

APPENDIX A. DESIGNING A RESEARCH PROJECT

Refer to Appendix C in the Banders' Study Guide for an example of a well-designed research project. To set one up and analyze data, you need not be a professional biologist, but you do need a rudimentary understanding of basic statistics (e.g., the mean, probability theory). Among other things, you can use statistics to determine average dates of arrival, significantly early or late occurrences, as well as the proportion of hatching-year birds to adults in a given population. Zar (1999) and Sokal and Rohlf (1995) are both good statistical textbooks, but they are not written for the lay-person. The Eastern Bird Banding Association produced an excellent introductory guide to ornithological statistics (Schneider et al., 1984). An excellent web site at the Patuxent Wildlife Research Center can provide software for estimating desirable sample sizes and analyses of some banding data (<http://www.mbr-pwrc.usgs.gov/software.html>; Nur et al. (1999)).

The "Methods" section of articles in journals like *North American Bird Bander*, *Journal of Field Ornithology*, *Condor*, *Auk*, and *Wilson Bulletin* provide guidance to well-designed research projects.

Project design proceeds through logical steps:

1. Ask a question. All well-designed projects focus on a well-defined question. This step usually implies some familiarity with the work of others. You can consult recently published literature at a large library. The BBL has an extensive literature list at their web site at: www.pwrc.usgs.gov/rwp/database_descriptions.htm#PWRCbib
2. Develop a hypothesis. This combines the question with the expectation of what the answer might be, and why. Much necessary theoretical background comes from studying other investigators' results.
3. Design a project. Most people need help at this stage to design a workable project and determine what kinds of, and how many, data are needed. Here is where statistics help. Usually, the statistical test used to analyze the data dictates, to some extent, the types and sample sizes required for analysis. By now you should have a clearly formulated question, with a hypothesis, a plan for collecting the necessary data, and a plan for their statistical analysis. An experienced researcher or statistician can confirm that your proposed sample size and types of data are sufficient. Banders experienced with the capture of the proposed species should confirm that the target number and trapping method are easily attainable. Get other opinions on the possible limitations of a study; they could save a lot of hardship later.
4. Collect the data. This step should be relatively problem free if you have planned how to collect the data and received any necessary practical training.
5. Analyze the data. The use of a computer with data entry and statistical analysis programs makes analysis much easier.
6. Publish the results. Remember that "negative" results are just as important as "positive" results because they allow later projects to build upon them. Many publication outlets, from regional bird bulletins to international research journals, are available.

A.1. Developing a Hummingbird Research Project

Banders can conduct research in two ways. They can analyze their own data or collaborate with others who have already designed projects (many of which may need skilled assistants). Many scientific studies can never be undertaken on an adequate scale by individual banders and are possible only as collective endeavors. Hence, even if banders have no specific project of their own, they can contribute to larger, organized projects. For leads to projects where you might help, contact the Banding Offices and check with researchers at universities and bird observatories, talk with other banders, and search for requests for assistance published in newsletters and journals or on the Internet. See the *Ornithological Newsletter* on the internet at <http://www.ornith.cornell.edu/OSNA/ornnews1.htm>.

To develop a research project:

1. Read extensively about hummingbirds, including the accounts in *The Birds of North America*. When questions come to mind, jot them down; questions lead to research. Pick a question that intrigues you and then conduct a literature search. If the information you find does not satisfy you, design a project of your own.
2. Consider the species that you might study and do a literature survey on each one, so you have a comprehensive knowledge of them. Gaps in the knowledge of a species may lead to suitable studies. Do questions arise during your banding? If so, see if you can find the answers in the literature; if not, perhaps the question may become a study.
3. Conduct a comprehensive search to find existing projects already studying this question. Check with the Banding Offices, other researchers, banders who already have hummingbird permits, publications and the Internet. It is sometimes counterproductive to duplicate an existing project instead of collaborating and could possibly interfere significantly in another bander's research. Although replication of studies is the foundation of much of science.

The following possible research topics would require banding or marking of hummingbirds.

1. Determine migration paths, significant stopover sites, breeding ranges, and wintering ranges

Example.—Anna's Hummingbirds in California are generally considered residents but no study has proven that individuals are present all year. Their post-breeding movement into the mountains has been documented, as well as migration to the south and east. Do they first go to the mountains, then move on to Arizona, and New Mexico and eventually return to their breeding area? Only one banding record exists as hard evidence of an Arizona to California migration route. Long-term banding projects might supply much needed information in both instances.

Example.—Long-term recapture data from Rufous Hummingbird studies have begun to confirm an elliptical, southeast-west-

northward annual migration that was first suggested by Phillips (1975). The migration route of the Calliope Hummingbird seems similar; although relatively few captures have been reported along the migration route. More recaptures along this route are needed to indicate that the birds may follow the same route in successive migrations.

2. Determine how physiological and energetic constraints influence the behavior of migrants

3. Relate body masses to time of day, time of year, weather, or flower availability

4. Estimate population size and population turn-over (through mark-recapture studies)

Example.—The impact of feeders and the presence of exotic plants appear to be beneficial to most hummingbirds, but no one as yet has determined the role of feeders in maintaining or expanding hummingbird populations. Some people maintain over 100 feeders; what is the impact of such large-scale feeding?

5. Monitor hummingbird and plant interactions

A hummingbird in the hand offers an opportunity to obtain useful information on the floral resources it uses to "fuel" its energetically costly migration. Because migration and, later, reproduction may be limited by the availability of flowers along the "nectar corridor" that hummingbirds follow, we should learn which flowers hummingbirds visit and whether their availability is limited by natural variations in climate or by other effects, such as competition from introduced plants or spraying of herbicides. Banders are encouraged to: (1) Record the flowers hummingbirds visit near banding sites, noting their general condition and abundance. (2) Make herbarium specimens of the flowers of these plants for identification by botanists. If it is inconvenient to prepare herbarium specimens, simply place a few flowers in a labeled coin envelope. (3) Obtain pollen samples from banded birds for later identification by touching the sticky side of a 6-cm piece of acid free "Scotch" tape to areas around the bill, crown (avoid the eyes), chin, and other places you see pollen. Affix the tape to the inside of a small plastic ziplock bag and use a permanent marker to label the bag with hummingbird species, band number, location, date, time, and your name. If you know which flowers in the area are probably used by hummingbirds, list them. The Arizona-Sonora Desert Museum in Tucson, AZ, may provide pollen and flower identifications and coordinate information exchanges in Mexico, the U. S., and Canada. Contact them by e-mail at: pol@desertmuseum.org; or at their web site: <http://www.desertmuseum.org> to inquire.

6. Study territorial behavior

On breeding and wintering territories, study site fidelity, mate selection, dispersal distances, daily movement patterns, resource partitioning, and diet, and how all of these vary according to age, sex, and experience. Banding is crucial for identifying and following individuals.

7. Peruse "The Birds of North America" for suggested studies

Much of the knowledge of North American hummingbird species is summarized in *The Birds of North America*. Included in each account is a section on Priorities for Future Research. Review these accounts to learn what work has been done and to gain ideas for your own study.

8. Compare sampling techniques used to estimate population numbers or habitat use

Most hummingbird sampling is done at baited sites, but how the results relate to the birds' use of nearby habitats is unknown. Capture rates of linearly set mist nets in different habitats could be compared. Ideally the research design would include a comparison with the results from baited sites. A study of this sort could lead to a design and protocol useful in establishing the importance of different habitats to hummingbirds.

9. Band hummingbirds as a part of a monitoring study

Few banders involved in the MAPS (Monitoring Avian Productivity and Survivorship) program or at constant effort stations band hummingbirds. Much could be learned if their skills were expanded to include the banding of hummingbirds.

APPENDIX B. BANDING EQUIPMENT, SOURCES, SUPPLIERS

Bags, holding. Commercially available from Avinet Inc. (P. O. Box 1103, Dryden, NY 13053-1103; phone 1-888-284-6387; FAX 607-844-3915, e-mail avinet@lightlink.com, web page: <https://www.avinet.com/>) and AFO Banding Supplies (Box 1770, Manomet, MA 02345; phone 508-224-6521; FAX 508-224-9220, http://afonet.org/wp_english/banding-supplies/). The material may be purchased from Nichols Net and Twine Co., Inc. 2200 Highway 111, Granite City, IL 62040. Telephone 800-878-6387, FAX 618-797-0212.

Bags, Banding: Order 6mm diamond mesh https://www.ahh.biz/mesh/mesh_nylon_hex_6mm.php . Instructions for making bags are in Appendix C.

Band cutting tools. Phil Arpke contact Arpke.design@gmail.com



Band Cutting Tools: Lee Rogers contact www.hummonnet.org See Appendix C for more details.



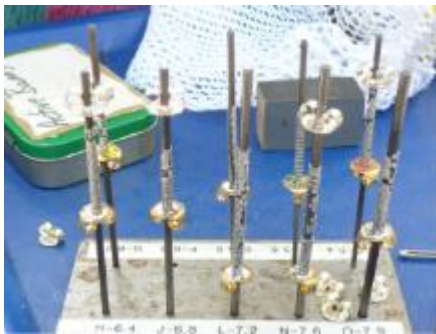
Band Forming Tools: Lee Rogers: contact www.hummonnet.org



Band stripping tool is necessary to cut the plates of bands received from BBL into stripes of 10 numbers. A mini metal shear/brake is available from Micro Mark (www.micromark.com) 800-225-1066, item #84734) and is easily used to make exacting band strip cuts; a similar unit is available from Harbor Freight www.harborfreight.com, item 90757. Note that the BBL now provides bands already cut into strips for banders who do not need large quantities per season (but a word of caution as sometimes the bands are cut too wide to safely use).



Band Storage Pins. Available for either Open or Closed Bands from Lee Rogers contact: www.hummonnet.org See Appendix C for instructions for making pins.



Banding pliers. Available from Lee Rogers: contact www.hummonnet.org



Band-opening Needle. Tapestry needles of various sizes, available at sewing and craft shops, are useful for opening bands.

Cage-wire. Traps last longer if made of “galvanized after welded wire.” It is available in a 1.0- x 0.5-inch (2.54- x 1.27-cm) mesh, 16-gauge wire in rolls 36-inches (91.4-cm) wide and in 100-ft (30.8-m) lengths, from Valentine, Inc., 4259 South Western Blvd., Chicago, IL 60609, telephone 1-800-438-7883; FAX 773-650-9099 (It is also available at Animal Stuff, LLC (Animal, Aviary, Herpetological & Zoological Supplies) for details see <http://www.valentineinc.com/contactus.html>). Local hardware or farm supply stores are likely to carry this type of material

Cage-wire clips and clip-closing tools. Obtainable from Valentine, Inc. (Address above). If you plan to make many traps, you will find their catalog useful. Also known as 'J-clip' and available, with a dedicated closing tool, at many local farm/feed stores as well as Tractor Supply Inc. (Advantek brand, see: <http://www.tractorsupply.com/tsc/search/cage%20accessories>)

Calipers. Inexpensive nylon and metal calipers are available in Dial and Digital types.. Accuracy to 0.1 mm is recommended for measuring wing and culmen measurements and accuracy of 0.01 mm is required when making bands and adjusting band cutters. Calipers may be ordered from Forestry Suppliers (<https://www.forestry-suppliers.com/>) or [Amazon](#).

