poison oak. It is characterized by intensely itchy, weeping blisters on the backs of the hands and fingers. It can result in a bander's hands becoming so swollen as to preclude further activity. It is caused by the skin being punctured by the claws of strong-footed species such as grackles and jays (which have been foraging in patches of poison ivy), allowing the toxin to penetrate under the skin. Treatment is with cortisone cream. Sunlight exacerbates the condition considerably. Prevention is effected by care during handling and by frequent hand washing, preferably using a carbolic soap.

Avian pox

Avian pox is a virus that is transmitted from bird to bird via exudative, wart like scabs on the face and/or feet. It does not affect humans. Depending on the serotype, its spread may be either intraspecific or interspecific. Since one cannot determine which without lab testing, it is for us banders to assume that any bird with the symptoms of avian pox is highly contagious to any and all other birds. Common symptoms include the appearance of painful, bumpy lesions around any of the mucocutaneous junctions (eyelids, nares, corners of mouth), or on the tops of the feet. These lesions may be runny or swollen and tend to bleed easily.



Figure 18. A Lincoln's Sparrow exhibits the symptoms of avian pox. Photo courtesy of John Woodcock.

Contagion

If one does not come in contact with the aforementioned areas while handling a bird with avian pox, the chances of transmitting the virus to another bird through touch are fairly low. Taking the precautions outlined below is nonetheless recommended. Moreover, other diseases, such as chlamydiosis, can be transmitted by ingesting or inhaling the feces of an infected bird (as while being transported in soiled bird bags). Every effort should be made to thwart any such possibility.

Precautions to Take While Banding

- 1) The first step in preventing the spread of disease is to maintain an awareness of the potential symptoms of disease in birds you are handling.
- 2) If potential symptoms are spotted (e.g. crusty or runny nares), the bird may be processed, but the bird bag used for that bird should not be used again until it has been washed in hot water. Diluted chlorine bleach is a good additive to the washer to

disinfect cloth bird bags.

3) Responsible banders should take care to wash their hands with carbolic or germicidal soap after handling any bird with potential symptoms of disease. Antiseptic towelettes (found at drugstores or medical supply stores) are handy for field situations. A bucketful of iodine solution mixed with water is also very effective.

4) To guard against contracting zoonoses: As a general precaution, regular washing of the hands is recommended, especially before eating or smoking. Never place bird bags in the mouth and avoid inhaling dust from bird bags or boxes, which should be washed or cleaned out regularly. Banders contracting curious complaints are strongly advised to inform their doctor of their contact with wild birds.

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APPENDIX A. Safety Precautions Checklist

The following list of questions can be used as a pre-season checklist, to ensure the highest possible standards of safety at your field station:

- 1) Are the mist nets of good quality and in good repair?
- 2) Are the banding kits well equipped, including:
 - banding pliers in good condition (proper tension, not rounded at the edges)
 - suitable band-removal equipment (e.g., end cutters)
 - an emergency first aid kit (see "*emergency first aid kit*" in the *Stress, Injuries and Field Treatments* section)
 - stainless steel 1A bands for cardinals (if applicable)
 - well-marked, spill-proof band housing
 - good extraction aids (e.g. dull-tipped seam-rippers, toothpicks, nail clippers)
- 3) Is your list of species band sizes up-to-date?
- 4) Are the bird bags clean and trimmed of loose threads?
- 5) Do you have a sturdy hospital/hot box with a good heating source?
- 6) Is your personnel well-trained and adequate in number?
- 7) Does your personnel understand the risks of disease and their precautions? Are they educated in injury prevention and field treatment?
- 8) Does your personnel understand closing protocol? (reasons of weather, predation, more birds than they can handle, etc.)
- 9) Are your net lanes well-groomed, and are precarious obstacles removed from the net-run trail?
- 10) Have you attempted to locate a competent, licensed avian rehabilitator in your area?

APPENDIX B. Trainee Safety Report Card

The following "report card" sample is designed to help banders evaluate trainees, in hopes that any issues relating to bird safety which need reinforcement will be illuminated and can therefore be addressed. Trainees who seem very cavalier about bird safety issues should be dismissed.

