

THE NORTH AMERICAN BANDERS' MANUAL
FOR
LOGGERHEAD SHRIKE (*Lanius ludovicianus*)

by Amy Chabot

A product of the
LOGGERHEAD SHRIKE WORKING GROUP
and
NORTH AMERICAN BANDING COUNCIL



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1.0 INTRODUCTION

The Bird Banding Manuals and NABC guides are considered required reading for anyone who wishes to band birds in North America. The guides are designed to complement each other. All banders and prospective banders should be familiar with the information presented in the Banders' Study Guide.

This guide contains basic information on banding birds at nest boxes in North America. It is not intended to supplant the Bird Banding Manuals or the relevant NABC manuals but is supplementary to these manuals.

The target audience for this guide includes banders and investigators interested in conducting field studies that involve banding adults and/or nestlings at nest boxes, or similar artificial cavities. While many of the techniques and procedures discussed here can be applied to birds nesting within natural cavities, this manual does not cover the specific challenges of working at natural cavities. Thus, this manual is limited to nest boxes where the investigator has more control over the structure, placement, access, etc.

Section 1 deals with more general information on banding at nest boxes while Section 2 provides more specific guidelines for selected species. Information on nest monitoring is not included in this guide as it is available elsewhere (see Appendix A).

1.1 THE BANDER'S CODE OF ETHICS

Bird banding is used around the world as a research tool. When used properly and skillfully, it is both safe and effective. The safety of banding depends on the use of proper techniques, equipment and training and expertise of the bander.

The Bander's Code of Ethics applies to every aspect of banding. The bander's essential responsibility is to the bird. Nothing matters more than the health and welfare of the birds you are studying. Every bander must strive to minimize stress placed on birds and be prepared to accept advice or innovation that may help to achieve this goal.

Methods should be examined continually to ensure that the handling time and types of data to be collected are not prejudicial to the birds' welfare. Be prepared to streamline procedures of your banding operation, for example, in response to adverse weather conditions or to reduce a backlog of unprocessed birds. If necessary, birds should be released unbanded, or the trapping devices should be temporarily closed. While there are circumstances beyond the bander's control, some mortality should not be considered inevitable or acceptable when banding.

Every injury or mortality should result in a reassessment of your operation. Action is then required to minimize the chance of repetition. The most salient responsibilities of a bander are summarized in the Bander's Code of Ethics; more details are found in Section 13 of the Banders' Study Guide.

Banders must ensure that their work is beyond reproach and assist fellow banders in maintaining the same high standards. Every bander has an obligation to upgrade standards by advising the Banding Offices of any difficulties encountered and to report and publish innovations. Banders have other responsibilities too. They must submit their banding data to the Banding Offices each year, reply promptly to requests for information, and maintain an accurate inventory of their band stocks. Banders also have an educational and scientific responsibility to the public to make sure that banding operations are explained carefully and are justified.

It is the responsibility of those leading projects to ensure that data are archived for analysis in a data repository, and for publishing. Banding data that are not analyzed or available for analysis do not contribute to science and are of little value. Finally, banders banding on private property have a duty to obtain permission from landowners and ensure that any concerns are addressed.

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 or Laboratory
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.*

1.2 BACKGROUND AND ACKNOWLEDGEMENTS

The Loggerhead Shrike (*Lanius ludovicianus*) is one of North America's most-threatened grassland bird species. Once common throughout much of North America, populations have decreased significantly across the species' range, with declines greatest in northern and eastern populations. Various state and provincial-level projects have been conducted but no systematic monitoring has taken place outside of the North American Breeding Bird Survey. However, shrike numbers have declined such that the species is no longer regularly detected through the BBS in numerous states; the BBS no longer produces reliable population trends for these regions. A color-banding program for wild, adult Loggerhead Shrikes will provide much-needed information on recruitment, longevity, site f

idelity, and dispersal. Banding and feather sampling will also assist in locating wintering areas, thereby facilitating the study of threats, wintering ecology and full-life cycle modeling.

This banding manual was adapted from the 1999 Banding Protocol developed by Bird Studies Canada (McCracken and Okines 1999), and has been updated as needed over time. The protocol is designed to be a living document, which changes as new techniques and information become available. The protocol is intended to ensure the health and welfare of the individual birds being handled, and to meet or exceed the scientific and ethical guidelines established by the North American Banding Council (NABC). Shrike banders should also be familiar with the NABC's North American Banders Study Guide (NABC 2001a), North

American Manual for Banding Passerines and Near-Passerines (NABCb), and, ideally, Manual for Raptor Banding Techniques (Hull and Bloom 2001). The protocol has been reviewed by the Canadian Wildlife Service's Animal Care Committee and Queen's University's Animal Care Committee as part of past permit approvals. The protocol has been reviewed and is endorsed by Canada's Eastern Loggerhead Shrike Recovery Team, North American Banding Council, and Environment and Climate Change Canada's Bird Banding Office. The author gratefully acknowledges the input and review by the wide range of individuals that have led to the current version of this document.

A Loggerhead Shrike Working Group was established in 2013 after biologists from eastern North America began identifying concerns related to the conservation of shrikes, research priorities, and possibilities for multi-state coordination. The Working Group has met annually since 2014. The following four *conservation and management priorities* were identified for this species, in order of importance:

1. Identify limiting factors, with a heavy focus on winter survival/mortality;
2. Determine genetic identity of shrikes in the northeastern United States;
3. Quantify population demographics and dispersal on a regional scale;
4. Develop habitat models addressing habitat requirements on both the breeding and non-breeding grounds, and identify possible sites and goals for adaptive management and research.

Continued population declines suggest that a collaborative, broad-scale approach is necessary to properly address the challenges faced by the Loggerhead Shrike and ensure the species' sustainability over the long-term. In addition, a broad-scale approach can help to better answer research questions that may otherwise be hampered by low sample sizes and by the patchy distribution of shrike populations. Because of the geographic scale of population declines and the migratory nature of shrike populations in the north, effective conservation will require local, regional and multi-national initiatives with collaboration among a variety of stakeholders. Lack of information on full annual life-cycle population dynamics, small population sizes, and lack of information on population connectivity within and

among seasons are all major challenges. Given the above, research and conservation efforts are required across much of the species' range in a collaborative and comparative manner. The focus of the Loggerhead Shrike Working Group is to facilitate these efforts. Additional information can be found at www.loggerheadshrike.org. The intent of this document is to guide banding efforts across a broader geography that will allow knowledge gaps to be addressed.

2.0 General Considerations

2.1 Banding equipment

A list of required and suggested optional equipment is provided in Appendix 1.

2.2 Permits

In Canada, banders must be permitted by the Bird Banding Office of the Canadian Wildlife Service (a branch of Environment and Climate Change Canada; <http://www.ec.gc.ca/bbo/>). In addition to the permission to band birds with federally issued metal bands, permission must also be obtained to band a Species at Risk, use auxiliary markers (i.e. color bands), and collect samples of feathers, blood, or any other type of biological sample. Depending on the location where banding is being done, additional permits from the regional office of the Canadian Wildlife Service may be required, as well as from provincial or territorial agencies. It is the bander's responsibility to ensure that all necessary permits are acquired before activities begin.

In the United States, a bander must be permitted by the Bird Banding Laboratory of the United States Geological Survey (<http://www.pwrc.usgs.gov/bbl/>). In addition to the permission to band birds with federally issued metal bands, permission for the use of auxiliary markers (i.e. color bands), and for feather and blood sampling must be requested on the permit. State permits are also required for trapping and banding. In some cases, an additional Threatened and Endangered Species permit is also required. It is the bander's responsibility to ensure that all necessary permits are acquired before activities begin.

2.3 Traps

A live walk-in type trap is recommended as these have been used with high success and no known significant injury. Trap success is increased with a round trap (Susan Craig, personal communication) and one with both side and top-opening doors (A. Chabot, unpublished data) (Figure 1). Traps and/or instructions for building a round, two-door trap can be obtained from A. Chabot.



Figure 1. Round, double-door walk in live trap for Loggerhead Shrike.

2.4 Age of birds and timing of trapping within a season

This protocol is designed for banding adult Loggerhead Shrike. Independent, fledged young can be trapped using methods similar to adults once they begin to forage on their own – usually two to three weeks post-fledge. Nestling banding is not considered under this protocol.

During the non-breeding season, shrikes can be trapped any time weather permits.

During the breeding season, consideration must be given to the stage of reproduction. Ideally, trapping will occur only once adults are observed feeding young at the nest. Breeding male shrikes can be trapped earlier in the breeding season, once egg-laying and incubation have begun, such that foraging occurs away from the nest tree. Special care should be taken to ensure that the female is not caught – the female is the sole incubator and is fed on the nest by her mate, but she will occasionally leave the nest to forage.

2.5 Trap placement

Traps should be placed within view of favored foraging perches, ideally in short grass or on bare ground. Whenever possible, traps should be placed in the shade. This is particularly important in hot conditions.

Using two traps is usually most efficient when trapping within breeding territories, but in some cases, one will be adequate – for example, when working from the road-side. If enough assistants are available to ensure all traps are monitored, more traps can be used, which may increase trapping success. This is particularly relevant in areas that have higher shrub density such that a shrike may move more frequently.