Computer, laptop. Some banders enter their data directly into a laptop computer at the banding site. Any model that operates a database or spreadsheet will be satisfactory if its display can be seen in the field. Even if you do not use a computer for field entry, you will need access to one for preparing and submitting schedules to the BBL or BBO via the Bandit program, referred to elsewhere in this Manual.

Drop Screen Trap (Hall Trap). Available from Lee Rogers contact: www.hummonnet.org

Feeders. There are many varieties. Unless you have large numbers of hummingbirds, a feeder with a small reservoir is adequate. Glass reservoirs are more resistant to sunlight than plastic models. Bases that come apart are easier to clean than single piece bases. Select simple models with a red base, into which the birds extend their tongues downward to reach the solution. The Dr. JB line (<http://drjbs.com/>) has proved especially popular because all parts may be safely washed in the top rack of a residential dishwasher. Best-1 glass hummingbird feeders are available for purchase on-line and in bird food stores with a variety of feeder bottle sizes. Perky Pet produces hummingbird feeders that are also widely available in stores specializing in bird feeders. And there are many other companies that make a good product too.

Foods, special. Nektar Plus may be obtained from Guenter Enderle Enterprises, 27 West Tarpon Ave., Tarpon Springs, FL 34689. Phone 727-938-1544. FAX 727-938-1545. NOTE: Nektar Plus (may only be available to licensed rehabilitators) spoils easily and should be used with care. Kits for growing your own fruit flies may be ordered from Carolina Biological Supply Co.; telephone 1-800-334-5551.

Light, portable. A battery-operated headlamp is useful on dark days or in poorly lighted locations. Available from sporting goods stores and by many mail order firms.

Magnifying lens. Some banders use a good jeweler's loupe, available from AFO Banding Supplies (see above), jewelry supply stores, the Nature Company, and other catalog houses. Flip-up binocular magnifiers that attach to an eyeglass frame are also effective; models are made by Donegan Optical Company, Inc., 15549 W 108th St., Lenexa, KS, 66219, and are available through many outlets, including Starr Gems (see under "Scales"). These lenses are excellent for observing bill corrugations and examining feather detail, injuries, and parasites. Other banders prefer a binocular visor attached to a head strap, available at sources cited above. One widely used instrument is OptiVisor, available from Donegan Optical Company. The Carson clip, available in several magnifications, has also proven useful (Carson Clip and Flip Multi Powered Clip-On, Flip-Up Magnifying Lenses OD-10, OD-12, OD-14). An eyeglass loupe is available from Bausch and Lomb (<http://www.bausch.com/our-products/vision-accessories/professional-magnifiers/classic-metal-eyeglass-loupes>).

Needle, knitting. A #2 knitting needle (~2.75 mm), available at sewing supply or fabric stores, is useful for probing for the feet of a hummingbird in a holding bag, as well as for opening bands prior to use. A large paper clip, suitably bent, also may be used.

Nets, mist. Available in 6- and 12-m lengths. Most hummingbird banders prefer a mesh of 24 mm (measured across the long axis of a mesh opening pulled taut), but some banders use a 30 mm mesh without problems. Nets are available from AFO Banding Supplies (address under Bags, holding) and from Eastern Bird Banding Association. Nets also available from Avinet (see address under Bags, Holding).

Poles, net. Ten-foot (3-m) sections of EMT electrical conduit (inside diameter 0.5 inch [1.3 cm]) may be bought at hardware stores and make excellent and inexpensive support poles for nets. For convenience, they may be cut in half with a conduit cutter, available wherever conduit is sold. Drive poles into the ground with a "pounder" made from a heavy pipe about 24 inches (61 cm) long (inside diameter 0.75 inch [1.9 cm]) with a welded plug in one end. The device is similar to a fence-pole pounder used on T-shaped metal fence posts. Invert the pounder over the end of the conduit, then pound the pole into the ground with an up-and-down motion. Caution: do not take such long strokes that the pounder is lifted above the conduit pole; this could result in an injury. A second pole may be inserted on top of the one in the ground with a 12-inch (30.5-cm) sleeve of copper pipe "M" (inside diameter 0.75 inch [1.9 cm]), or equivalent. Crimp the center enough to prevent it from sliding down the conduit pole. These sleeves may be cut from 20-ft (6-m) lengths purchased at the hardware store. Do not pound poles with a heavy hammer because the ends then flare outward and sleeves will not fit. Poles driven into the ground become clogged with earth, adding weight. Some banders drive galvanized electrical ground rods (or a section of 0.375-inch rebar) into the ground and place the conduit pole over the bar. Standard 8-ft (2.4-m) ground rods can be easily cut into three 32-inch (81.3-cm) lengths for the ground driven stakes. Grind or file freshly cut ends to prevent any jagged edges. If you use rods to support the net poles, you need a hammer; a 2-lb (0.9 kg) electrician's mallet is excellent. Hardware stores may stock other types of rods that would function well.

Rulers. Use a thin metric rule 15 cm long to measure tail and other characters. Narrow stainless-steel rules are often found in stores that sell drafting supplies and in large hardware and supply stores, as well as from AFO Banding Supplies or Avinet (see above).

Scales. Readings to the nearest 0.1 g are adequate; no hummingbird in the United States exceeds 10 g. The simplest weighing device is a 10-g spring scale (Pesola is a well known brand), available from Avinet, AFO Banding Supplies (see addresses under Bags, holding), or Forestry Suppliers. Many hummingbird banders use small electronic balances available from jewelry and biological supply houses; Ohaus (<http://us.ohaus.com/us/en/home.aspx>) is an excellent brand. They are small, compact, and may operate on batteries. The Pocket Pro 150 made by Acculab is available from Starr Gems, Inc., (<http://www.silversupplies.com/index.shtml>), its capacity is 150 g, which makes it useful for larger birds. The Ohaus Model CT-200 series (measures weight to 0.01 g) and is battery operated, but you may not need the accuracy. Be sure that the scale or balance has a weight to use in calibrating it.

Table, adjustable. If you wish to use a wire cage trap at or near a feeder that has attracted birds, an adjustable table, such as a slide projector table, is indispensable. It can duplicate the height of the feeder in the cage or trap. One manufacturer, DA-LITE, makes a stand called Project-O-Stand (<http://www.da-lite.com/products/multimedia-carts-and-stands/projection-carts-and-stands/projectostand>); it is available at many camera and audiovisual supply stores and occasionally at flea markets and tag sales. As another option, you may be able to hang a trap with wire or support it with electrical conduit.

Table, banding. Folding tables with attached seats, available at sporting goods stores are very useful for field banding.

Tarsus Gauge: See next page for details. Lee Rogers contact: www.hummonnet.org

Hummingbird Tarsus Gauge

The Hummingbird Tarsus Gauge (HTG) has 24 slots that increase in width by .065mm and is meant to measure the exact diameter of the tarsus. The edges of the correct slot should barely touch the skin on both sides. One slot smaller will obviously move the skin. One slot larger will be a bit loose. You will feel as much as see the correct fit. The premise is: If you can exactly measure the tarsus you can calculate the optimum band size for the individual hummingbird.



It requires two hands to measure the hummingbird's tarsus, one hand to hold the foot and the other to hold the gauge. The bird must be restrained in a mesh bag or other device that allows control of the bird while leaving both hands free to manipulate the gauge.

The hummingbird tarsus has an oval shape. Measure the longest dimension, front to back, about where the band will sit. The calculated band size is based on having the inside diameter of the band 0.5mm larger than the tarsus measurement. This amount of space is based on extensive work with Black-chinned hummingbirds and seems to work well with the medium and small birds. It is not enough space for the larger birds however. At this point we add one size for *Amazilia* and two sizes for *Lampornis* and *Eugenes*. The larger species appear to require proportionally more space between leg and band. This New Tarsus Gauge is capable of measuring most hummingbird species. Birds measuring slot sizes P through X may require addition space (+3 or +4 sizes) between band and leg. Additional research is required to determine optimum band sizes for the largest hummingbirds.

The goal is to find the optimum band size for the individual bird. Use your banding skill and knowledge to sanity check your measurements and choice of band size. Generally 'round up' for female birds since their tarsus tend to swell during breeding.

You can **practice** getting the feel of the Hummingbird Tarsus Gauge by using an **inter-dental brush** available at drug stores. **Standardize** your tarsus measurements by comparing with other banders to ensure consistency and accuracy of measurements.

Hummingbird Tarsus Gauge Translation

Slot ID	Band Size	Slot ID	Band Size
A	5.0mm	X	9.6
B	5.2	W	9.4
C	5.4	V	9.2
D	5.6	U	9.0
E	5.8	T	8.8
F	6.0	S	8.6
G	6.2	R	8.4
H	6.4	Q	8.2
I	6.6	P	8.0
J	6.8	O	7.8
K	7.0	N	7.6
L	7.2	M	7.4

The soft aluminum material that bands are made of is easily formed by the banding pliers to the shape of the hole. Banding pliers of unknown size can be tested to determine the exact size band they create by cutting a test band from a blank band strip (between numbered strips) equal to suspected size, forming, closing with test pliers, and measuring the outside diameter across both the x and y axis. Compare measurement to the table that follows (from Lee Rogers, Hummingbird Monitoring Network). See table below.

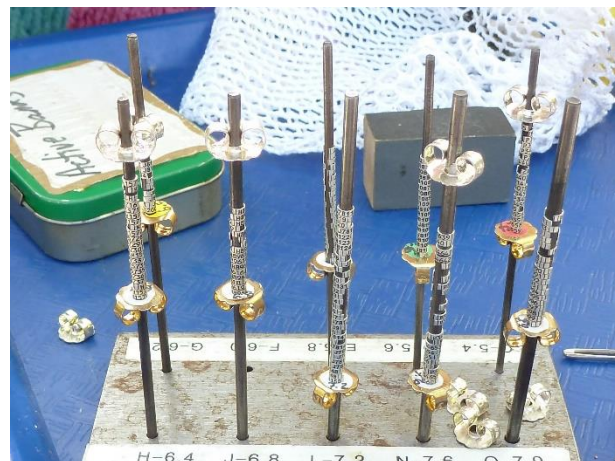
Band Dimensions					
Tarsus	Band Length	O.D. Circle	O.D. 1x Oval	O.D 1.5 x Oval	O.D 2x Oval
A	5.0mm	1.89mm	1.92 x 1.86mm	1.94 x 1.84mm	1.96 x 1.82mm
B	5.2mm	1.96mm	1.99 x 1.92mm	2.01 x 1.90mm	2.02 x 1.89mm
C	5.4mm	2.02mm	2.05 x 1.99mm	2.06 x 1.97mm	2.08 x 1.95mm
D	5.6mm	2.08mm	2.11 x 2.05mm	2.13 x 2.03mm	2.14 x 2.02mm
E	5.8mm	2.15mm	2.18 x 2.11mm	2.19 x 2.10mm	2.20 x 2.09mm
F	6.0mm	2.21mm	2.24 x 2.18mm	2.26 x 2.16mm	2.27 x 2.15mm
G	6.2mm	2.27mm	2.30 x 2.25mm	2.32 x 2.23mm	2.33 x 2.22mm
H	6.4mm	2.34mm	2.37 x 2.30mm	2.32 x 2.29mm	2.39 x .28mm
I	6.6mm	2.40mm	2.43 x 2.37mm	2.44 x 2.36mm	2.45 x 2.35mm
J	6.8mm	2.46mm	2.50 x 2.43mm	2.51 x 2.41mm	2.52 x 2.41mm
K	7.0mm	2.53mm	2.56 x 2.50mm	2.57 x 2.48mm	2.58 x 2.47mm
L	7.2mm	2.59mm	2.62 x 2.56mm	2.64 x 2.54mm	2.65 x 2.53mm
M	7.4mm	2.66mm	2.69 x 2.62mm	2.70 x 2.61mm	2.71 x 2.60mm
N	7.6mm	2.72mm	2.75 x 2.69mm	2.76 x 2.68mm	2.77 x 2.67mm
O+	7.9mm	2.81mm	2.84 x 2.78mm	2.86 x 2.75mm	2.87 x 2.75mm

Band Storage Pins (Band size is in mm).