- Executes bander's grip and leg hold correctly:

poor fair good excellent

comments:

- Is attentive to the disposition of the bird being handled:

poor fair good excellent

comments:

- Exhibits a 'firm but gentle' approach when handling birds:

poor fair good excellent

comments:

- Does not have repeated problems with birds escaping:

poor fair good excellent

comments:

- Uses correct band sizes:

poor fair good excellent

comments:

- Applies bands well:

poor fair good excellent

comments:

- Has demonstrated ability to successfully remove bands:
 poor fair good excellent
 comments:
- Shows an understanding of and can perform field first aid procedures:
 poor fair good excellent
 comments:
- Shows an understanding of avian diseases and zoonoses:
 poor fair good excellent
 comments:
- Walks net lanes from end to end; checks nets thoroughly:
 poor fair good excellent
 comments:
- Exhibits willingness to keep net lanes trimmed and "snagproof":
 poor fair good excellent
 comments:
- Wears appropriate (snag-free) clothing:
 poor fair good excellent
 comments:
- Takes account of birds captured each net run; makes sure none forgotten:
 poor fair good excellent
 comments:
- Makes sure all nets are closed/taken down at end of banding day:
 poor fair good excellent
 comments:

- Cooperates and communicates well w/other banders during banding:
 poor fair good excellent
comments:

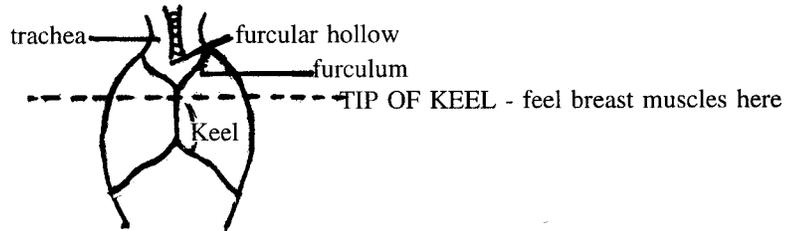
- Does not frequently over-handle birds for personal gain (e.g. photos):
 poor fair good excellent
comments:

- Understands appropriate "double-bagging" procedures:
 poor fair good excellent
comments:

APPENDIX C. A Field Technique for Measuring Relative Body Fitness in Birds

The following technique has been adapted from methods used by the Alaska Bird Observatory.

To aid in measuring the relative body fitness of a bird, one can feel the breast muscles across the upper breast where they intersect the tip of the breastbone (keel). The bird should be held in the bander's grip, while the thumb or fingers of the other hand press lightly from one side of the breast, across the keel, to the other side of the breast. The level of distention of the keel should then be noted, as well as the relative firmness and development of the breast muscles.



Keel Classification System:

The shapes below represent a cross-section of a bird's breast; the vertical line is the keel.

0 = Keel cannot be felt. Excellent fitness. 1 = Keel felt as small "nub"; muscles fully developed. Very good fitness.



2 = Keel feels sharp; muscles firm. Good fitness.

3 = Keel feels sharp; muscles barely detectable. Fair-poor fitness.



4 = Keel very sharp; muscles indetectable, giving concave appearance. Emaciated. Very poor fitness.