When working alone, the bander should remove the trap(s) when a bird is caught to ensure that no other birds will be trapped and left unattended while the bander is focused on processing. Closing the doors and leaving the trap may reduce trapping success later as the bird may check the trap and become frustrated by not being able to access the bait – usually shrike will give up after three attempts (A. Chabot, personal observation). If working with an assistant, the traps may remain in the field, but they must be monitored continually. If another bird is trapped, it must be removed from the trap immediately and placed in a bird bag, or clean holding container to be held until it can be processed.

2.6 Mice

Traps should be baited with a live domestic mouse placed in a protective hardware cloth cage and provided with a small piece of apple. Smaller mice (>4 cm/1.5 inches), i.e.

“hopper” size or juveniles, are preferred. Younger mice should not be used as they are not active enough.

Mice are the key to successful trapping. While shrikes usually prefer insect prey, insects do not make good bait as they are harder to keep enclosed and harder for the shrike to see from a distance. Bi-colored white and black mice usually provide the greatest visual contrast against the background. They are also usually more vigorous and have black eyes – the pink eyes of albino mice are sensitive to the sun. Dark, monochromatic mice are more likely to overheat and usually contrast less with the background substrate.

Mice should be regularly switched out of traps and provided with food and water. Aside from animal welfare concerns, using healthy, active mice is essential as the shrike is attracted to the trap by the movement of the mouse.

Ideally, a mouse should not be held in a trap for more than one hour, less in cold conditions. Even when weather is moderate, they must be removed after two hours. If trapping has not been successful, a change of plan is recommended. For this reason, it is useful to have 3 or 4 (or more depending on the length of trapping effort each day) mice on hand.

When not being used, mice should be kept in a suitable cage and provided with food and water. On warmer days, mice should not be kept in the vehicle as they will overheat. Rather, they should be placed in a shady location. A small portable mouse cage placed in a tote bag helps to keep the mice in a calm, dark setting.

Whenever possible, the traps should be placed in a shady location so that mice will not overheat or burn in the summer, or become chilled in the winter. In hot conditions, a small amount of water can be drizzled over the mouse to ensure they do not overheat or dehydrate. The activity of the mouse in the trap should be monitored – they should remain active in order to be noticed by a shrike. The more active the mouse, the more interest the shrike will have in the bait.

2.7 Bands and color banding scheme

Stainless steel (rather than aluminum alloy) numbered bands issued by the Bird Banding Lab/Office in the U.S. or Canada must be used on shrikes. Banders must be able to safely apply stainless steel bands prior to working with shrikes. An instructional video on the application of hard metal bands can be found on the NABC website - <http://www.nabanding.net/bander-resources/>. Unopened, versus pre-opened, stainless steel bands are recommended as they provide a flusher closure. Prior to use, bands must be inspected to ensure quality. Bands with illegible numbers or without flush edges should not be used. Appendix 2 provides instructions on opening bands. Stainless steel bands are extremely difficult to open once they are on a bird’s leg. Appendix 3 provides a method for removing overlapped stainless steel bands. Incoloy bands can be used at the discretion of the bander. This type of band can be adjusted to ensure flush edges, but is not as hard as (i.e. more easily crushed than) stainless steel.

In addition to a metal band, shrikes should receive three plastic (Darvic) color bands in a double-overlap style. Details for ordering color bands are provided in Appendix 4. Each bird will receive a unique combination of two bands per leg (e.g. Dark Green over Silver on right leg, Dark Blue over Orange on left leg). Band combinations are maintained in a database, assigned and tracked. Currently, the database is maintained by Amy Chabot (amy@chabotcuddy.ca) and is available on the North American Loggerhead Shrike Working Group web site (www.loggerheadshrike.org). The scheme has been adopted and endorsed by the Bird Banding Office and Lab. The scheme ensures that no two shrikes receive the same color band combination within a year, and to ensure that dispersing birds can be accurately assigned to banding origin. The species’ range has been divided into eight regions (Table 1).

Table 1. Regional breakdown of Loggerhead Shrike range for banding purposes.

Region	States/Provinces in Region
1	Indiana, Illinois, Ontario, Virginia, West Virginia
2	Kentucky, Tennessee, Mississippi, Louisiana
3	Arkansas, Missouri, Nebraska, Kansas, Iowa, Oklahoma
4	North Carolina, South Carolina, Georgia
5	Florida, Alabama
6	South Dakota, North Dakota, Montana, Alberta, Saskatchewan, Manitoba
7	California, Arizona, New Mexico, Colorado
8	Texas, Mexico

Each region will use a unique “year” color band in conjunction with the metal band (i.e. Silver) (Table 2). Starting in 2017, each of the 8 available colors will be used in a fixed rotational order, with no two regions using the same year color in any one year.

Table 2. Regional rotation of unique year color bands.

Region	Rotation of color, starting in 2017
1	Red, Dark Blue, Light Green, Orange, Light Blue, Dark Green, White, Yellow
2	Orange, Light Blue, Dark Green, White, Yellow, Red, Dark Blue, Light Green
3	Yellow, Red, Dark Blue, Light Green, Orange, Light Blue, Dark Green, White
4	Dark Green, White, Yellow, Red, Dark Blue, Light Green, Orange, Light Blue
5	Dark Blue, Light Green, Orange, Light Blue, Dark Green, White, Yellow, Red
6	Light Green, Orange, Light Blue, Dark Green, White, Yellow, Red, Dark Blue
7	Light Blue, Dark Green, White, Yellow, Red, Dark Blue, Light Green, Orange
8	White, Yellow, Red, Dark Blue, Light Green, Orange, Light Blue, Dark Green

The following rules are included in the scheme to facilitate resighting and reading bands in the field:

1. To the extent possible, combinations of color over silver on the right leg will be used first;
2. Year color on right leg will be used for the breeding season;
3. Year color on left leg will be used in the wintering season;
4. Combinations of color/silver and silver/color will not be used in the same state or province within a year;
5. To the degree possible, only one of light blue, light green and white will be used in the same state or province within a region. Efforts will also be made to avoid using dark green and dark blue in the same state or province within a region. Where multiple states or provinces within a region are banding shrikes, assigned combinations will include either: light blue and dark green, or light green and dark blue. If three states are banding within the same region, white will also be uniquely assigned.
6. In Region 1, captive bred birds are being released in Ontario. These birds will receive a color/silver or silver/color on the left leg. Wild birds in the region will use combinations with color/silver or silver/color on the right leg.

2.8 Banding location, time of day and weather

During the hotter months in the summer season, trapping is most successful in the morning and evening. In more moderate weather, trapping is routinely successful throughout the day, in particular when nestlings are older or young have recently fledged. The banding location should be chosen in advance, outside of the territory and away from the area in which traps are placed.

Trapping and banding should not occur when temperatures are higher than 85°F/30°C (including humidex), if it is raining heavier than a light drizzle, or if there is a threat of rain. On hot days (>75°F / 24°C), it is important that banding occurs in the shade – using a bush, tree, vehicle or the bander’s body to provide cover for the birds.

2.9 Bird handling

Shrikes must be removed from the trap as quickly as possible as they will continue to flutter and can exhaust themselves. The captured bird should be placed in a clean bird bag for transport from the trap to the banding site. During handling for banding, place the bird in a toilet paper tube, which is taped closed or covered at one end with cardboard, and has air holes (Figure 2). Shrikes usually become calm after being placed in the tube and banding and morphological measurements can be undertaken more easily and quickly. However, care must be taken to ensure the bird does not ‘back out’ and escape from the tube. This is accomplished by ensuring a very firm grasp is kept on the tube (without squeezing) and a finger is kept behind the birds’ legs and over the entrance to the tube at all times. The bird’s head must be kept upright at all times when in the tube. Birds that face downward run the risk of aspirating fluid into their lungs, which can cause death (Susan Craig, personal communication). When a second bird is caught at a site before the first bird is released, the second bird can be held in a bird bag until the first bird is released.

It is recommended that the handling process take no more than 15 minutes per bird for an experienced shrike bander, inclusive of the time at which the bird is trapped to release and in the case where full sampling is being undertaken. Handling time should be closer to 5 minutes per bird in cases where birds are only being banded and measured and feather samples are being collected.

Attention must be paid to the bird during handling to ensure that they do not become overheated, and to monitor stress levels. During banding, the bird’s eyes should remain open, bright and alert. The bird should not be lethargic when handled, although they will struggle less once in the tube. If a bird appears to be overly stressed, or overheated, banding should be aborted and the bird released immediately.

2.10 Predators

Avian and mammalian predators should be considered when trapping and banding, or when working near a nest. Jays and crows may be attracted by a shrike’s alarm calls. To reduce scent trails during the breeding season, and thus



Figure 2. Secure hold of a shrike in a customized toilet paper tube.

the risk of mammalian predation of the nest, a round-about way should be taken to and from where the trap is placed. Areas within a 50-m radius of the nest site should be avoided altogether.

2.11 Best Practices

The following (non inclusive) actions are recommended as best practices in the field:

- Mosquito repellent or perfumed hand soap or lotion should not be used to avoid rubbing these chemicals on a bird’s plumage, which may later be ingested.
- Clean bird bags must be used, ideally laundering between use at different sites to reduce risk of cross-contamination with viruses, bacteria, etc.
- Physical disturbance (trampling, etc.) of the banding location should be minimized to reduce drawing the attention of predators.
- Individuals handling birds should clean their hands with hand sanitizer between banding events to avoid cross-contamination.
- Vocalization and other noise should be minimized during banding to reduce the birds’ stress levels.