Lee Rogers contact: www.hummonnet.org

Storage Pins can be made from **Numbered Drill Rod**, available from Granger www.grainger.com or on internet. They are exactly the same size diameter as the pins on your forming tool and will protect the shape and integrity of your bands.

The numbered drill rod comes in 30" or 36" pieces. A 3.5" segment of rod will hold 50 bands and fit into an Altoids tin. Use gun bluing on rods to help prevent rust. Polish pins with abrasive cloth after bluing to ensure metal is smooth and clean of residue. Large earnuts, jewelry supply, are drilled to fit individual pin size and used to cap each end. The earnuts are available in silver and gold finishes which can be useful for marking the beginning and end of a series. Inventory Dots can be used to label the earnuts with band size.



Band Size	# Rod for Open C Bands	# Rod for Closed Bands
5.4	49	54
5.6	48	53
5.8	47	1/16
6.0	46	52
6.2	44	51
6.4	43	50
6.8	41	49
7.2	37	47
7.6	35	44
7.9	32	43

Adjustable Band Cutter

Verify the adjustment of the band cutter by cutting a test band from a blank strip. Measure the test piece with digital calipers capable of .01mm increments.

Use a ¼" wrench to **Adjust** the movable slotted plate. Manipulate the two nuts on each bolt connecting the stationary plate to the slotted plate. To shorten the band length, loosen the outside nuts on the right side of the stationary plate and tighten the inside nuts on the left side. To lengthen the band, loosen the inside nuts and tighten the outside nuts. Adjustable Band Cutter The top slot is the smallest slot and can be adjusted as small as 5.2mm. The slot length increases by .2mm as they get closer to the operator.



The slot closest to the operator is .6mm longer than the top slot. To ensure that the plate is square maintain the numerical relationship. (i.e. if the top slot is adjusted for 5.4mm the bottom slot should be adjusted to 6.0mm)

Once the tool is adjusted and the band size verified with blank material you can start cutting actual band strips.

Recommended width of band strip is 1.3mm. Strips must be <1.5mm to fit into slots.

Clean and Polish the strip to remove any burrs or sharp edges. 600 grit wet/dry sandpaper works well to clean edges. For final polish use 1000 to 2000 grit sandpaper.

Look at the cutting pad and note the mark where the razorblade touches the pad. Place the strip flat on the cutting pad with the numbers visible and **upside down**. The letter preceding the lowest numbered band should be closest to the blade.

Consult the Hummingbird Banders Manual for the appropriate place to make the initial trim cut.

Manipulate the band strip to the bottom edge of the slotted plate. Align the initial point over the cut mark on the pad and lower the cutting lever to make the first cut.

Insert the band in the appropriate slot and cut again.

Double check the first few bands to verify length and then go into **production**.

Spot Check to ensure calibration and adjust if necessary.

Use **Caution** when cutting the last band in the strip or anytime the fingers get close to the razorblade.

Lee Rogers contact: www.hummonnet.org

Adjustable Band Cutter Maintenance: Over time, depending on use and technique, the razorblade will cut a groove in the cutting mat. If the groove becomes too deep the band edge can be damaged. Check cut band edge for smoothness and sand appropriately. It is important to rotate the mat periodically to provide a fresh surface when groove becomes too deep.

Rotate Mat: Use a Philips screwdriver and wrench to remove the two bolts holding the adjustable bracket to Chopper base. Rotate cutting mat 90 degrees clockwise, so old holes in mat are in lower right-hand corner of Chopper. Turn Chopper upside down and mark the center of mounting holes on the underside of the cutting mat. Drill 11/32 holes in mat at the two marks. Replace adjustable bracket so that slotted plate is square to base a close to but not touching upper, ruled, edge. Adjust as usual for desired band length.

Replace Razorblade: Use a small Philips screwdriver to remove retaining bolt in handle, remove holding plate and blade. Replace with standard single-edge razorblade from craft or hardware store. Mount the replacement blade so that the cutting edge comes down squarely on the mat. Ideally entire length of the blades cutting edge will touch the mat at the same time. If inside part of the cutting edge touches first, remove blade from handle and adjust angle of cutting edge slightly. Remount and check.

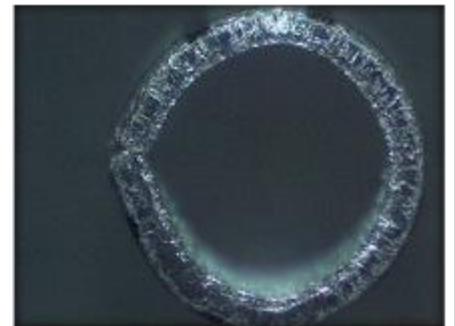
Numbers Down for Better Band Closure

Hummingbird Bands are photoetched onto sheets of 'dead soft' aluminum in groups of 100 with up to 300 numbers per sheet. These sheets are 'sliced' into strips with 10 band numbers and then 'diced' into individual bands at a length determined by the bander, formed into either an Open 'C' shape or a Closed ring, and placed on a Storage Pin or other medium until they are applied to the hummingbirds leg.

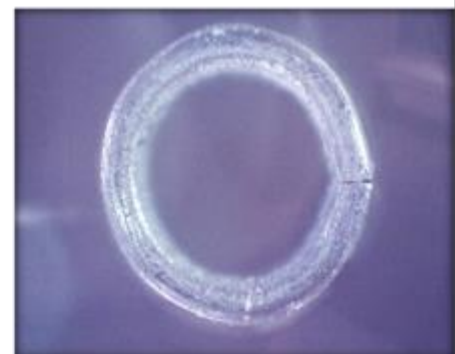
The thickness of the band material is 0.3mm so, remembering our High School Geometry, the circumference of the inside surface of a perfectly closed band is slightly smaller than the outside circumference. When the flat band material is cut to the desired length, and if the edges of the band are cut perfectly straight, as with scissors or flush-cutting dikes, the inside surface of the band will touch first when the band is applied to the bird, leaving a slight 'V' opening at the outer surface.



Similarly, if the band is cut with a razorblade the 'dead soft' aluminum material actually retains the impression of the tapered 'V' cutting edge of the razorblade. The result is that the bottom surface of the band is slightly longer than the top surface. When the band is cut with the numbers facing up a situation is created that exacerbates the closure problem.



We can use the slight bevel created by the razorblade cut to our advantage by cutting the band to length with the **numbers facing down**. This way the numbered surface of the band will be slightly longer than the inside surface of the applied band resulting in a smooth seam.



Technique: Using the Adjustable Band Cutter, maneuver the band strip, numbers facing up, to the bottom edge of the slotted plate. Align the initial point over the cut mark on the pad so that it is slightly before where the normal cut would be made and lower the cutting lever to make the initial cut. Keep the lever lowered with the razorblade touching the pad. Turn the strip over so that the numbers are down, slid the strip over to touch the razorblade, raise the lever and then slide the strip slightly under the blade. Cut off a small shard from the strip to set up the bevel on the letter side of the band. With the numbers still down slide the strip into the appropriate slot and make the final cut, creating the bevel on the number edge of the band. Form the band in your usual fashion and store for later use.

Be careful, especially when making shorter bands that the first bevel cut is made close enough to the letter edge of the band so that you do not damage the last digit when making the final bevel cut.

Lee Rogers contact: www.hummonnet.org

APPENDIX C. DESIGNS AND INSTRUCTIONS FOR BUILDING TRAPS, NET TRAPS, HOLDING CAGES, AND BAGS

NOTE that in many places there are both metric and imperial measurements, but if there is not, the conversion is 1 inch = 2.5 cm. For example, 3 inches = 7.5 cm (# inches multiplied by 2.5), and 15 cm = 6 inches (# cm divided by 2.5).

C.1. A Portable Drop-door Cage Trap

This is a cuboidal trap 18 inches (45.7 cm) on a side and made from 0.5-inch (1.3 cm) hardware cloth readily available in rolls 18 inches wide at most hardware stores. The design may be modified to use material available; the cage must be large enough to hold a feeder.

C.1.1. Materials list

- 10 ft 4.5 inches (3.2 m) of 18-inch (45.7-cm) wide galvanized hardware cloth; 0.5-inch (1.3-cm) mesh
- 44 plastic cable ties
- 6 inches (15.2 cm) of 1-inch (2.5-cm) wide hook-and-loop fastening tape (e.g., Velcro®)
- 1 flat lead weight (or equivalent)
- 2 hose clamps (0.375 inch; 9.5 mm)
- 1 pole to support trap; could use 5 ft (1.5 m) section of EMT electrical conduit
- 1 wire flower-basket hanger (or improvise)
- 8-24 inches (20.3-61.0 cm) of 0.25-inch (6.4 mm) wood dowel; the length depends upon the construction plan that is followed
- 1 piece of release line (nylon, monofilament, cotton, etc.; long enough to extend from trap to release point)

C.1.2. Tools required

- shears (or pliers) to cut hardware cloth
- scissors
- needle
- file, to smooth ends of wire
- pliers
- heavy thread

C.1.3. Instructions

1. Cut the hardware cloth into three 18- x 36-inch pieces (trap walls); save the remaining piece (16.5 x 18 inches [41.9 x 45.7 cm]) for the trap door.
2. In one of the large pieces, to make the door opening cut out a 12-inch (30.5-cm) square from one end so that it is 3 inches (7.6 cm) from the edge on three sides. Either file or grind smooth all sharp points to minimize injury to the birds and trapper.
3. Assemble the walls with at least five plastic cable ties per edge to form a cube. You may substitute metal clamps.
4. Attach the trap door with four ties or clips 1 inch (2.5 cm) above the door opening. The sides of the door should be even with the sides of the trap.
5. Attach three 2-inch (5.1-cm) hook-and-loop fastening tape strips to the lower edge of the inner surface of the drop-door (at corners and in center); attach the matching pieces opposite them on the outside of the trap. The tape is intended to keep the door closed after the trigger is pulled (because hummingbirds are very fast, they can escape through a bouncing door).
6. Attach a flat lead weight to the center of the exterior portion of the lower edge of the door to speed its fall. Some banders prefer to control the fall of the door by gently releasing the control line (see paragraph 10); they do not use the extra weight.
7. You may substitute strip magnets for hook-and-loop fastening tape or lead weights to speed the fall of the door and increase the likelihood of its sticking when it makes contact with the trap wall.
8. Attach hose clamps [sufficiently small to fit through the hardware cloth mesh and large enough to fit around a support pole (e.g., 0.5-inch metal EMT electrical conduit)] to the upper 1/8 and lower 1/8 of the center of the back wall of the trap. If you use a feeder to pre-bait birds, adjust the height of the trap to match that of the feeder.
9. Attach a flower basket hanger to the top of the trap; this will enable you to hang the trap from a tree limb, clothes line, or other support.