APPENDIX D. Internal Diagrams of Birds

14 / Topography

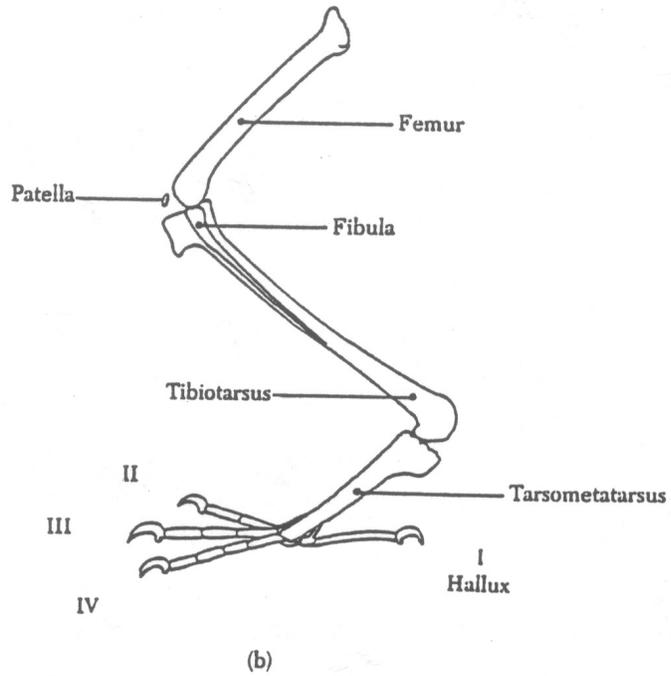
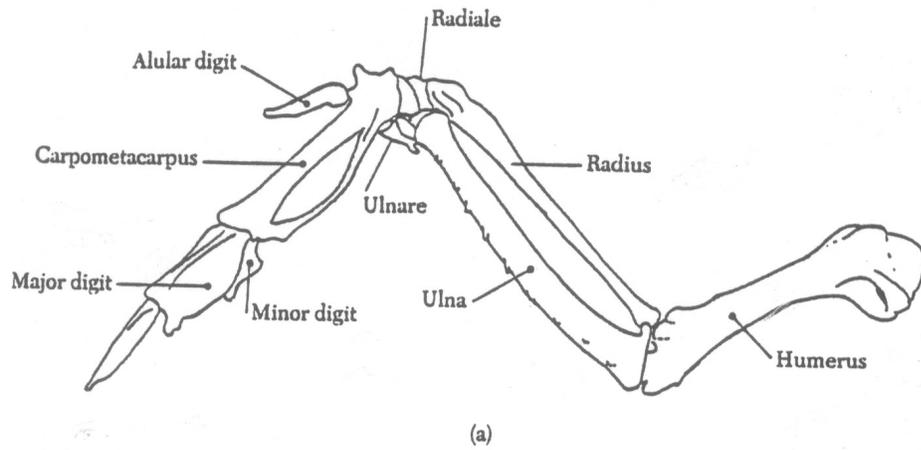
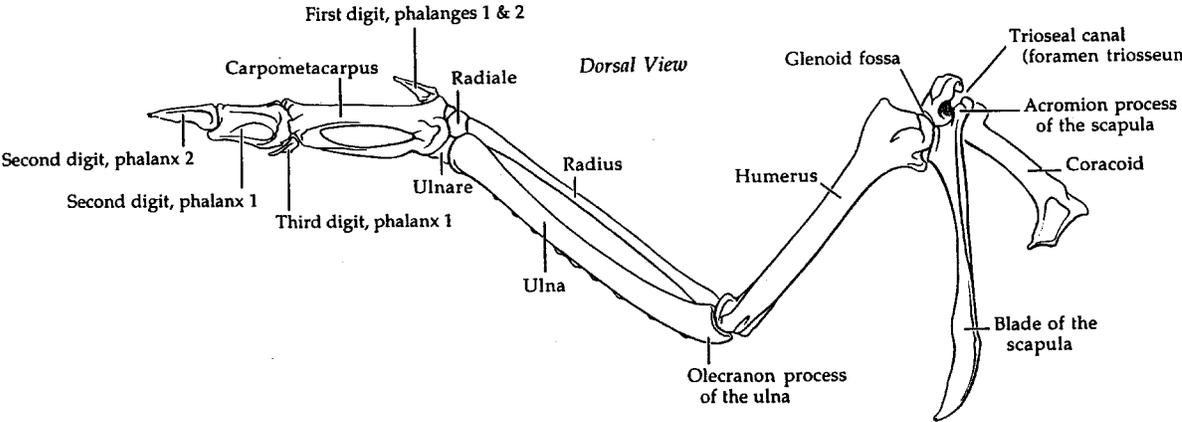
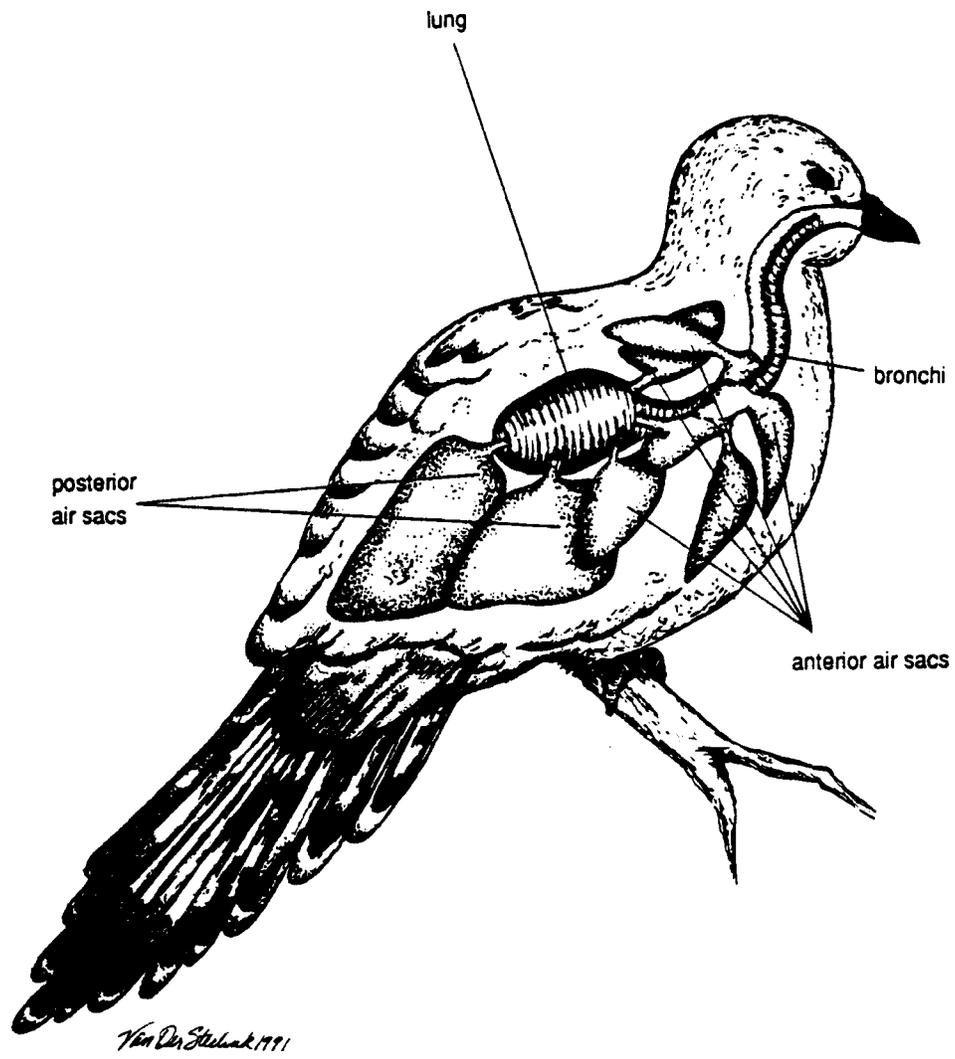