- Displacement of individuals from point of capture is minimized.
- The number of on-site visitors during banding is minimized.
- The time spent on site is minimized.
- The handling time and number of handlers is limited.
- The activities are scheduled to avoid disturbance during sensitive periods.
- Activities are restricted to days with clement weather.
- Site disturbance is limited and restored to original conditions as possible.
- Existing roads and trails are used for access where possible.

3.0 Banding Protocol

The following is a step-by-step guide to the banding process. The order of information follows the banding data sheet provided in Appendix 5.

3.1 Data Sheet Table 1

Location Description: Note the name given to the site, if any. Use the location description previously used in Bandit, the data entry program of the Bird Banding Office and Laboratory, when possible.

Latitude: Record the full latitude for the location of the banding activity, with GPS if possible. Use degrees/second notation. If known, the location of the nest site should be used for the latitude and longitude, but GPS coordinates *must* be taken after young have fledged. Otherwise, note the banding location.

Longitude: Record the location of the banding activity, taken with GPS if possible, using the full longitude with degrees/second format. If known, the location of the nest site should be used as the location, otherwise, note the banding location.

State/Province: Note the state or province where banding is taking place.

County: Note the county where banding is taking place.

Nearest town: Note the name of the nearest town to the banding site.

Miles to town: Record the number of miles in a straight line distance between the banding site and the edge of the nearest town.

Direction to town: Record the direction to the nearest town as NE, SE, NW, SW, or in more detail (e.g., NNE).

3.2 Data Sheet Table 2

Date: Note the date of banding using Bird Banding Laboratory and Office format of MM/DD/YY.

Bander: Put the bander's full name and banding permit number for the first bird banded each day. After first notation, the bander's initials can be used, unless a different bander bands subsequent birds.

Scribe: Note the scribe or assistant's full name the first time, and initials thereafter.

Band size: Using a leg gauge, determine the appropriate band size. Sizes to be considered include 1A, 1D and 2. Most shrikes require size 1D. The leg gauge should be moved up and down the plane of the bird's tarsus. As the bird's leg is not round but rather oval, the gauge should be placed on the larger axis. The bands should move freely up and down the bird's leg, but should not be so large as to fall over the foot.

Size chart to ensure the proper fit of bands:

Tarsus Measurement	Band Size	Internal Diameter of Band
≤3.00 mm	1A	3.18mm
3.01 -3.45 mm	1D	3.50mm
3.46 to 3.70 mm	2	3.97 mm

Band number: Once the appropriate band size has been determined (see below), the full band number must be recorded. The bird can then be banded on either the right or left leg. Possible color combinations should be determined in advance, ideally with the metal band always being applied to the same leg within the season. All possible color combinations available for use should be on-hand

during banding. Ideally, all combinations used in the past few years would also be on hand, in case a bird has removed a color band so that it can be re-applied.

Banding pliers from the British Trust of Ornithology, Avinet or Porzana are required to properly close size 1D bands. Using BTO-style pliers, the band should be inserted into the third hole from the tip of the pliers, then slid over the bird's leg and gently partially closed. The band should then be inspected to ensure that there will not be overlap in closure. If it looks like the band will close with flush edges, it should be rotated 90 degrees from initial position, again placed in the third hole of the pliers, and closed fully using gentle pressure. If the closure looks acceptable, but needs to be tighter, use a greater amount of pressure, but maintain the band in the same hole of the pliers. A proper band closure will not allow a fingernail to be inserted at the closure point. BTO pliers will also work to close size 1A and size 2 bands, using the next smaller or larger holes, respectively.

Color combination: Record the full color combination, left leg first, upper band over lower band, and then right leg, upper color over lower color. For example, RD/DB LB/SI indicates Red over Dark Blue on left leg, Light Blue over Silver (metal) on right leg (Figure 3).

The double-wrap style Darvic band must be partially or fully unwrapped to be placed on the bird's leg, then rolled back on to itself and tightened using the banding pliers. Care must be taken not to crimp it, and to return the band to its original shape and internal diameter. Have the assistant unroll the band and place it around the leg while the bander holds the bird, or use circlip/O-ring style pliers to open the band with one hand and place over the leg while holding it in position (Figure 4).

If the color band becomes crimped, it must be removed and replaced. This can be done using circlip/o-ring style pliers inserted between the band and the bird's leg, by having an assistant unroll and remove the band, or by opening the end of the band and using small blunt-end safety scissors to snip the band into small pieces until it can be removed.



Figure 3. Full, four-band combination, read as: red (RD) over dark blue (DB) on left, light blue (LB) over silver (SI) on right.

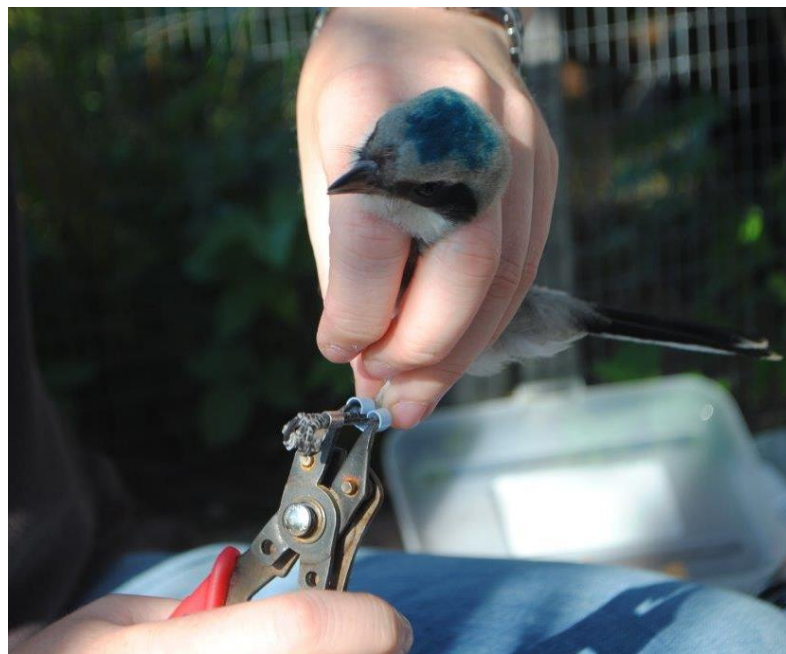


Figure 4. Placing opened double-overlap color band on leg.

Age: Age in shrikes can be determined by the retention of juvenile plumage (Pyle 1997). Shrikes undergo an incomplete molt in the fall of their first year. Body feathers, some to all tail feathers, and a portion of the wing feathers are molted (Chabot et al. 2017a). The retained juvenile flight feathers appear browner in color than the molted feathers (Figure 5).



Figure 5. Retained brown juvenile secondary feathers (S1-S6), primary (P2-P10) feathers and partial coverts (all primary, and distal median coverts), and molting first primary feather of a Second Year Loggerhead Shrike.

Non-breeding season (~September to December)

Hatch Year (HY) – has retained juvenile plumage
 After HY (AHY) – does not have retained juvenile plumage

Non-breeding season (January to early March, depending on latitude)

Second Year (SY) – has retained juvenile plumage
 After SY (ASY) – does not have retained juvenile plumage
 AHY – not possible to distinguish molt limits

Breeding season (early March through August, but may be as early as February in southern areas)

SY – has retained juvenile plumage
 ASY – does not have retained juvenile plumage
 AHY – not possible to distinguish molt limits

HY – has retained juvenile plumage. Note, HY birds can be distinguished from adults by behavior (e.g., being fed by adults or adults can be identified at a territory using bands), by juvenile body feathers, in particular light tan barring of breast feathers, buff-tipped upper wing coverts (Figure 6, upper) and incomplete mask development (Figure 6, lower).

How aged: Note if a shrike is aged by molt limits or, for independent HY birds, retained juvenile plumage.



Figure 6. Independent Hatch Year shrike prior to fall body molt. Note buff-tipped secondary coverts in photo and incomplete mask in photo on left.

Sex: Females alone incubate and, during the breeding season, sex can be determined by the presence of a brood patch. This is the most reliable sexing method, but does not work outside of the breeding season. Males can be sexed by the presence of a cloacal protuberance, but only for a short period of time (S. Craig, personal communication; A. Chabot, personal observation). However, the method is not as reliable as the absence of a brood patch once incubation has begun. Sex can also be determined based on the pattern of white on the 6th primary (Figure 7 a,b), or by molecular methods (Chabot 2011) using markers developed by Fridolfsson and Ellegren (1999). Appendix 6 explains how to sex by primary feather pattern in detail.

How sexed: Indicate with “BP” if the bird was sexed based on the presence/absence of a brood patch, “CP” if a cloacal protuberance was noted and/or “P6” if feather pattern on the 6th primary was used to sex the bird. If more than one method was used, indicate all of those used. In some cases, it may be desirable to confirm sex with genetic sexing. DNA obtained from a plucked tail feather is adequate for this purpose (Chabot et al. 2017b). If sex was determined by molecular methods, or is intended to be, note DNA on the data sheet.



Figure 7b. Female. Showing more sharply angled pattern and more extensive brown pigmentation in rachis. (Sustaita et al. 2014, A. Chabot, unpublished data).



Figure 7a. Male. Showing more horizontal pattern and less extensive brown pigmentation in rachis. (Sustaita et al. 2014, A. Chabot, unpublished data).

3.3 Data Sheet Table 3

A table with median morphological measurements has been provided in Appendix 7.