10. The mechanism to drop the door can be either above or below. The simplest below-door release mechanism is a 8-inch (20.3-cm) dowel rod (or equivalent) to prop open the door. Attach a string (nylon, monofilament, cotton, etc.) to the rod and run it through a counterweight (brick with holes works well) immediately below the trap on the ground and then to your hand. Figure 27 shows how to set the dowel. When the hummingbird enters the trap to feed, pull the string, thus releasing the door and trapping it.

For an above-door release, fasten a 24-inch (61-cm) dowel rod to the top of the trap, one end even with the back and the other end extending over the front. Screw a small hook into the front end and run a string through the hook to the door. See the plans for Sargent, collapsible cage-wire trap for details.

11. Customizing the trap might include cutting a round hole in a side wall large enough to allow you to reach into the cage to remove the hummingbird. Cover this opening with some type of fabric to prevent the hummingbird's escape. Netting sewn with an elastic cuff is one possibility. Some banders paint their traps to blend with the surroundings. For a trap that can be flattened for transport, cut six 18-inch (46-cm) squares from a 10.5-ft (3.2-m) length of hardware cloth.

A pull-door trap is believed less hazardous to the birds by some banders. It has a door that extends the width of the trap and is hinged at the bottom. The height of the door opening is a little less than the height of the trap. A line is used to pull the door upward to shut it; when closed, a weight on the end of the line may serve to keep the door shut until the captured bird is removed. The trapper controls the speed of the closing door.

12. Hummingbird feeders should be small enough to fit easily through the door and have perches from which the birds may feed. A perched bird is more easily captured than one hovering.

13. Some hummingbird banders have had good results with remote releases for traps, which can be constructed with easily obtainable electronic components by persons with some electronics expertise. These traps must be used with caution, as some birds will attempt escape when they hear the release and could potentially be caught in the door as it closes. This type of trap should not be used in attempts to capture rarities for the same reasons.

Example remote: will trip any door or drop any net, up to 100 feet away. The only construction required is to attach the receiver and solenoid to small board and add a 12 volt battery to power that (photo: Anthony Hill)
https://www.amazon.com/dp/B0033YECEK/ref=cm_sw_r_em_api_i_c_JfezCbEPPZ7H4



C.1.4. Vertical Sliding Door Trap

A vertical sliding door trap is constructed in much the same manner except that the door is mounted on two 3/32 in. wires (piano wire) with a two larger diameter small plastic tubes epoxy-glued to the sides of the door (four small tubes needed) so that the door slides up and down on the runners to open and close the door. A fine cloth mesh (~1 in. wide) is applied across the bottom edge of the door and on the bottom edge of the opening. Door stops are placed at the bottom end of the vertical wires/door runners to prevent the door from completely closing. The mesh cloth closes the opening when the door is dropped and prevents potential injury to a bird that may unexpectedly leave or fly into the trap as the door is closing.

C.2. Round Sliding-door (Cartwright) Cage Trap (Figure A)

C.2.1. Materials list

- metal frame and hanging hook from 'pet-store' style bird cage: often the plastic bottoms and tops of these cages crack or break and they are discarded so they are easily re-purposed
- enough ¼" hardware cloth to line the inside of the bird-cage frame or make a cylinder in your chosen diameter, two round pieces with a diameter slightly larger than the cage for the top and bottom, and one square piece for the door
- garden mesh, or 24 mm mist netting: enough to line the inside of the bird-cage frame if you prefer this over hardware cloth
- 6"/15cm or smaller plastic zip ties
- metal cage clips (optional)
- 2 metal coat hangers
- 4 cotter pins with 'eye' large enough to fit over coat hanger
- monofilament line: 1 piece of monofilament line long enough to extend from trap to release point and extra for fastening mesh
- guide (see illustration) to run trapping line through
- 2-4 plastic twist ties used to close bread or garbage bags
- hook or length of chain to suspend feeder inside cage

C.2.2. Tools required

- wire-cutting pliers
- electric grinder or a fine-toothed metal file (for smoothing cut edges)
- scissors if you are using mesh or mist netting to line the cage frame
- optional: work gloves

C.2.3. Instructions

1. Remove damaged plastic top and bottom from bird-cage and set the cage on a flat surface. Remove and save the cage hanging hook: these usually have a ring or loop on top to hang the cage, and another hook underneath to hang a swinging perch.
2. Flatten hardware cloth on work surface and cut the following pieces:
 - one panel the same height as cage frame. Calculate circumference of frame and cut hardware cloth to same length.
 - two round pieces the same diameter as the cage frame
 - one panel approximately 0.5"/1 cm larger on all sides than the existing door opening
3. Smooth trimmed edges on all pieces to avoid injury to birds and trappers from sharp edges.
4. Roll the hardware cloth into a cylinder slightly smaller than the frame and place it inside the frame with the butted edges at the back of the cage away from the door.
5. Mark the door opening and remove the hardware cloth to cut out the door. Smooth the cut edges and replace the hardware cloth inside the frame. Fasten it with thin wire or monofilament line at the door and in several locations along the top and bottom of the frame. The butt ends can be fastened to each other and the frame with wire, line, or plastic zip ties.
 - 5a. To make this trap without the bird-cage frame, cut the door opening out of the hardware cloth while it is flat, smooth the edges, then fasten the hardware cloth into a cylinder and secure it with plastic zip ties where the ends butt together.
 - 5b. To make this trap with a mesh or mist net lining, cut a piece of material large enough to line the inside of the bird-cage and secure it to the inside of the cage with monofilament line, then cut out the door with scissors.
6. Use plastic zip ties to fasten top to cage every 2-3"/5-10 cm. Attach the cage hanging hook by feeding the bolt through a hole in the hardware cloth, centering it so the cage hangs level. The hook or length of chain which suspends the feeder will be hung here when the trap is complete but leave it out for now.
7. Cut the coat hangers along the sides that lead to the hanging hook. Leave at least 4"/10 cm on each side. Unbend them so the coat hanger is now shaped like a 3-sided square. Slide two cotter pins onto each hanger. Position the door between the hangers and slide one cotter pin over the door near the top and bottom of each side. You may need to pry the pins open a bit to get them over the hardware cloth.
8. Carefully bend the door slightly into a curved shape to match the outside of the cage. Position the door over the cage opening and use plastic zip ties or metal cage clips to secure the 'arms' of the coat hanger to either side of the door. Check to make sure the door slides up and down evenly and then secure the cotter pins tightly in position on the door with plastic zip ties.
9. Attach guide to top of cage above center of door with plastic zip ties. Attach the monofilament release line to the top of the door and feed it up through the guide.
10. Use plastic zip ties to fasten bottom to cage in two locations close together. Do not tighten the bottom ties completely so there is some room for the bottom to swing open. Use the plastic twist ties to secure the bottom shut.
11. Suspend a feeder from the center using the hook or adjustable chain, and hang the entire cage up. Check to make sure the weight of the cage does not create gaps where the top attaches to the sides. If it does, simply add more zip ties to close the gaps.
12. As with all drop door traps, do not release the door until the bird is well inside, preferably feeding. Remove trapped birds through the door opening. If the door sticks after being stored for the winter, rub the coat hanger 'slides' with a bit of lubricant.

Figure A. Cartwright Trap (photos: Cindy Cartwright).



C.3. Collapsible Cage-wire (Sargent) Trap

This trap, made from 1.0- x 0.5-inch (2.5- x 1.3-cm) galvanized cage-wire, is 17 inches (43.2 cm) square and stands 36 inches (91.4 cm) tall; height may be modified as needed. A trap door is released remotely by a monofilament line. The trap may be permanent or collapsible. It may be suspended or placed on any flat surface. It is more durable than a hardware-cloth trap, but more expensive.

C.3.1. Materials list

- 8 ft 9 inches (2.67 m) of galvanized cage-wire: 1- x 0.5-inch (2.5- x 1.3-cm) mesh, 16-gauge, 36 inches (91.4 cm) wide. Galvanized after-welded wire is heavier, more durable, and more expensive than galvanized before-welded wire. Few hardware stores sell this wire.
- cage-wire clips: Valklips from Valentine, Inc.
- 18 inches (45.7 cm) of hook-and-loop fastening tape (e.g., Velcro®), 0.75 inch (1.9 cm) wide, with adhesive backing. Cut into six 3-inch (7.6-cm) strips
- 36-inch (91.4-cm) wooden dowel rod, 0.5-inch (1.3-cm) diameter; cut to 30 inches (76.2 cm) and 6 inches (15.2 cm)

- 1 small screw eye
- 1 piece monofilament line long enough to extend from trap to release point
- 1 piece coat hanger wire, to hang feeder in trap

C.3.2. Tools required

- wire-cutting pliers
- electric grinder or a fine-toothed metal file (for smoothing cut edges)
- Valclinchier (a tool to crimp cage-wire clips, from Valentine, Inc. see contact information above)
- work gloves
- drill and small drill bit for making hole in dowel for screw eye

C.3.3. Instructions

1. Flatten the wire on a work surface and cut six panels, each 17 x 36 inches (43.2 x 91.4 cm). Smooth all edges by trimming closely and grinding smooth. The grinding is critical for the safety of birds and handlers. Remember that you lose one rectangle of mesh each time you cut.
2. In one panel (front), cut out an opening 8 x 10 inches (20.3 x 25.4 cm), the 8-inch dimension 2 inches (5.1 cm) from one end and 4.5 inches (11.4 cm) from each side. Smooth edges.
3. In each of two panels (sides), cut out an opening 6 x 5 inches (15.2 x 12.7 cm), the 6-inch opening 6 inches from an end and 5.5 inches (14 cm) from each side. Smooth edges.
4. The back panel has no cuts.
5. From remaining two panels, cut three 17-inch (43.2-cm) squares for top, bottom, and false bottom. Smooth edges.
6. From the remaining 17- x 19-inch (48.3-cm) piece, cut out three pieces (doors), one 10 x 12 inches (25.4 x 30.5 cm), and two 7 x 6 inches (17.8 x 15.2 cm). Smooth the edges.
7. The trap is 36 inches (91.4 cm) high. Operate it upright. The openings in the three panels are near the top with doors wider and longer. Attach the top wire of each door to wire immediately above it, using wire clips. Using self-stick hook-and-loop fastening tape, place a “hook” piece on both sides of the bottom of each door by folding the hook-and-loop fastening tape over the bottom and back on itself, sticky sides together with the door sandwiched between the two sides. Place “loop” pieces in corresponding locations on the bottom edge of the openings in the trap. The hook-and-loop fastening tape catches the door as it closes, holds it to prevent bounce, and keeps the side doors secure.
8. Smooth the ends of the 30-inch (76.2-cm) and 6-inch (15.2-cm) dowel pieces to prevent splintering. Drill a tiny starter hole in one end of the long dowel and carefully insert the screw eye.
9. The panels may be transported unattached. For a temporary assembly, use bread bag twist ties. Twist tie the four sides together with the large door on the front, the two small doors on the sides, and the fourth panel on the back, but do not attach the final two panels. Twist tie one 17-inch (43.2-cm) square approximately 12 inches (30.5 cm) above the bottom. This is a false bottom and makes it easier to catch birds to remove them from the trap; it also raises the “catch area” when the trap is used on a low table. Fasten the remaining uprights together, then attach the bottom and top. Center the 30-inch (76.2-cm) dowel on top of the trap so that it extends outward over the larger opening through which birds enter, then fasten it with ties. Run a long piece of monofilament line down through the screw eye and tie it to the lower edge of the trap door; extend the other end to the operator, however far away that may be. Tie a 12-inch (30.5-cm) line to the 6-inch (15.2-cm) dowel, and tie the other end to the front of the trap just below the door opening. Use this dowel to prop the door open while you secure the end of the long line at the operator’s position (a clothes pin attached to a board works well to hold this end of the line). The short piece falls away when you pull the long line to raise the trap door. Hang a feeder that hummingbirds like in the trap with a piece of wire that can be fastened permanently to the top.
10. To make a permanent, nonfolding trap, use wire clips instead of twist ties to fasten the trap pieces. Some banders prefer a shorter trap made from wire 24 inches (61.0 cm) wide.
11. After baiting the trap and leaving the large door open, release the door only after a bird is well inside to lessen the chance of its flying out as the door is dropping. Remove birds through the smaller side doors.