Figure 4 Common Pigeon
(a) Skeleton of wing. (b) Skeleton of leg and foot.
(reprinted from Pettingill 1984)

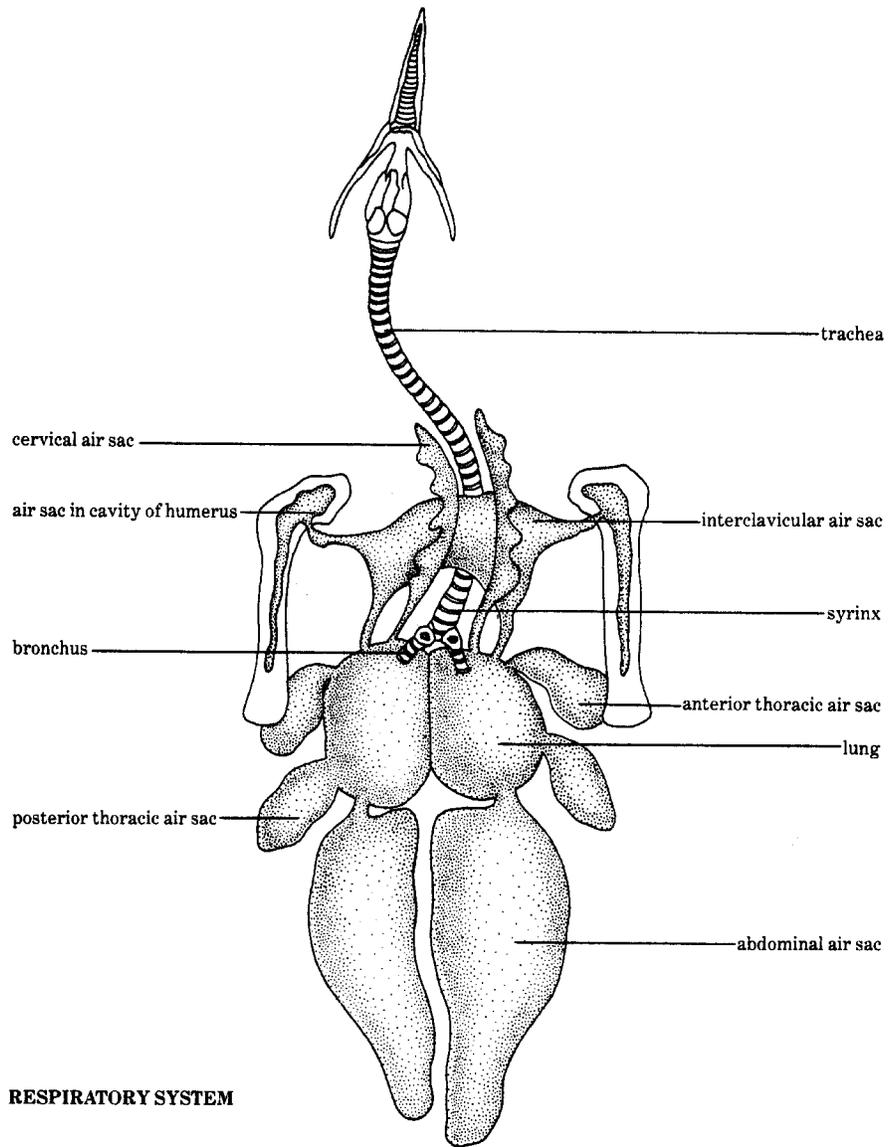
Superior View of the Left Wing Skeleton
Rock Dove (*Columba livia*)