The data sheet has been ordered to facilitate data entry into Bandit. To minimize the handling time, and number of times the bird is placed into a removed from the tube, a different order is recommended. Specifically, after initially putting the bird in a tube, then gauge leg size, band the bird, measure tarsus width, leg diameter, tail measurements, then weight. Remove the bird from the tube and take wing and fat measurements. Sexing can be done before or after initially putting the bird in a tube. Feather samples should be obtained after tail measurements as the removal of the R1 will impact tail measurements. Blood sampling and other health measures should be conducted after banding, which is the priority.

Leg diameter: Measure the width of the tarsus using calipers on the wider axis at the thickest point near the middle of the leg (Figure 8). Note: the measurement may be slightly less or greater than that suggested above – use of the leg gauge is critical to ensuring proper band size.



Figure 8. Leg diameter measurement.

calipers to the distal edge of the last scale that completely encircles the dorsal surface of the foot.

Short tail: Measure using a small clear plastic ruler by inserting the ruler between the two middle tail feathers (R1; Figure 9). Hold one end of the ruler snugly without pushing too hard against the bird's rump, and measure to the distal tip of the longest middle rectrix. If the central rectrix feathers are broken or missing, do not take a tail



measurement.

Tarsus length: Measure using calipers, by 'notching' one end of the calipers in the heel, and then extending the

When a feather sample is collected, put a check mark or “yes” in the appropriate box. Details on how to sample feathers are provided below. Place each sample in a separate envelope. Label the envelope with the bird’s band number and note which feather was collected.

Feather Plucks

R6: Pluck one of the two outer tail feathers (R6) and place it in a small coin envelope (#1 or #3 size). Place only one feather per envelope.

Tail feathers are sometimes absent as they tend to be adventitiously shed (Chabot et al. 2018). If a different feather was collected (e.g., the R6 is not available or is being replaced, so it should not be plucked as it may damage the follicle and cause bleeding), note which feather was plucked instead.

Shrikes will often shed tail feathers in the trap, bird bag, or sometimes during handling. In this case, the shed feather should be used instead of plucking another. If possible, note which feather was shed. If this is not possible, write ‘shed’ in the box.

R1: Pluck one of the two R1 feathers and place in a small envelope.

Body feathers: If body feathers are collected for trace element assays, please note this with a “yes”. Feathers from “known source” birds are required for assignment of unknown birds. These can be obtained from previously banded birds that are retrapped, or from independent HY shrikes. The goal should be to obtain known-source feathers from at least 10 known-source birds to ensure accurate assignment (A. Chabot, unpublished data). Body feathers should be plucked from the lower belly near the legs. The feathers in this area are larger and pluck more easily than those higher on the breast (A. Chabot, personal observation). A dozen large-sized breast feathers are required from each bird for trace element assays.

Weight: With the bird still in the bag, first tare the Pesola scale to zero with the toilet paper tube *and* elastic. Alternately, do not tare the Pesola but record the weight of the tube and subtract it from the total weight of the bird and

Long tail: Measure using a small clear plastic ruler by gently blowing on the dorsal surface of the bird’s rump to expose the uropygial gland. Hold the ruler flat and gently push under the distal end of the gland. Holding the ruler steady, measure to tip of the longest middle rectrix.

Feathers: Feather sampling can serve many purposes, and the different feather types are sampled in different ways. One or two plucked tail feathers can be used for genetic assays, but do not provide adequate DNA for others, such as Single Nucleotide Polymorphism assays. The outer rectrix (R6) and ninth secondary (S9) are also a reliable indicator of wintering ground isotopic value (Chabot et al. 2018). The first primary feather is reliably molted on the breeding grounds, and when obtained from a breeding bird, it can be used to assess dispersal among breeding grounds. When obtained from a wintering bird, it can be used to determine breeding ground origin. Body feathers are also reliably molted on the breeding ground. A pilot study is underway to assess trace elements in breeding shrikes to determine if they provide a more fine-scale resolution of dispersal than is possible with stable isotopes and genetics to date.

tube. Either method is valid, but it is recommended that the bander be consistent in recording the gross or net weight of the bird and tube.

Place the bird in the toilet paper tube, or bird bag (a toilet paper tube is recommended as birds will flutter and be hard to weigh in a bag). Gently place a rubber band around the tube, and under the tail of the bird. Firmly clip the end of the rubber band that runs around the closed end of the tube inside the teeth of a Pesola scale (i.e. keep the bird's head facing up). Open your hand so that the bird is suspended from the scale but be sure to keep your hand just free so that you can quickly regain control of the tube (Figure 10), and read the weight of the bird



Figure 10. Weighing a bird in a tube using a Pesola scale.

Wing Measurements:

Wing chord: Measure the wing chord using a wing rule, from the wrist to tip of wing, with the wing unflattened and flexed at the wrist (Figure 11). Use your thumbs to keep the bird from fluttering and steady the wing while measuring.

Figure 12. Position of wing and wing rule for measurement of white in primary.



Figure 11. Position of wing and wing rule for wing chord measurement.

White in primary: Place the edge of the wing flush to the edge of a wing ruler that is inserted as if to measure wing chord and use your fingernail to mark the location of the distal edge of the basal white spot on the wing (Figure 12). The wing should be slightly opened and unflattened. Holding your nail on the ruler, remove the bird's wing and note the distance between the wrist and edge of the white spot.



Feather Snips:

PI: Gently clamp the distal end of the first primary feather with a hemostat to ensure that it does not get lost and then snip ~1 cm/0.5 inch off the tip using a pair of blunt-edge scissors. If an assistant is present, they can collect the snipping while the bander holds the bird's wing firmly in place.

S9: Gently clamp the distal end of the ninth secondary feather in a hemostat and snip ~1 cm/0.5 inch off the tip

using a pair of blunt-edge scissors. If an assistant is present, they can collect the snipping while the bander holds the bird's wing firmly in place.

Fat: Using the information provided in Appendix 8, assess the bird's fat stores, using a scale of 0 to 8 judged on the extent of fat in the furculum. Determine fat levels by gently blowing the feathers away from the furculum and under side of the wing and assessing the extent of yellowish fat stores under the skin. Shrikes seldom carry fat and thus scores above 3 are uncommon (A. Chabot, unpublished data).

Muscle: The extent of muscle mass on the breast has been used as a metric of body condition in birds (Brown 1996). Using the information provided in Appendix 9, score muscle mass on a scale of 0 to 3 by blowing the feathers and visually assessing.

Notes: Use this section to note if samples are being collected for a specific research study. The Loggerhead Shrike Working Group has, from time to time, research projects on which interested banders are welcome to collaborate. For example, choanal/cloacal swabs and fecal samples were obtained from multiple banders for a health assessment study in 2016-2018 led by the Smithsonian Conservation Biology Institute. Information on current or past research is made available at www.loggerheadshrike.org or can be obtained by contacting the Working Group coordinator.

This area can also be used to make any notes on bird's health, past injuries (e.g., appears to have had broken a toe in the past, healed at present) or other notes of interest (e.g., feather quality poor and fault bars found in tail feathers). If more room is needed, please use the back of the data sheet. For this reason, it is useful to have only single-sided banding sheets.

4.0 Post-release monitoring

The bander should watch where the bird flies and observe the bird's behavior for a few minutes following release. Ideally, the bird will resume normal activity. If the bird does not (e.g., it pecks at the bands), this should be noted. In most cases, it is best to leave the site within a few

minutes after the final bird is released. If normal behaviour is not resumed shortly after being released, a follow-up visit should be made later in the day or the following day. Such occurrences would include excessive band worrying or not attending to begging young.

5.0 Emergency Procedures

Only healthy birds should be banded. The bander must be able to identify signs of distress and stop activities if they are causing unacceptable stress or are likely to cause injury. The bander should be prepared to recognize and treat animals injured as a result of their actions. Prior to undertaking fieldwork, the bander should identify a veterinarian or rehabber who will be available for care or advice and carry this contact information with them in the field. Despite careful planning and training, emergency situations can arise during fieldwork. Suggested procedures for the care of an injured bird are provided in Appendix 10.

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Appendix 1. Equipment for banding Loggerhead Shrike

Required trapping equipment:

1. Trap(s).
2. Hardware cloth mouse cage and twist ties to close cage.
3. Mice
4. Apple – to provide mouse with some moisture and food when in the hardware cloth cage.
5. Jackknife – to cut apple, and just in case.
6. WD40 (or silicon-based lubricant) and rag to clean door guides - this is best done each morning before trapping begins. The door guides will build up dirt, etc. and even a small amount reduces the efficiency of the door closure.

Required banding equipment:

1. Metal bands: size 1A, 1D and 2 – obtain these from the Bird Banding Lab (U.S.) or the Bird Banding Office (Canada). You need to have a Master Bander permit to order bands. Though they come in different metals, stainless steel is preferred. The aluminum alloy is very soft so the birds could potentially crush the bands, and would likely wear the numbers off with their beaks. Incoloy is a harder metal, but not as hard as stainless steel. It is also thinner than either stainless steel or aluminum. While they can be manipulated to a degree, i.e. to flush the edges of the band, they seem to hold a shape that does not fit the shrike leg as well as stainless steel.
2. Double-overlap Darvic bands – from Haggie Engraving. Orders of 55 or more in a single color are not subject to the surcharge. Band order sheet and other information are provided as Appendix 4.
3. Banding pliers with appropriate size to close size 1D are required. These are not the same as the standard North American banding pliers. British

Trust of Ornithology pliers are recommended, which can be ordered at either of the following: <http://app.bto.org/btos/ringingSales.htmlx>, or <https://www.avinet.com/en/tools-and-repair/uk-banding-pliers-without-pin>.