C.3.4 A Modified Sargent/Drop-door Trap with Transfer Cage (Figures B, C and D)

This trap made from 1.0 x 0.5-in (2.5 x 1.3-cm) galvanized welded wire (hereafter “welded wire”) offers sturdier construction (than hardware cloth depicted in the Drop-door design) as offered by the Sargent trap, and facilitates construction by using an 18-inch cube design (45 cm) made from readily purchased 36-in (90 cm) wide rolls of welded wire from which only three 18 x 36-in (45 x 90) pieces need to be cut. Each piece is bent at a right angle at its midpoint lengthwise and attached each to the other by clips or wire to form a cube as opposed to cutting and mating six sides, lessening the amount of cutting and filing to trim sharp projections.

In addition, an improved method of retrieving birds from the trap is offered in the form of a transfer cage (Figure B) attached to the trap wherein rather than reach into the entire volume of the trap to retrieve a bird (full arm extension and then some at times), the bird is guided into a 6 x 6 x 12-in (15 x 15 x 30-cm) enclosure from which it is easily retrieved by hand avoiding all the arm reach into the larger volume of the trap.

Since most trapped hummers tend to fly upward in a trap in an attempt to escape, this transfer cage is placed at the top of a side of the trap (Figure C) to facilitate their removal from the trap.

Construction (in all cases where wire is cut, the sharp wire projections should be filed or ground smooth)

Transfer Cage

1. Cut a 12 x 25-in (30 x 63-cm) piece of welded wire with the 1-in wires running widthwise, trimming/filing the rough edges. Make a right-angle bend along that width at 6 in (15 cm), another at 6.5 in (16 cm) and a third at 6 in (15 cm) to form a four-sided enclosure requiring attachment with clips or wire where the two sides meet as in Figure B.

2. Select which will be the top side of the cage and from it cut the one-inch wires at their furthest extension from the cage, cutting those same wires on the other three sides nearest to the cage reducing the body size of the cage to 11 in (28 cm) in length.

3. Using those extended wires atop the cage, carefully bend each with needle nose pliers at mid-length at a right angle to allow the cage to form hooks to allow it to attach and hang from the edge of the trap.

4. Cut a 6.5 x 6-in (16 x 15-cm) piece of welded wire with the 1-in wires running widthwise for a door. Attach it at the back end of the cage with clips or wire loops allowing the door to swing inward.

Trap

1. Cut three 18-in (45 cm) wide pieces of welded wire from a 36-inch (90 cm) wide roll, and bend each piece 90° at the midpoint lengthwise and attach the three pieces with clips or wire to form a cube.

2. Select one side to be the front and at 2 inches (5 cm) down from the top cut a hole 8 inches (20 cm) wide and 12 in (30 cm) high centered on that side, i.e., 5 in (13 cm) in from each side as shown.

3. On either the right or left side (depending on convenience at the location where this trap will ultimately be used) cut a 5.5-in wide by 6-in long hole (14 x 15 cm), centered on the face of the side at the top of the trap.

4. Make two doors as follows from welded wire: 1) a door 10 in wide by 14 in tall (25 x 35 cm) to be attached to the outside of the front hole with clips or wire allowing the door to swing freely outward (the 1-in wires running vertically); and 2) another door which may be cut from the welded wire removed for the front hole 7 in high by 6.5 in wide (18 x 16 cm) to be attached on the inside of the trap at the side hole as depicted in Figure C.

5. To the top front of the trap attach a 5/8th-in (1.6-cm) hardwood dowel, 24 in long (60 cm) for use as a support for the front door. Since the door is 14 in long (35 cm), the dowel must extend out the same distance from the face of the trap. From a piece of wire form a hook with an eye and use a screw through the eye to connect the hook to the end of the dowel. On the inside roof of the trap hang a wire hook from which to hang a feeder centered 4-5 in (10-12 cm) from the back depending on the design/size of the feeder.

6. Two pieces of monofilament line, approximately 6-lb test (2.7 kg) need to be attached as follows. One piece about 40 in (1 m) long attaches to the inside door of the entry to the attached cage and with the door open, pass the monofilament out through the roof of the trap directly over the edge of the door, over the top and down the opposite side where it may be clipped to the trap with a pinch-clip clothespin. The second piece of monofilament is attached to the front door as illustrated and passed over the hook on the dowel to wherever the trap operator sits, typically 20-30 ft away (6-9 m), holding the monofilament trap line.

7. Lastly, the trap needs to be fitted with hook-and-loop fastening tape (Velcro brand) on the inside of the front door and on the front face of the trap to secure closure of the trap when the door is closed. Black tape 3/4-in (2 cm) wide is used. Tape that has adhesive on one side is not recommended because the adhesive is not very weather resistant. For the inside of the door, cut a 3-in (8 cm) strip of the hook tape and wrap it hook side toward the trap around four of the half inch wire in the position shown on the door in Figure C. Secure the hook tape with a 1.5-in piece (4 cm) of loop tape. Repeat this procedure at the second location on the door.

For the trap body, cut four pieces of loop tape 2 in long (5 cm) to be used in pairs, and cut four pieces of hook tape 1 in long (2.5 cm). At the positions on the trap body where the tape on the door would touch the trap, wrap a piece of the loop tape with loops facing outward and secure it with a piece of hook tape on the inside of the trap. Repeat this step again and twice more at the other side of the door and body.

Trap Use/Operation

This trap is used on a window ledge secured by an overhead guy line from atop the window. The open trap with feeder is constantly in place from beginning to end of season allowing birds to acclimate to it and use it daily. When not being used during a trapping session, the front door is secured in place by the hook on the dowel so that the door cannot accidentally close. The door leading to the transfer cage is closed.

During a trapping session, the front door is freed from the hook on the dowel, and opening and closing of the door is managed using the monofilament trap line from a chair 20-30 ft (6-9 m) away. When a bird enters the trap, the door is not closed until the bird has settled on the feeder and inserted its bill into the feeder. Most captures are singles, occasionally doubles and very rarely triples.

When a bird is caught, the monofilament operating the inside door to the transfer cage is pulled to open the door, the bird is guided into the transfer cage and the inside door closed behind it. Then from the other side of the trap a hand is gently inserted into the transfer cage to extract the bird. The trap is reset using a spring clamp to secure the trap line to the chair allowing other birds to use the feeder while the bird in hand is being processed.

Figure B. Sargent Trap (Robert P. Yunick)



Figure C. Sargent Trap (Robert P. Yunick)

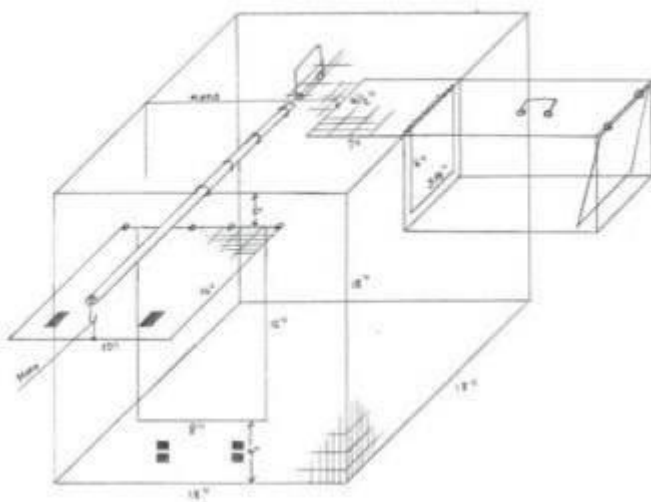
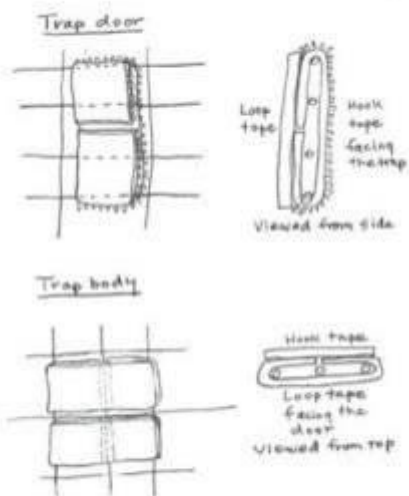


Figure D. Sargent Trap (Robert P. Yunick)



C.4. Open-sided, Collapsible Netting Trap ("Hall" or "Bonnet" Trap)

Bill Coughenour's original design has been modified by Bill Womack and Mike Hall. These plans were provided by Mike Hall. The directions are for a frame painted red, covered with red netting. While a red trap may attract birds, you may prefer to use a neutral color of fabric, leave the frame unpainted, and depend upon red in the feeder to attract birds. This type of trap is also available from Lee Rogers.

C.4.1. Materials list

- 25 ft (7.6 m) coil of 0.5-inch (12.7 mm) hard-surfaced, rigid-walled, plastic, hot-and-cold water pipe, such as Questpex
- 2 Questpex, brass, 0.5-inch Pex barb x 0.5-inch PB barb connectors (short pieces of plastic tubing the same size as the inside diameter of the water pipe may be used as substitute connectors)
- 3 PVC pipe tees, 0.5-inch, bottom leg of tee is threaded
- 3 iron threaded plugs, 0.5 inch
- 4 feet (122 cm) of clear vinyl tubing, 0.125 inch (3.2 mm) (inside diameter) x 0.1875 inch (4.8 mm) (outside diameter)
- 1 package of Stanley brand wood closet pole socket, 1.375 inch (3.5 cm)
- 6 feet (183 cm) of ice-maker tubing, 0.25 inch (6.4 mm) (outside diameter)
- 1 inch (2.5 cm) of ice-maker tubing, 0.25 inch (inside diameter)
- 1.5 pint (0.71 l) of bright red enamel paint (optional)
- 1 number 11 rubber "O" ring, 0.75 inch (19.1 mm) (outside diameter) x 0.5625 inch (14.3 mm) (inside diameter)
- 4.0-inch (10.2-cm) wooden dowel, 0.1875-inch (4.8-mm) diameter
- 6 steel eye hooks, 0.8125 inch (20.6 mm)
- 3 steel eye hooks, 1.1875 inch (3.0 cm)
- 1 tube Super Glue
- 1 spool monofilament fishing line, clear, 30- or 40-lb (~13-18 kg) test
- 3 black fishing barrel swivels, Size 3
- 1 single-foot fishing rod guide, Number 8
- 3 black interlock fishing snap swivels, Size 3
- 3 lead fishing weights, 2-oz (57-g)
- 1 package red hook-and-loop fastening tape strips (e.g., Velcro®), 0.5-inch or 0.75-inch (19.1 mm) wide
- 3 yards of red tulle fabric or a more durable fabric such as a fine-mesh insect netting in a neutral color
- 1 spool of red (optional) thread (one shade darker than fabric)
- 1 metal eyelet, 0.125 inch (3 mm)
- 1 bottle of Liquid Stitch permanent, clear-drying, machine-washable fabric adhesive
- 1 porcelain awning guide, 1.625 inch (4.1 cm) (outside diameter) (or substitute a similar size wood or metal ring with smooth sides)
- 1 plastic kite string winder (hand grip style)
- 1 16-oz hanging hummingbird feeder with perches
- 2 lengths of clothes hanger wire; 1 piece about 12 inches (31 cm); 1 piece about 28 inches (71 cm)

C.4.2. Tools required

- Electric drill
- Sewing machine
- Marking pen
- 0.125-inch (3.175 mm) drill bit
- Hand garden pruner
- Small hand awl
- 0.0625-inch (1.5875 mm) drill bit
- Cloth measuring tape
- Scissors
- Wire cutters
- Liquid dish soap
- Hard rubber mallet
- Paint brush
- Sand paper
- Needle
- Needle-nose pliers

C.4.3. Instructions

The **pull string guide** is assembled using the Stanley brand 1.375-inch (3.5-cm) pole socket. The package contains two sockets. Use the full socket, not the socket that is partially cut away along its bottom rim. On the underside of the socket, sand the sharp edges of the rim until they are slightly rounded and no longer sharp. Paint the socket bright red using enamel paint.