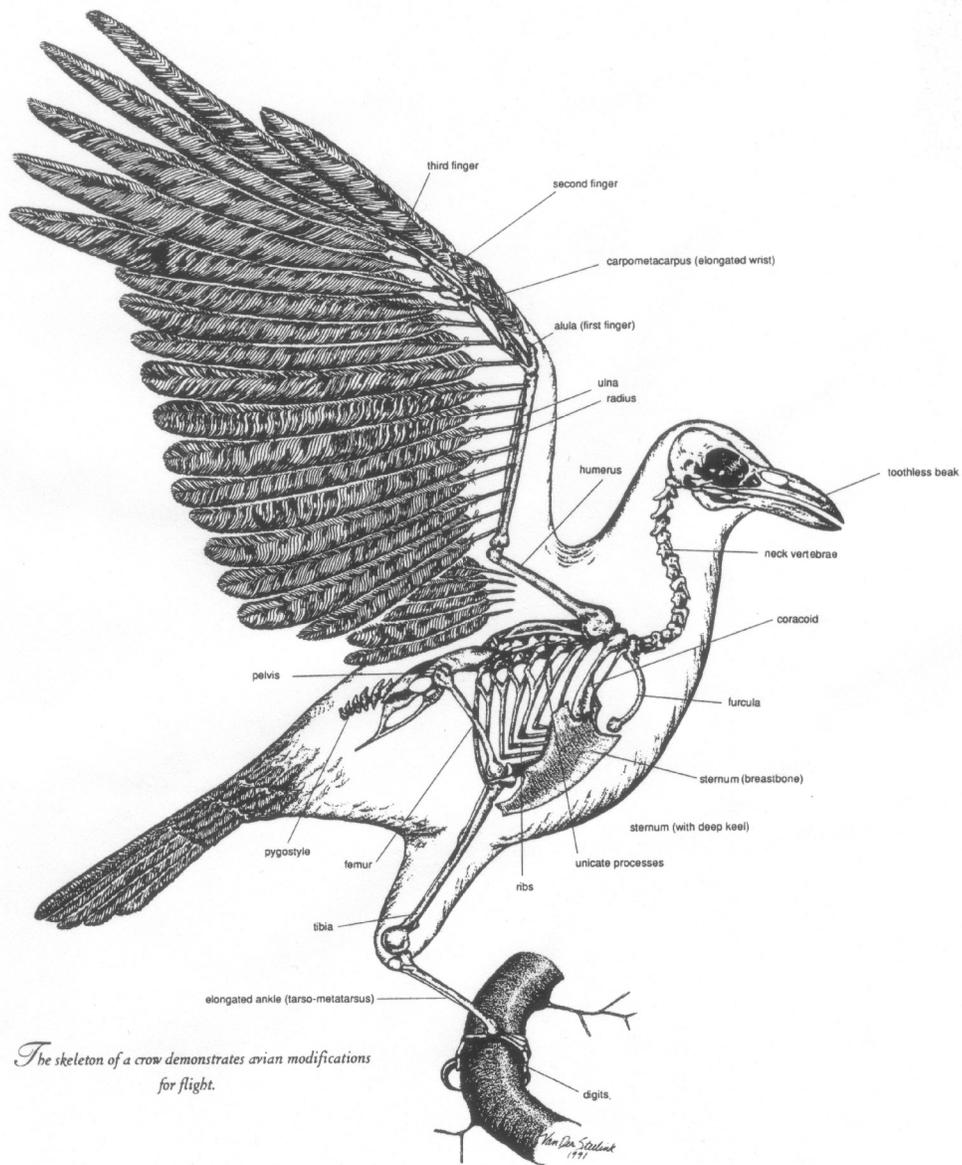
(reprinted from Proctor and Lynch, The Manual of Ornithology, Yale University Press © 1992)



(reprinted from Jenner 1991)



(reprinted from Terres 1980)



The skeleton of a crow demonstrates avian modifications for flight.

(reprinted from Jenner 1991)