Cost (As of Jan 2017):

\$51 USD through BTO or \$78 USD through Avinet

4. Circlip pliers or O-ring pliers - some people use these to open and apply the Darvic bands. They cannot be used to open or remove stainless steel bands once applied to the bird's leg. (<http://app.bto.org/btos/ringingSales.htmlx>) Cost (Jan 2017): \$43 USD
5. Calipers (preferably digital) – can be ordered online at a variety of sites (e.g., Amazon) or bought at hardware stores. https://www.amazon.com/VINCA-DCLA-0605-Electronic-Fractions-Conversion/dp/B017KUC6XQ/ref=lp_2476630011_1_1?s=industrial&ie=UTF8&qid=1473448109&sr=1-1 Cost (September 2016): \$17 USD
6. Extra battery if using digital caliper – they take different batteries, so make sure you determine the type you need, then get at least one extra.
 7. Leg gauge (must include size 1D) - some gauges have different sized openings for the bands, please use the Avinet gauge if possible. Before using a leg gauge, make sure that there are no burrs or sharp edges – use a fine metal file to de-burr the gauge as needed. <https://www.avinet.com/en/node/173>. Cost (Jan 2017): \$38.50 USD
 8. Small clear plastic ruler (may need to be trimmed to start at 0) – available at Walmart or Staples, etc. Trim with a utility knife for a clean edge. http://www.staples.com/Westcott-reg-Shatterproof-Plastic-Rulers/product_SS711739. Cost (Jan 2017): \$2 USD

9. Wing rule - these come in a variety of lengths and widths. The shorter and narrower rule works well, with a stop at the top.
<https://www.avinet.com/en/tools-and-repair/standard-wing-rules-15cm>.
Cost (Jan 2017): \$25.75 USD
10. Hemostat (preferably two) – these are used to hold the feather that will be snipped for stable isotopes or those plucked for trace elements to keep them from being lost in the wind.
https://www.amazon.com/Precision-Forceps-Tweezers-Silver-Straight/dp/B00EKQ7FY4/ref=sr_1_1_a_it?ie=UTF8&qid=1473448434&sr=8-1&keywords=hemostat
Cost (Jan 2017): \$3 USD
11. Small envelopes – size #1 or #3 coin envelopes are recommended. Larger sizes can be used, but they are more expensive and bulky. Small plastic bags can also be used. Shrike tail feathers are no more than 4 inches in most cases, so size accordingly.
https://www.amazon.com/dp/B000Y50ZD8?ref=ams_ad_dp_asin_2. Cost (Jan 2017): \$18 USD/pk (500 count)
12. Small blunt-end fingernail or safety scissors – for cutting wing feather tips for stable isotope analysis.
<https://www.amazon.com/Blunt-Safety-Sewing-Scissors-717/dp/B00WSWEJ9Q>. Cost (Jan 2017): \$12 USD
13. 100 gram Pesola or other spring scale (Avinet catalogue number 93011 Micro 100g x 1g) or you can also use a small digital scale.
<https://www.avinet.com/en/tools-and-repair/pesola-%C2%AE-spring-scales>. Cost (Jan 2017): \$52.25 USD

14. Toilet paper tubes (preferably in various diameters) – punch two holes on each side of one end about 1.5 inches from the edge. Press edges together to close, and use masking tape to secure the end with holes. Crease the edges to create a blunt end.
15. Rubber bands for weighing bird – preferably size 64, but size 32 will work.
https://www.amazon.com/Universal-Rubber-Bands-3-1-2-164/dp/B0007893VM/ref=sr_1_13?s=office-products&ie=UTF8&qid=1473448729&sr=1-13&keywords=rubber+bands
Cost (Jan 2017): \$7-10 USD
16. Bird bags - try to use a fresh one for each bird and wash between uses, so order as many as you think you will handle birds in a day.
<https://www.avinet.com/en/other/economy-holding-bags>. Cost (Jan 2017): \$4.15 USD each
17. Watch – for monitoring handling time.
18. Color-band combinations are available on-line at www.loggerheadshrike.org. Contact Amy Chabot (amy@chabotcuddy.ca) regarding combinations available.
19. Clipboard - this type is nice as it folds shut over the data sheet and feather samples, and extra data sheets, the color combination sheet, etc. can be stored inside. http://www.staples.com/Staples-Aluminum-Clipboard-Memo-Silver-10-x-6-1-4-x-1-1-8-/product_1828056.
Cost (Jan 2017): \$24 USD
20. Data sheets – see Appendix 5.
21. GPS – any kind will do. A phone application that will give coordinates should work as well.

22. Permits – Federal Bird Banding permit, with permission for each state/province in which you work, and with permission for feather sampling and use of color bands (if applicable)
23. Needle-nosed vice-grip pliers (used in conjunction with needle-nosed pliers for band removal) – 4” is best, but you can use 6”; see Appendix 3 for procedure. https://www.amazon.com/WISE-GRIP-Original-Locking-Pliers-1602L3/dp/B0000BYD9A/ref=pd_sim_469_1?encoding=UTF8&psc=1&refRID=270TMVCWRMQC75CR4NC3 Cost (Jan 2017): \$15 USD
24. Needle-nosed pliers (for band removal) – see Appendix 3 for procedure. https://www.amazon.com/KC-Professional-95510-Long-Pliers/dp/B004W7Z2BE/ref=sr_1_9?s=power-hand-tools&ie=UTF8&qid=1483979609&sr=1-9&keywords=needle+nose+pliers Cost (Jan 2017): \$10 USD
25. Antibacterial hand gel or wipes – to clean hands prior to handling each bird.
26. Contact information for veterinarian or wildlife rehabilitation center – it is a good idea to know where to take an injured bird if by chance you need to, before you go to the field.
27. Transport carrier – for transport of wild, injured birds (e.g., a small cardboard box with air holes and a perch, and towel to wrap into a ring to support birds that cannot perch). Cardboard pet carriers with a stick or dowel that can be inserted through the sides as a perch work well and can be stored flat. <https://www.amazon.com/Revival-Animal-Health-Cardboard-Carrier/dp/B000MVX70W> Cost (Jan 2017): \$33 USD for 12pk

Optional equipment:

1. Two-way radios – these can be useful if working with an assistant to communicate regarding the location of the shrike, trap placement, etc.
2. Clothes pins tied with flagging tape – clip onto a tree near the trap when working in tall grass to help in locating the trap from the observation point
3. Drinking straw – use to blow feathers when assessing fat
4. Trap repair equipment (i.e. fishing line, rubber bands)
5. Alcohol swabs, antibiotic cream, ‘new skin’ – to treat minor injuries on birds
6. Bleed-stop – see http://naturalhistory.si.edu/BIRDNET/documents/guidelines/Guidelines_August2010.pdf
7. Non-chlorinated water – for over-heated birds or to pour on mice suffering from heat stress, or to rehydrate in hot weather and for birds in emergency situations
8. Eye-dropper – to provide water to over-heated birds
9. Louse dusting powder – to treat infestations of feather mites
10. Plastic surgical gloves – for handling extremely ill birds
11. Plastic ziplock bag – if a dead bird is found

Appendix 2. Procedure for opening stainless steel bands

Unopened stainless steel bands tend to close more evenly than those pre-opened by mechanical means (Figure 1). The following is a suggested method for opening stainless steel bands.



Figure 1. Mechanically pre-opened band on left. Unopened band that has been opened using the method described below on right.



Figure 2. Equipment required for opening stainless steel bands.

Equipment:

- Nail set
 - preferably a set of 3 that vary in size and are suitable for opening 1A, 1D and size 2 bands
- Straightedge screwdriver
 - the slot end must be free of burrs or groves which can create rough edges on the band
 - preferably a set of 3 straight-edge screwdrivers that work well for opening all 3 sized bands
- Small piece of hardwood scored with a table saw blade
 - various depths can be used from ~0.5-2 cm being adequate
- Rubber tubing or copper-coated electrical wire
 - size 12 or 14 wet and dry works to store opened bands
- Hammer

Band opening procedure:

Slide the band onto the end of the nail set. Center nail set with band over the groove in the wood jig and firmly push the nail set down. The band will catch on the edges of the jig and begin to open (Figure 3). Push the nail set until the band opens enough to insert the tip of the screwdriver (Figure 4; a hammer may be used to facilitate this step). Remove band from end of nail set by catching it on the lip of the jig and pulling backwards.

Next, insert the edge of the screwdriver into the newly opened slot on the band. Center the band over a groove in the wood, and then push firmly on the screwdriver. The band will be pushed up the shaft of the screwdriver, widening the opening (Figure 4). Remove the band from screwdriver, turn over, and repeat process. This creates a straight opening. Be sure to open the band enough to allow it to be placed onto the leg of the bird, but avoid opening wider than necessary as this may increase chances of overlapping the band when closing it. Refer to Appendix 6 for average leg diameter measurements.

Slide the band off the end of the screwdriver and place it on rubber tubing or electrical wire for storage. After all bands have been opened and stored for use, check to ensure that they are in proper sequential order, and that the band has not torqued in the opening process (i.e. ends will meet flush when closed). Slight torquing can be fixed with pliers, but it is advisable that only pliers with smooth surfaces are used to adjust bands, as pliers with toothed surfaces can rough band ends. Roughed bands may cause injury when applied, so they must not be used.