Super Glue a 0.125-inch (3 mm) metal eyelet into the flat top center hole of the socket (Figure E-A). Turn the socket upside down revealing a larger counter sunk center hole (Figure E-B).

Using wire cutters, cut away the metal foot or band encircling the number 8 single-foot fishing rod guide. All that now remains is the round ceramic guide (Figure E-C).

Super Glue the guide into the counter sunk socket hole. The combination of a metal eyelet and ceramic guide will allow the trap's pull strings to run quickly and smoothly through the top of the trap.

With the socket still in the upturned position, screw one large 1.1875-inch steel eye hook into the interior side wall. When viewed from above, the threaded shaft of the hook is midway, top-to-bottom, in a horizontal position. The hook's eye is centered horizontally above and encircling the fishing rod guide. Remove the hook. Cut a short piece of 0.125-inch (inside diameter), clear vinyl tubing, just long enough to cover any sharp, exposed threads of the hook. Slide the tubing over the hook's threads and screw the hook back into position (Figure E-D).

Wrap a cloth measuring tape around the flat outside bottom rim of the socket. Measure, mark, and drill three 0.0625-inch pilot holes approximately 1.75 inches (4.4 cm) apart for the three 0.1875-inch, small, steel eye hooks. Screw the hooks into the socket's rim until the threads no longer show. When the lower portion of the pull string guide is completed and viewed from the underside, the small eye hooks are vertical, the large eye hook is horizontal, and the fishing rod guide is glued inside the counter sunk hole.

Turn the socket over. Screw two large 1.1875-inch steel eye hooks into the flat top of the socket. The hooks should be directly across from one another, on the center line, and near the outside edges. Screw the hooks in securely, allowing some threads to show. The pull string guide is now completed (Figure E-E).

Later, when the trap is strung, the three monofilament pull strings will be threaded up through each of the small, vertical eye hooks, through the large centered horizontal eye hook, through the fishing rod guide, through the metal eyelet, and out the top of the trap's pull string guide.

Make two **hoops**. The hoops provide the trap's basic structure. From coiled 0.5-inch plastic water pipe cut two pieces of pipe 67.5 inches (171. cm) long with a garden hand pruner. Bend the pipes into 21.5-inch (54.6-cm) diameter round hoops, measured outside-edge to outside-edge.

Connect both hoops using two brass connectors. Lubricate the threads of the brass connectors with liquid dish soap. Drive the connectors into the pipes using a hard rubber mallet. Push the other end of the connectors into the pipes to complete the hoops. With the hoops held horizontally, measure, mark, and drill three 0.125-inch vertical holes through each hoop (Figure E-F). The holes should be centered, vertical, and an equal distance apart, approximately 22.5 inches (57.2 cm). Adjust the distance between the holes to the size of the hoops. Prepare the hoops for painting by sanding them lightly. Paint the hoops with bright red enamel paint.

If one hoop is slightly larger, use it as the top hoop. With the top hoop in a horizontal position, make three small pilot holes on the inside center of the hoop. Each hole should be offset about 0.25 inch (6.4 mm) from the 0.125-inch vertical holes. Screw in three 1.1875-inch small steel eye hooks horizontally into the pilot holes until no threads show. When viewed from above the eye hooks are screwed horizontally into the hoop's center.

The three **counterweights** are made from 0.5-inch PVC pipe tees. The upright or bottom leg of the tee is threaded to accept a metal plug. Sand the tees to remove any sharp edges. Screw a 0.5-inch iron threaded plug into the vertical leg of each tee. Paint the tees with bright red enamel paint (Figure E-G).

Cut a 2-inch (5.1-cm) long piece of red hook-and-loop tape (hook part) and glue it on the back or top of the tee using Super Glue. Drill a 0.0625 inch hole at the top edge of the tee, above the metal plug, opposite the Velcro. Thread and tie off a 3-ft length of 40-lb (~18 kg) test monofilament fishing line through the 0.0625-inch hole. Repeat for remaining tees. **Note:** If you have never tied monofilament line, ask how. Monofilament is very "slick" and comes untied easily. Wet the monofilament when tying to help it slide smoothly, and, once it is dry, glue the knot with Duco cement or an instant glue.

Make the **fabric curtain** by cutting a 71-inch (180-cm) long x 35-inch (89-cm) wide piece of red tulle fabric (Figure E-H). Sew the 35-inch ends together to make a cylinder that is 35 inches high and 71 inches in circumference. Fold down 1 inch (25.4 mm) at both the top and bottom edges, stitch to form 0.5-inch (12.7 mm) pockets. The pockets will later accept a top drawstring and a bottom hoop of ice-maker tubing.

Lay the bottom hoop on the remaining piece of tulle fabric. Cut a circle outside the hoop large enough to wrap over the edge of the hoop and sew a seam. Sew around the inside edge of the hoop about 1-2 inches (2.5-5.1 cm) in from the inside edge. Trim away the excess fabric. The fabric should cover the hoop tightly.

Make a top **drawstring** by tying an 8-inch (20-cm) long piece of 40-lb (~18 kg) monofilament line to a rubber "O" ring. Drill a 0.0625-inch hole through the side of a 4.0-inch (10.2-cm) length of 0.1875-inch wooden dowel, centering the hole. Thread the other end of the monofilament line through the hole in the dowel and tie it off. Work the dowel through the 0.5-inch pocket at the top of the curtain, gathering the material and assuring the "O" ring remains outside the end of the seam (Figure E-I).

Thread the 72-inch (183-cm) length of 0.25-inch (outside diameter) ice-maker tubing through the sewn 0.5-inch pocket at the bottom of the curtain. Adjust the size of the finished loop so it will fall easily around the bottom hoop of the trap, and connect the two ends of the tubing by sliding them into a 1-inch long section of 0.25-inch (inside diameter), 0.375-inch (outside diameter) ice-maker tubing (Figure E-J).

The three **vertical uprights** are made using 0.125-inch (inside diameter) x 0.1875-inch (outside diameter), clear vinyl tubing. Cut three 15-inch (38-cm) long lengths of tubing (Figure E-K).

String **the trap** using 40-lb (~18 kg) test monofilament line. Cut three 2-ft lengths of line. Tie a size 3, black fishing barrel swivel on the end of each line. Run the three lines up through the holes in the underside of the bottom hoop and out the topside of the hoop's holes. Make a knot at the far end of the lines and push the lines through the 15-inch lengths of tubing, using a straight portion of clothes hanger wire. Slide the counter weights over the vertical uprights. Feed the line for the vertical uprights through the underside of the holes in the top hoop and out the top hole. Tie off the lines, wrapping them around the top hoop several times, to complete all three 15-inch vertical uprights. Trim off any excess line.

Cut three 2-ft (61-cm) lengths of monofilament line. Tie them through the same holes in the top hoop where the vertical uprights were tied. Double the lines through several times before tying them off. String the lines to the base of the vertical eye hooks in the bottom of pole socket's rim. Tie off the first line to the base portion of a hook, not to the eye of the hook. Measure the line's length approximately 9.75 inches (24.8 cm) from the socket to the outside edge of the top hoop. Tie off the remaining two lines at the base of the other two hooks, so that the trap hangs level. This takes some adjusting. With completion of this step, the pull string guide is connected to the trap's top and bottom hoops. If the trap does not hang perfectly level, it should not hamper the trap's operation.

Thread the three counter weight **pull strings** through the small hook eyes in the bottom of the pull string guide, then through the three horizontal eye hooks screwed into the inside center of the top hoop. Next, thread the pull strings through the large, centered, horizontal eye hook, through the fishing rod guide, through the metal eyelet, and out the top of the trap's pull string guide (Figs. 28D, E).

Bring the counterweight pull strings together and tie them off to a size 3, black barrel fishing swivel. The swivel should be tied off about 2.5 inches (6.4 cm) above the top of the pull string guide.

Tie a 6 m length of 40-lb (~18 kg) test monofilament line to the other end of the barrel swivel to create the trap's pull string. Tie the other end of the line to a plastic kite-string winder (hand grip style) for ease of handling. The pull string's length may be adjusted.

Drape the curtain over the top of the trap. Draw the top drawstring snug at the base of the pull-string guide. When the curtain is snug, trim the dowel on both ends to shorten it to 1.5 inches (3.8 cm), and slide it through the "O" ring to hold the curtain in place.