Figure 3. Band opened on end of nail set.



Figure 4. Band being fully opened on screwdriver. The depth of the groove in the wood and width of the screwdriver will determine how far the band can be opened.

Appendix 3. Procedure for removing bands

Color bands:

Improperly closed color bands can be removed by carefully inserting the tip of small fingernail-clipper style scissors between the band and the leg and snipping the band off, or snipping the band open and then inserting circlip pliers to remove the band. However, it may not be possible to snip through both layers of a double-wrap style band, in particular if blunt-tipped ‘safety’ scissors are used. If the scissors do not fit, the band can be removed by snipping small sections at a time, starting at the exposed end, until the band can be gently opened and taken off the leg using circlip or O-ring type pliers.

Stainless steel bands:

If too much pressure is applied when closing a band, it may overlap. Overlapped bands must be removed. It is best to be extra careful during banding, because removing stainless steel bands is a very difficult, and potentially hazardous activity, Extreme caution must be taken to ensure that the bird is not injured during removal of the band. If this occurs, the bird may need to be taken into captivity temporarily and rehabilitated.

Depending on the degree of overlap, different methods may be applied. Band opening pliers can be used if the tines can loosely fit between the band and the leg, but banders should be careful to avoid damaging the scutes on the leg. However, stainless steel bands are too hard and cannot usually be removed with circlip type pliers.

If the scutes on the leg are damaged during this process, a replacement band should not be applied to that leg, but could be applied to the other leg.

Another method using mini vice-grip and long-nosed pliers has been successfully used with captive birds. However, it requires the assistance of a second person. If a bander working alone is faced with having to remove a band from a wild shrike, they should attempt to get assistance as quickly as possible. If the bander must wait for assistance, the bird will have to be held temporarily and monitored for signs of over-heating or extreme stress. If the bander is faced with holding a bird for the purpose of removing an overlapped band, they should place the bird in a suitable carrier (see banding equipment checklist), which should be placed in a cool and quiet location (e.g., under the shade of a tree).

Equipment (available at hardware stores):

- Needle-nosed vice-grips (‘mini’ size - 4” – is best)
- Long-nosed pliers (5”, with grooves in the “nose” for gripping)

Have one person hold the bird securely and stabilize the leg with the overlapped band. A second person will use the equipment to remove the band.

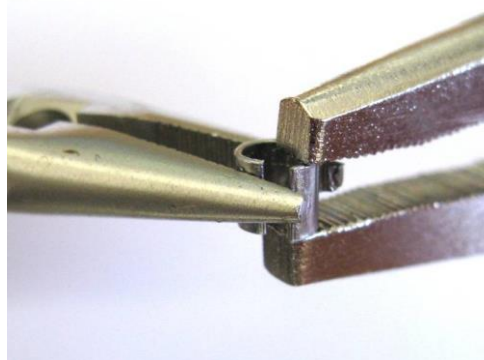
Adjust the vice-grips so that they are slightly LESS than the band height; this ensures a tight grip. It is important that the vice-grips lock tightly onto the band, otherwise the band may slip as you are using the pliers. Secure the vice-grips so that they are gripping the top and bottom edge of the band on the side that is under-lapped, and lock them in place – continue to hold onto them, so that no weight is put on the band.



With the other hand, place the long nose pliers around the circle of the band and “catch” one of the inside grooves on the overlapped lip.



While holding the vice-grips securely and steadily, gently roll the pliers back, unrolling the band. Repeat and reposition as necessary.



Once the band is more open, you may use the plier nose to grip and pry back the band until the opening is large enough for the leg to come out. Ensure that a firm grip is maintained on the vice-grips at all times, so that the band is held in a steady position around the leg during the entire procedure.

Appendix 4. Ordering color bands

Double overlap color bands are made by Robin Haggie, with contact information as follows:

Haggie Engraving
PO Box 66
Crumpton, Maryland 21628, USA
Telephone and Fax: 410-928-5228
Email: haggie@intercom.net

The information required to complete the Haggie Order Form (see next page), is as follows:

1. Species: Loggerhead Shrike (LOSH)
2. HE Band sizes: 1A, 1D, 2
3. Colors: Plain, 9 colors
 - a. White 011
 - b. Red 4121
 - c. Grey 997 (Salbex)
 - d. Yellow 2077
 - e. Lt blue 770
 - f. Rblue 725 (Salbex)
 - g. Orange 303
 - h. Green 6169 (Salbex)
 - i. Lgreen 661
4. Plastic thickness: 0.5mm
5. Band height: 5.5
6. ID
 - a. 1A (3.1mm)
 - b. 1D (3.5mm)
 - c. 2 (3.8mm)
7. Bevelled (standard)
8. Overlap: double
9. Code series: Darvic and Salbex (as noted)
10. Quantity: order in batches of 55 in total to avoid surcharge
 - a. Size 1D: a minimum recommended order would be of 20 bands of each color. Refer to Table 2 (regional rotation of unique year color bands) and order additional bands of the year color for the year in which you are banding (and possibly the next few subsequent years)
 - b. 1A and 2 are not commonly used, but should still be kept on-hand
 - i. recommend 10 per color per area
11. Delete reversible codes? Not engraved - ignore
12. Order request: 'Standard' is ideal. For 'urgent' or 'emergency' needs, check with Amy Chabot to see if bands could be loaned from another bander, to be replaced with a 'standard' order.
13. Color band description – use previous reference “HE14-065”

HAGGIE ENGRAVING, BAND ORDER and ESTIMATE SHEET
P.O BOX 66, CRUMPTON, MARYLAND 21628, USA
Tel & fax: 410-928-5228 E-mail: haggie@intercom.net

Name: _____ Affiliation: _____

Street address (911 for shipping): _____

_____ Tel#: _____

Species: _____ USGS, HE band size: _____

Color(s): _____ Plastic thickness @3.2/2.4/1.6/1.0/0.8 or 0.5: _____

Band ht: _____ mm; ID: _____ mm. Overlap: standard/double/reverse/reduced (ROL DV only). Circle one.

Corner rounding (CR) & bevel (=std). CR by request for plain color bands < USGS #6 where possible.

Code series: _____ Delete reversible codes: Yes/No

Tarsal/tibia bands, ELFs, neck collars, NC&TB set (circle 1). COST: tarsus @: \$ _____

Total number bands ordered: _____ collars @: \$ _____

BBL permittee name & #: _____ ****Sales Tax: \$ _____

Purchase order # _____ Shipping/handling/insurance: \$ _____

Due date: _____ (please do not put ASAP) Expedited* / Surcharge*:\$ _____

Payment: cash/check w/invoice (discount) or credit card TOTAL ORDER: \$ _____

For DR acrylic glue use IPS Weldon #16 and order online: www.rplastics.com or www.tapplastics.com

Order request (please circle one): EMERGENCY*, URGENT*, NON-URGENT or STANDARD.

Authorization: _____ date: 2016
(please sign above and return)

N.B. Clients are responsible for obtaining necessary permits from the BBL, Laurel, MD. RED sections = minimum requirement.

Please use "Request Read Receipt" for email order confirmation or telephone if you do not hear from me in 24 hrs.

****EXEMPT INSTITUTIONS, please provide copy of Retail Sales Tax Exemption Certificate.

* Emergency/urgent and small orders will incur an additional \$45.00 minimum charge each.

"Bands, for birds and research - our only business since 1967"

Appendix 5. Data sheet, one row per bird, 3 birds per page.

	Location Description	Latitude	Longitude	State or Province	County	Nearest town	Miles to town	Direction to town
1								
2								
3								

	Date (MM/DD/YY)	Bander/Scribe	Band size	Band number	Colour Combo (L/R)	Age	How aged	Sex	How sexed
1									
2									
3									

	LEG		TAIL		PLUCKS			Weight	WING		SNIPS		Fat	Muscle	Notes
	Diam	Tarsus	Short	Long	R6	R1	Body		Chord	White in PP	P1	S9			
1															
2															
3															

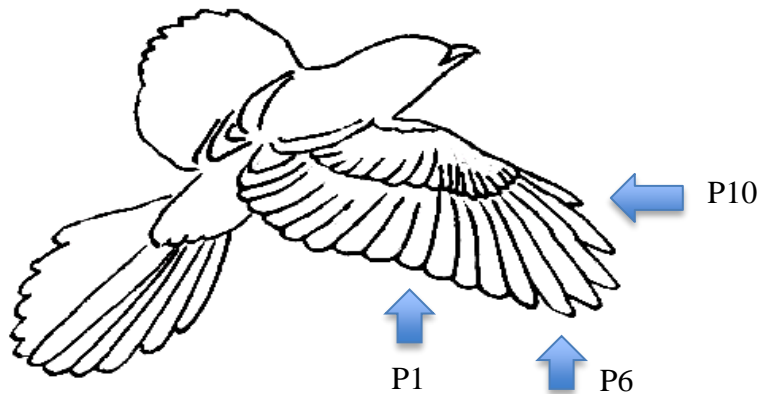
Appendix 6: Sexing Loggerhead Shrikes using pattern and pigmentation in the 6th primary

Introduction:

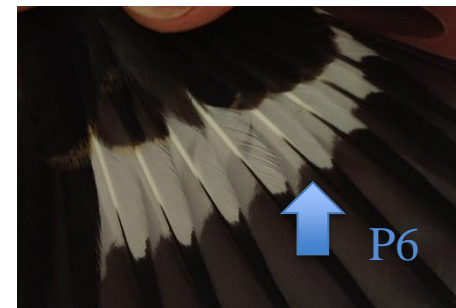
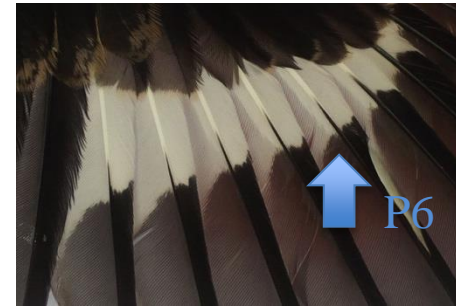
Loggerhead Shrikes (*Lanius ludovicianus*) are sexually monochromatic and therefore difficult to sex in the hand. In Northern Shrikes (*Lanius excubitor*), the pattern of the white-to-black color transition in the 6th primary feather appears to be a good indicator of sex. Adult (AHY) and hatch year (HY) Loggerhead Shrikes often have a similar distinction between the sexes, but there is ambiguity. It is possible that two measures in combination, the extent of pigmentation in the rachis of the 6th primary and the shape of the white-to-black color transition, may allow for sex differentiation. A more angled, v-shaped transition and more extensive pigmentation (see below for details) is typical of females. A horizontal transition and less extensive pigmentation is typical of males.

Method:

Primary feathers are counted from the middle of the wing outwards, from P1 to P10 (a reduced feather in shrikes).



Birds with an angled “v-shaped” pattern in the feather vane along the rachis, and for which at least half of the rachis within the white zone of P6 is darkly pigmented should be scored as “female”. Birds with a less sharply angled, more “horizontal” pattern in the transition of black to white feather vane along the rachis in the P6 and for which less than half of the rachis within the white zone of P6 is darkly pigmented should be scored as “male”. Photos of P6 are provided below as a reference below.



More pigmentation (50% or more of rachis in white section of P6 feather is black) and the transition between white and black is more sharply angled (v-shaped) in the P6 wing feather. This is characteristic of a female shrike.

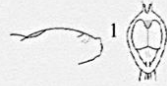


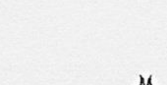



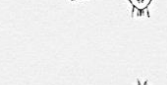

Less pigmentation (less than 50% of rachis in white section of P6 feather is black) and the transition between white and black is less sharply angled (more horizontal) in the P6 wing feather. This is characteristic of a male shrike.

Appendix 7. Median morphological measurements for Loggerhead Shrike (Chabot 2011)

Cohort	Leg Diameter	Tarsus Length	Short Tail	Long Tail	Wing Chord	White in Primary	Weight
Adult female Average Quartiles	3.1 23 - 3.2	26.7 26.00-27.32	92 89-94	98 95-100	96 94-98	53 51-55	52 49-55
Adult male Average Quartiles	3.16 3.05 -3.27	27.02 26.50-27.54	94 92-97	101 99-104	98 97-100	55 54-57	52 50 -54
HY Average Quartiles	3.11 3.03 - 3.21	26.72 26.07-27.29	93 90-95	100 97-102	97 95-99	53 51-55	50 48-52
SY Average Quartiles	3.11 3.02 - 3.23	26.91 26.20-27.43	92 90-95	98 96-100	96 95-98	54 52-56	52 49-54
ASY Average Quartiles	3.14 3.04 -3.24	26.93 26.39-27.48	95 92-97	101 99-103	98 97-100	55 53-57	52 50-55

Appendix 8: Scoring fat stores

The following information was obtained from the British Trust for Ornithology's web site, accessed January 2017:
<https://www.bto.org/volunteer-surveys/ringing/taking-part/resources-ringers/resources-data-collection>.

(a) ESF system		Fat Scores	(b) BWG System	
Score	Description		Score	Description
0	no visible fat. Dark red		0	no visible fat. Dark red
1	F: wide wedge of fat. A: trace of fat. Light red		1	F: trace of fat. (~E0.5) Light red/pink
2	F: completely covered but deeply concave. A: slips of fat. Light yellow		2	F: base of tracheal pit obscured by fat to about one third full. (~E1.0) Yellow-pink
3	F: moderate fat reserves cover ends of inter-clavicles but concave. A: flat or slightly bulging pad. Light yellow		3	F: tracheal pit about two-thirds full. Muscle within tracheal pit visible between fat and clavicles. (E~1.5) Yellow-pink
4	F: filled up to far end of clavicles. A: covered by clearly bulging pad of fat. Yellow		4	F: completely filled up to far end of clavicles but still concave (not bulging). (~E3.0) Pale yellow
5	F: convex bulge, perhaps overlapping breast muscles. A: extreme convex bulge. Yellow		5	As ESF
6	F and A: fat covering breast muscles by several mm.		6	As ESF
7	F and A: 3/4 of breast muscles covered. Yellow		7	As ESF
8	F and A: breast muscles not visible. Yellow		8	As ESF



(F=Furcular region or tracheal pit; A=Abdomen)

Under the BWG scale, ESF scale equivalents are given (eg E0.5) eg a score of 3 on the BWG scale is equivalent to about 1.5 on the ESF scale.

From *Ringers' Manual* BTO, Thetford

Appendix 9: Scoring pectoral muscle condition

The following information was obtained from the British Trust for Ornithology's web site, accessed January 2017:
<https://www.bto.org/volunteer-surveys/ringing/taking-part/resources-ringers/resources-data-collection>.

Pectoral muscle score

Score Class	<i>Prominence of sternum</i>	<i>Pectoral muscle shape</i>
0	Sternum sharp	Muscle depressed
1	Sternum easy to distinguish but not sharp	Muscle neither depressed, sharp nor rounded
2	Sternum still distinguishable	Muscle slightly rounded
3	Sternum difficult to distinguish	Muscle rounded (full)

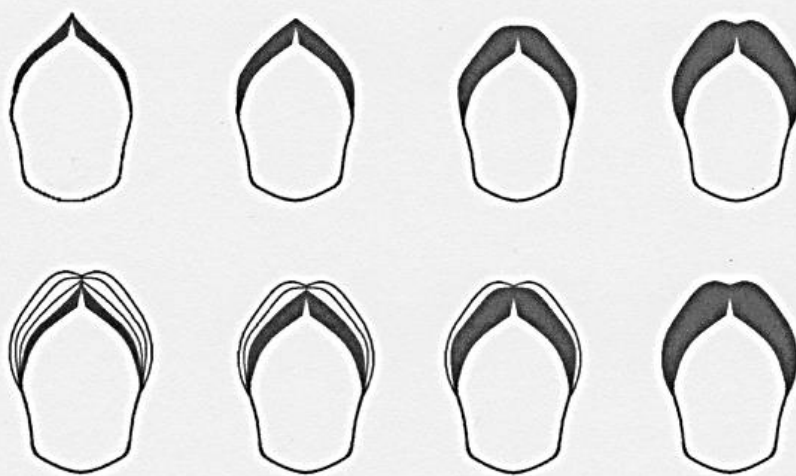
Score class

0

1

2

3



The black areas are the muscles.
 The white areas on the bottom row show the differences between scores.

Pectoral muscle scores
 After Bairlien (1995) redrawn, with permission from *European-African Songbird Migration Network Manual of Field Methods*.

Appendix 10. Health evaluation and procedures for dealing with injured birds

Only healthy birds should be banded. The following is suggested for a general health evaluation. See ‘Emergency Procedures’ below for more instructions.

- Appearance: birds should be checked to ensure that they are bright, alert and responsive. Glazed eyes are signs of dehydration. Birds that are concussed will show symptoms of head turning, lower responsiveness and/or eye turning. Displaced tail or wings (e.g., wings held higher or lower than normal, as determined by displaced bi-lateral symmetry) can be a sign of a bone fracture.
- Respiration: birds may breathe open-mouthed during handling due to the stress of capture and handling or heat. However, if such breathing is prolonged or noisy, this can indicate disease or injury.
- Feather condition: feathers should be intact, relatively parasite free and waterproof.
- Vent: staining or clumping of vent feathers with droppings may be caused by diarrhea or other illness, or may be due to injury and inability to void properly.
- Capture myopathy: stress during capture can result in capture myopathy, whose symptoms may include muscle tremors and a catatonic state. The probability of capture myopathy can be reduced by effective trapping, reduced handling time, low light conditions, and ensuring ambient temperature does not exacerbate hyperthermia (greatly elevated body temperature) induced during capture. A ‘hood’ (e.g., banding tube) may also minimize stress during handling. If the bird does become catatonic (i.e. appears to be in an unresponsive stupor), this may be remedied by keeping it in a quiet, warm environment. A veterinarian or bird rehabilitation center should be consulted, if possible, before the bird is released. If the bird becomes responsive, however, it should be released. Regardless, it is useful to take pictures to assist in the consultation process or later assessment.
- Blood: As part of the general health evaluation, the bander should look for signs of blood from scrapes or minor abrasions. Cream-based antibiotics (rather than ointments, which can affect waterproofing) such as Flamazine can be used on these minor injuries. Ideally, photos would be taken of any unusual physical characteristics, which would be forwarded to Amy Chabot to compile for future reference by banders, but also can be used for veterinarian consultation after release.