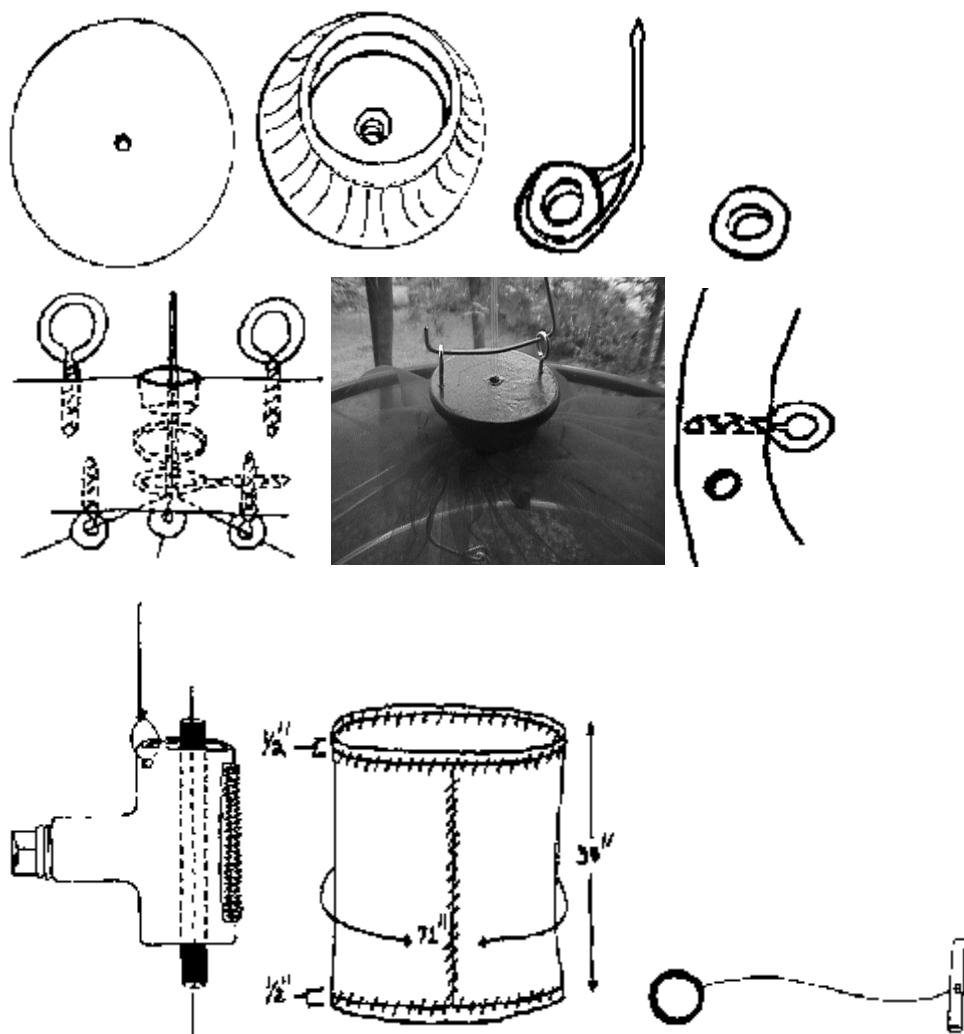
Adjust the curtain down the length of the trap until it hangs naturally. Cut three 8-inch (20.3-cm) lengths of hook-and-loop tape (the side with loops). Where the lowered counter weights match up to the curtain's base, wrap and mold a piece of tape around the curtain's bottom hoop (ice-maker tubing), matching tape ends approximately 4 inches (10.2 cm) up on the netting. Glue the tape vertically to both the inside and the outside of the curtain's wall with Liquid Stitch fabric adhesive. Stitch the ends together through the curtain (Figs. 28L, M). After the curtain's loop tape is connected to the counter weights' loop tape, adjust the curtain's length and raise it with the drawstring (Figure E-N). When the drawstring is released the trap is sprung and the curtain is dropped to capture the hummingbird (Figure E-O).

The **feeder hanger** hangs inside the trap. Bend an 8-inch (20.3-cm) piece of straight clothes hanger into a "C" shape on one end and a "U" shape on the opposite end. Sand the wire's ends to remove any sharp edges. Next, bend the same wire to fashion a gently flowing "C" shape. Hang the wire over the threaded shaft of the horizontal eye hook in the top inside the pole socket. The hook's threads are already covered with clear vinyl tubing so the wire will not damage the threads. Bend a 3-inch (7.6-cm) piece of straight clothes hanger wire into short "U" shaped hooks on both ends. Next, bend one "U" shaped end around the bottom of the "C" shaped hanger (Figure E-P). Sand any sharp edges and cover the short "U" shaped hook, where the feeder will hang, with a length of 0.125-inch (inside diameter) clear vinyl tubing. Hang a hummingbird feeder from the small hook inside the trap.

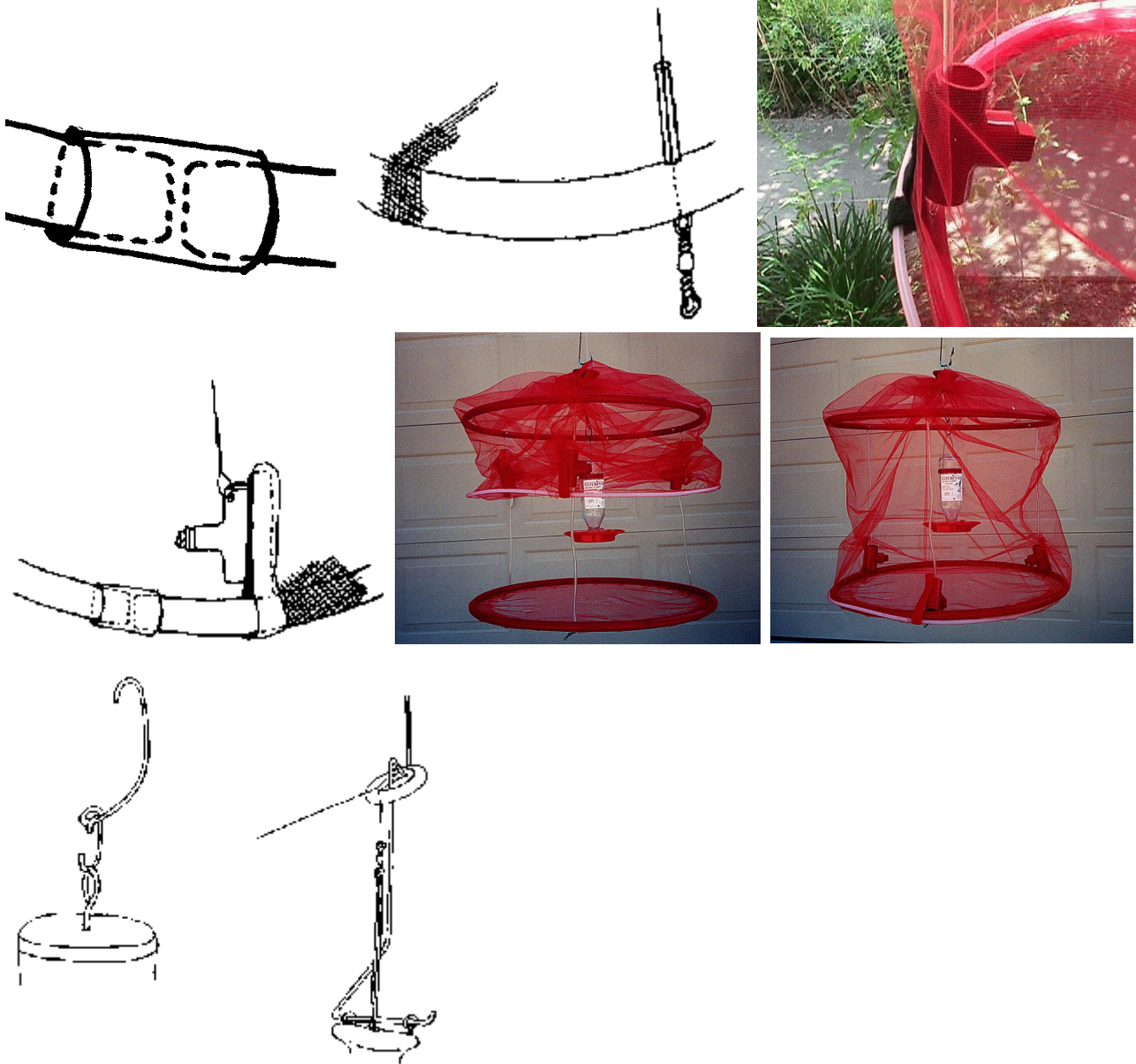
Make a **trap hanger** from clothes hanger wire (Figure E-Q). Bend the wire so that the porcelain awning guide hangs directly above the trap's pull-string guide. Run the trap's pull string through the porcelain guide. Pull the trap's pull string to raise and lower the trap's curtain.

Make **stabilization weights** by tying three 12-inch (30.5-cm) lengths of 40-lb (~18 kg) monofilament line to three size 3, black interlock fishing snap swivels. On the opposite ends tie off three 2-oz (57-g) lead fishing weights. Snap the weights onto the barrel swivels at the base of the uprights to stabilize the trap during windy conditions.

Figure E. The Hall trap: (A) flat top of socket; (B) underside of socket with counter-sunk hole; (C) single-foot rod guide (left) and guide with metal foot cut away (right); (D) pull string guide: exploded side view—large eye hooks on top and small eye hooks on bottom; (E) top of pull string guide; (F) top view of hoop: vertical 0.125-inch hole and horizontal offset eye hook; (G) counterweight with monofilament line and 0.125- tubing vertically upright through center; (H) fabric curtain; (I) draw string threaded through top, sewn-in pocket of curtain (Mike Hall).



The Hall trap (contd.): (J) tubing (0.25-inch (0.1 cm), outside diameter) slipped inside a 1-inch piece of 0.25-inch (inside diameter) tubing connector; (K) vertical upright, line through bottom hoop and tubing, barrel swivel attached below the hoop; (L) curtain with hook and loop fastening tape attached to the counter weight; (M) detail of curtain with hook and loop fastening tape attached to the counter weight; (N) curtain raised; (O) curtain lowered; (P) assembly of the feeder hanger; (Q) pull string through top of pull string guide, then through porcelain awning guide (Mike Hall).



C.4.4 Hall-Taylor variant

The Taylor modification uses the same trap design but the weighted ring does not drop all the way to the trap base/floor. Instead, small black 3" (7.5 cm) plastic tubes are installed on the three vertical wires to stop the weighted ring above the trap base/floor. A mesh net is installed around the weighted ring and secured to it. The circular mesh net is measured to reach the base/floor of the trap when the trap is closed. The purpose of this important modification is to prevent potential injury to a bird unexpectedly leaving or entering the trap as the trap is closed. The Hall-Taylor variant trap functions in the same manner as described below.

C.4.5. Instructions for using the trap

Hang the feeder approximately 1 inch (2.5 cm) above the bottom of the trap. Pull the sides of the trap up about half the distance of the feeder's height. Make certain that the trap's strings are running freely and smoothly. The trap's curtain must run fast to catch hummingbirds.

Start trapping by allowing the bird to sit on the feeder's perch before springing the trap. The trap will require some break-in time. Nevertheless, this trap is fast. Once the trap is broken-in and running smoothly, it should easily catch hummingbirds on the fly, without the necessity for the bird to sit on the feeder's perch.

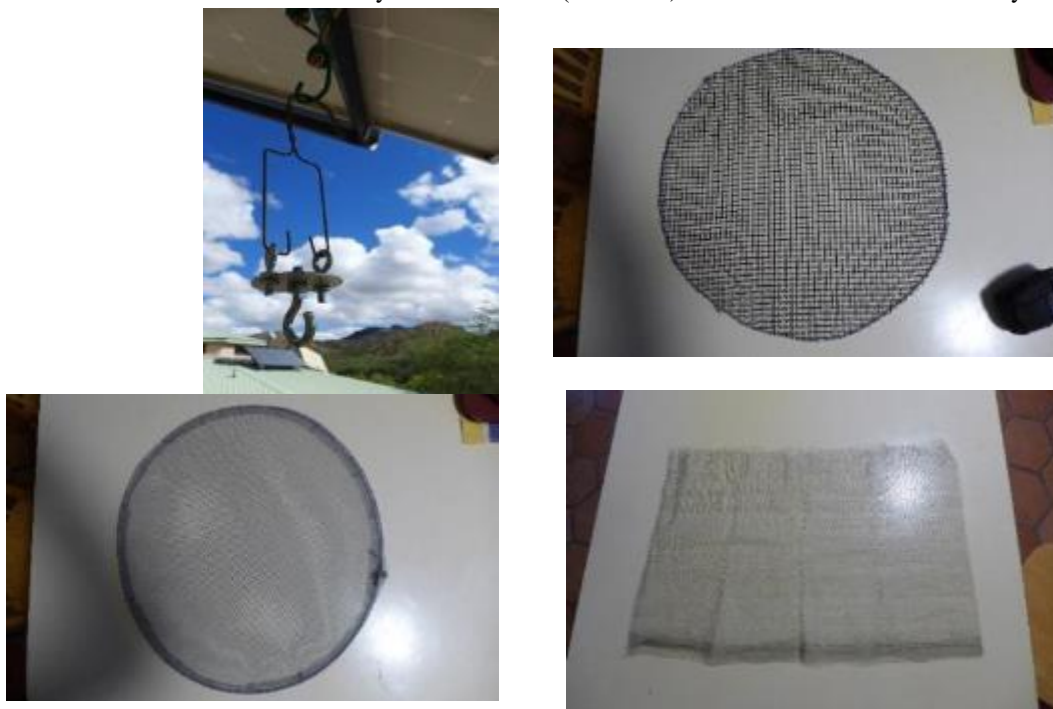
To collapse the trap, remove the hummingbird feeder and allow the trap to flatten down onto itself. **CAUTION:** Heavy wind and hail can shred the trap's fabric.