Emergency Procedures

The following guidelines for dealing with injured shrikes in the field has been developed using information in the British Trust of Ornithology’s *Ringer’s Manual* (Redfern and Clark 2001), the Canadian Council on Animal Care (CCAC) *Guidelines on the care and use of wildlife* (<http://www.ccac.ca>) (CCAC 2003), Environment Canada’s *Migratory Birds in Research Animal User Training Guide* (Environment Canada 2008) and the Ornithological Council’s *Guidelines to the Use of Wild Birds in Research* (Fair et al. 2010). The CCAC guidelines state that individuals conducting field studies should anticipate and be prepared to deal with the range of conditions that may cause undue stress and/or injury to the animal. The removal of animals with dependent young from the wild should be avoided and capture and handling of these animals must be carried out with particular care to avoid abandonment.

A bander should be able to identify signs of a bird in distress and stop activities when these will cause unacceptable stress or are likely to cause injury, e.g., during extremes of weather (including temperature extremes). The bander should be prepared to recognize and treat animals that are injured as a result of their actions. Euthanasia should be used only when an animal is suffering un-relievable pain and/or distress as a result of the capture or handling procedures or has an impairment that will affect its probability of survival. To be fully prepared to handle an emergency situation, prior to fieldwork, the bander should have identified a veterinarian or rehabber that will be available for care or advice.

With good handling, cases of injury in wild birds as a result of banding are extremely rare. However, some individuals may be

more susceptible to mild stress as a result of disease, high parasite load, old age, poor condition, or congenital defects rather than bad handling. Injured or diseased birds should not be banded. Despite careful planning and training, emergency situations can arise during fieldwork.

An injured bird must be treated appropriately. In broad terms, there are three types of emergency situations, each of which has a different appropriate course of action:

1. Birds that are in distress with no or only minor apparent physical injury (e.g., hypo- or hyper-thermia, or physiological shock as a result of being caught). These individuals should be allowed to recover in a safe environment *in-situ*.
2. Birds that have suffered physical injury and may therefore suffer unnecessarily if released, but are likely treatable. These individuals should be stabilized, transported to a qualified veterinarian or wildlife rehabber for treatment and released when fit.
3. Birds that have suffered physical injury and may therefore suffer unnecessarily if released, but are untreatable or unlikely to recover, should be humanely killed as quickly as possible.

Injured birds must be placed in an appropriate hold cage for transfer to a vet or rehabilitation center. The bander should carry a suitable holding cage in their vehicle at all times, non-chlorinated water and an eye-dropper for administering water or unflavoured “Pedialyte” solution. Holding cages should be protected from direct sunlight, wind and precipitation. Care should be taken to minimize psychological stress by shielding cages from excessive light, noise and human activities. For example, The temperature of the vehicle should remain close to 21°C during translocation. The radio should remain on during transport at a low level to create 'white noise' which can dampen loud sounds. The conversation level should also be kept low.

When morbidity is observed during or following handling, it must be immediately documented and investigated. If possible, where mortality has occurred, the carcass should be submitted to a qualified pathology lab for a full necropsy to determine cause of death.

1. Guidelines for dealing with birds in distress are as follows:

Any captured bird which appears to be in genuine distress as a result of being captured or handled for banding should be released quickly, whether or not it has been banded, preferably by placing it in a covered release box, or in a quiet, sheltered place where it can recover at its own pace. Occasionally a bird is reluctant to fly when released. This may be due to several causes:

- *'Inertia'* (possibly caused by disorientation) - There is no physiological problem and recovery is fast. Such a bird will be quiet and may 'freeze' but will be bright-eyed, not fluffed-up and not breathing excessively fast. Being placed in a safe open position for a short time will usually result in a quick recovery.
- *'Shock'* - This is physiological and due to a severe drop in blood pressure with associated poor circulation. The bird will be very quiet, not responding to stimuli, fluffed-up and often breathing very quickly. The problem may be due to several causes: poor condition (low energy levels due to malnutrition or migration in severe weather), low temperatures or damp plumage leading to hypothermia, or an inability to cope with serious stress (such as from a raptor attack or excessive handling). This type of problem should be dealt with immediately by keeping the bird in a warm, quiet and dark place. A single-use heat pack should be wrapped in a towel if the weather is cool and placed in the bottom of a suitable holding container (i.e. transport carrier). However, a degree of ventilation is important and care should be taken not to compress or damage the bird. If plumage has become excessively wet, the integrity of the plumage needs to be restored by allowing time and space for preening; the bird should therefore be kept in a warm, dark box until the plumage is dry and not excessively ruffled. A car heater may be useful to dry and warm birds.
- *'Heat stress'* - Banders should be aware of the dangers of excessive heat, particularly when working in hot and humid conditions. Heat stress may be associated with panting and respiratory noises. Birds showing evidence of heat stress

should be released quickly, whether or not they have been banded.

- ‘*Capture myopathy*, in which the bird’s muscles stop function normally, can result from handling and capture and can result in mortality. Well-planned capture methods that reduce trapping and processing time, low light conditions and ensuring ambient temperature does not exacerbate hyperthermia induced during capture should help to reduce incidents of capture myopathy. As struggling is thought to be a cause of capture myopathy, reducing struggling by covering the bird’s eyes, or placing it in a darkened holding cage is encouraged. If myopathy occurs, the bird may enter into a catatonic state. This may be remedied by keeping the bird in a quiet, warm environment. A veterinarian or bird rehabilitation center should be consulted. Treatment for severe capture myopathy potentially involves drugs, nutritional and mineral supplements, as well as physical therapy, thus requiring the bird to be taken into captivity temporarily, or the bird may be a candidate for euthanasia. Necropsy is the only way to confirm that capture myopathy was the primary cause of death. If capture myopathy is confirmed, capture and restraint techniques and capture and handling protocols should be reviewed and modified as needed.

2. Guidelines for dealing with birds with a physical injury are as follows:

- A bird which is otherwise alert may appear to have difficulty using both wings properly and be unable to fly when released. This may be due to ‘wing sprain’ or joint dysfunction (bruising, ligament damage), or to fracture. Fractures may be difficult to diagnose, especially in small birds. Anecdotal evidence suggests that birds affected by wing sprain will recover. Fractures are more serious and are best treated by immobilization and veterinary care. However, it is difficult to distinguish between wing sprain and a bone fracture, and the bander will have to use their judgment to decide if a bird is fit to be released into good cover or has a suspected trauma that prohibits mobility, in which case they should be placed in a warm padded carrier and veterinary advice/attention sought as soon as possible.
- Major wing fractures can only be treated by immobilizing the wing by gently wrapping the bird with ‘vet wrap’ with wing held against the body, taking the bird into care and seeking veterinary help.
- Wheezing may indicate a lung hemorrhage arising through stress. The circulatory system of birds differs from that of mammals in several important respects, in particular the heart has a high stroke volume, which generates a higher blood pressure. Excess stress resulting in a faster heartbeat can lead to rupture of blood vessels. In severe cases, the bird should be kept in captivity until fit or, if recovery is unlikely, it should be humanely killed to prevent further suffering (see below).
- Leg injuries that may cause suffering and are unlikely to heal correctly without intervention will require veterinary advice. The fracture should be stabilized with a splint and the bird transported in a carrier well-padded with shredded newspaper to ensure as little pressure is placed on the leg as possible.
- When it is deemed necessary to take an injured bird into captivity, the bander should stabilize any fractures, and open wounds should be gently cleansed with saline solution to wash out debris and covered appropriately, thus providing pain management to the degree possible. The bird should then be placed in a warm carrier, well-padded with shredded newspaper, and transported immediately to the appropriate care provider. If needed a small syringe or dropper can be used to provide a small amount of water to the bird, by placing a droplet on the top of the beak and allowing the bird to swallow on its own.

3. Guidelines for dealing with birds with a severe and untreatable injury is as follows:

- If there is a question as to whether a bird has an injury that can be treated, the bird should be brought immediately to the closest pre-designated animal care provider (see below) to be assessed and if not recoverable will be euthanized by the care provider using their protocols.
- A bird with severe injury that is clearly untreatable should be killed humanely as soon as possible. The following recommendations for euthanasia are based on the *2000 Report of the AVMA Panel on Euthanasia* (AVMA 2000).

Many recommended means of euthanasia for captive animals are not feasible in the field. Physical methods of euthanasia, when properly applied, kill rapidly and cause minimal stress and offer a practical solution for field euthanasia. Two methods may be used:

1. Inhalant: a cotton ball should be soaked in isoflurane and placed in the bottom of container. The bird's head will be inserted into the container and the container should be 'sealed' using the banders' hand. Humane euthanasia renders the animal insensitive to pain, then causes cardiac and respiratory arrest. For this reason, the above-noted methods should be used whenever possible. However, isoflurane is a restricted substance and requires a veterinary prescription. Thus, it may not be available for use in the field.
2. Cervical (neck) dislocation: The technique involves quickly stretching the neck to cause separation of the cervical vertebrae from the skull, specifically, the neck is stretched in one swift motion, thus hyper-extending the neck to separate the first cervical vertebra from the skull. This method should be used if the necessary supplies for pharmaceutical method of euthanasia are not available.

The investigator must be prepared to euthanize any animal in the field that is suffering un-relievable pain or distress. The primary purpose of euthanasia is to terminate suffering, so speed is important. The possibility for euthanasia should be considered and planned for in advance. The most important consideration for humane euthanasia includes minimizing pain, suffering and distress to the animal. The method chosen must be reliable, consistent, predictable, reproducible and safe; cause minimal stress on the animal, investigator and on-lookers; minimal impact of the environment; and ideally be carried out in isolation from other animals.