C.4.6 Rogers variant

The soft sided, drop screen trap is an effective and gentle method of catching hummingbirds that come to feeders. Birds may approach the central hanging feeder from 360 degrees and may come and go unrestricted until the trap is triggered, either manually or remotely. Birds are retrieved by reaching under the curtain and placed into holding bags for transport to the banding table.

The earlier Bonnet and Hall traps inspired many follow on variations and continuous improvements along the way. Important bird safety innovations by Bill Taylor moved the support strings to the outside of the curtain and a mechanism to stop the falling weight before they hit the bottom so a bird could not be injured by the weight.

Put together the four components before assembling a trap. The hanger assembly, the top surface, bottom surface, and curtain. The hanger assembly supports the trap and feeder. The continuous wire of the of type clothes hangers used by dry cleaners to hang pants, with the cardboard tube across the bottom, are perfect for hanging the traps. Use a 1-1/2" or 2" (~5 cm) fender washer for the main support. Drill two holes on either side of the central hole to mount eye-bolts. Mount the third eye-bolt will fit into the central hole. You will need two nuts for each eye-bolt and a 1/2" (~1.25 cm) washer that fits on the center eye-bolt.



Top left – Hanger. Top right – Trap top (Lee Rogers).

Bottom left – Trap bottom. Bottom right – Curtain (Lee Rogers).

The body of the trap is made up of three heavy wire rings. The galvanized wire that is used to strengthen the top of chain-link fencing works well. The wire comes in a coil and available at any hardware store. Cut three lengths of wire 6'2" (185 cm).

Connect each piece into a loop using a #2 Chair lug (available in electrical supply store). This will result in a trap that is about 24" (60 cm) in diameter. One ring is used for the top, one for the bottom, and one will be attached to the curtain as the weight to bring the curtain down quickly.

Attach ½" (1.25 cm) plastic hardware cloth to the perimeter of the top ring with J-clips (available at feed store, used for making rabbit cages). The hardware cloth provides a dark ceiling for the trap and the ½" squares allow any collected bees an escape path. Mark the outside edge of the top ring to divide the circumference into thirds. Set aside top until later.



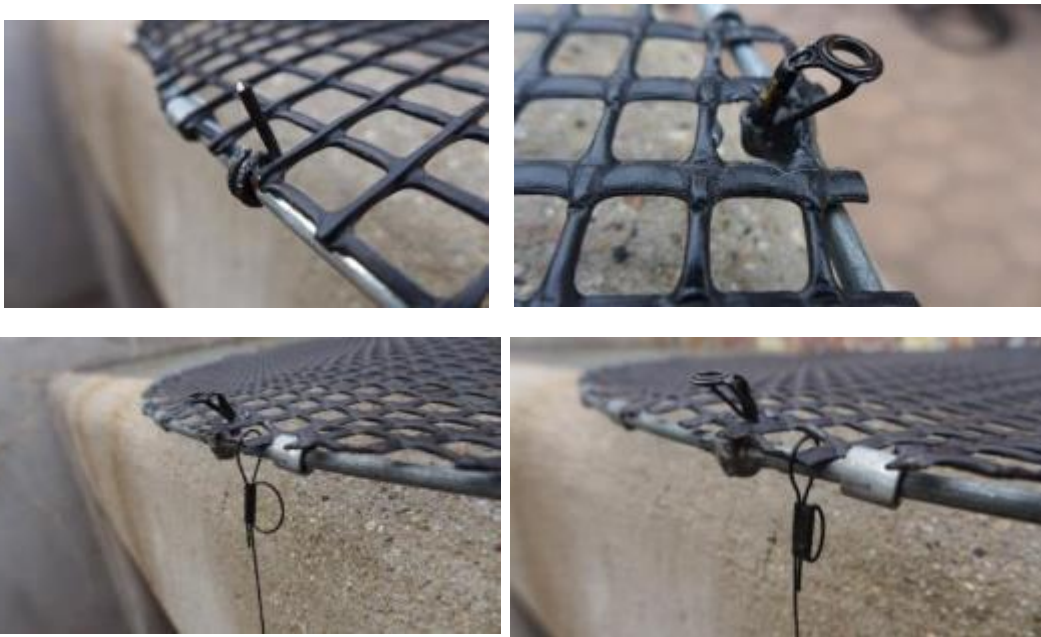
Photo: Lee Rogers

Grey nylon screen door material (any hardware store) makes a good bottom floor. Lay the bottom ring on the screen door material and cut, leaving about 3" (7.5 cm) excess around the ring. Fold bits of the material over to make a series of darts around the base ring. Sew the material using a stretch stitch and trim the excess. Set aside bottom.

Cut a piece of soft nylon mesh material to be 19" x 72" (47.5 x 180 cm). Fold over about 1" (2.5 cm) on long edge and sew a pocket to be used to house a ¼" nylon tube. Sew the two short sides together to create a cylinder. Set aside curtain.

Connect the hanger assembly to the top unit. Locate the balance point of the top unit. It will not be in the exact center because the weight of the chair lug changes the balance point. Take the center eye-bolt and press open the loop to make a hook to hang the feeder on. Thread a nut all the way onto the eye-bolt, insert the eye-bolt into the center hole in the fender washer and through the closest hole to the balance point in the hardware cloth of the top unit. Put on the ½" washer on the eye-bolt and thread the second nut onto the eye-bolt. Install the other two eye-bolts by threading one nut as far as you can onto the eye-bolt. Insert the eye-bolt through the top and through the holes drilled in the fender washer on either side of the center hole. Tighten all nuts and attach wire clothes hanger. Hang up the assembled unit. It should hang pretty level, maybe slightly down on the side that has the chair lug. If the top tilts too much move the hanger assembly to a better position.

Attach three fishing rod tips to the top unit that will eventually house the drop strings. Note the three marks made on the outside edge of the top unit that divide the disk into three parts. Wrap a piece of construction wire (used in concrete work to tie rebar together, found in hardware stores) tightly around the galvanized wire of the top unit at each of the three points and cut so that there is about ½" of wire sticking out. Use JB Weld adhesive to glue the construction wire to the top unit, put extra adhesive around the ½" bit sticking out and slip the fishing rod tip over the wire. Set this aside until the next day to allow the adhesive to cure properly.



Top left – wire post for mounting rod tip. Top right – Rod tip glued in place (Lee Rogers).
Bottom left – Adjustable loop with steel leader. Bottom right – Loop crimped closed and trimmed (Lee Rogers).

Attach the bottom unit to the top assembly using coated steel leader (fishing store, Cabela's, about 30 to 40 lb (~13-18 kg) test). Thread the steel leader through a #5 copper sleeve, around the top galvanized wire about ½" to the right of each rod tip, then back through the sleeve. Loop the leader back through the sleeve to ensure no slippage, adjust the fit and crimp the sleeve flat. Cut each steel leader to be 19 ½" (~49 cm) long.

Lay the bottom unit up against the top unit so that the chare lugs are on opposite sides (for balance). Mark the three spots on the bottom unit that correspond to the attach points of the steel leader at the top. Attach the leader to the bottom points. First thread the leader through a sleeve, into the spot marked on the bottom unit, back through the sleeve, loop around through the sleeve again to prevent slippage. Adjust each support line so that the distance between top unit and bottom is 17". DO NOT crimp the sleeve, leave it adjustable until the end.

Attach the nylon screen. First, loosen the chair lug on the third galvanized ring, cut off about 3" from the length of the wire and reconnect with the chair lug. This will allow the drop ring to fit nicely inside the support wires of the trap when operating. Lay the ring on the bottom unit and check the balance of the trap. Cut a piece of 1/4" refrigerator tubing to fit the circumference of the trap, thread the 1/4" tube through the small pocket sewn into the bottom of the nylon curtain and connect the loop with a 3" piece of 3/8" tubing. Pin the top edge of the curtain evenly around the top unit. Use the drop ring as a weight to hold the bottom of the curtain flat on the bottom of the trap while you are sewing the top edge of the curtain to the top unit of the trap. Use a locking stitch to hand sew the curtain to the top. Be mindful that the curtain stays even and uniform as it is sewn onto the top.

Mark the drop ring at the three points corresponding to the support lines. Attach a second length of steel leader about ½" to the right of each of the three support lines and crimp the sleeves at the top unit. Cut the length of these new leaders to be about 1" below the bottom trap unit. Thread the leader through a sleeve, around the galvanized drop ring, back through the sleeve, and loop back through the sleeve. Adjust the drop ring to be 14 ½" from the top unit. DO NOT crimp the sleeve until after the final adjustments.

Using a lock stitch, sew the drop ring to the curtain. Ensure the tubing in the bottom pocket of the curtain stays flat on the bottom trap unit. Now adjust the length of the leaders holding the drop ring to be 14" long and crimp the sleeves tight. Now adjust the leaders connecting the top to the bottom unit to be 15 ½" separation and crimp sleeves. With this configuration there will be a 1 ½" gap between the weighted drop ring and the bottom of the trap to ensure no bird is pinned by the ring.

Finally, place a 1" plastic ring over the close hanger hook, thread three lengths of braided nylon fishing line through the plastic ring, through the rod tip, and secure to the weighted drop ring. Once secure, tie the three ends of line together to set the length and then attach a swivel to the drop lines using a bowline knot. At this point you can attach a length of fishing line as a manual release or attach a remote trigger mechanism.

This trap is very light and fast but needs some stability to keep it from wiggling around when being operated. You can use a length of heavy plastic tubing filled with lead shot as a weight. Four lengths of 1/8" nylon line with a cord lock on the loop around the weighted ring, for adjusting height, and a small 'A' clip to attached to the trap. A bicycle wheel bag makes a nice trap carrier.



Photos: Lee Rogers

C.5. Collapsible Dawkins/Mesh Netting Trap

C.5.1 Materials list:

1. Two round metal "hoop style tomato cages" available at garden centers or plastic hula-hoops available at Dollar Stores and stores that sell children's toys. The 16-inch diameter works well. Cut one of the stakes that come with them and bend it to form an X in the center of the top of the trap.
2. Two 17" square pieces of 1/4" or 3/8" bird netting to cover the top and bottom of the trap.
3. One 20" X 55" piece of 1/4" or 3/8" bird netting for the side of the trap. This length will overlap about 5" and is used to place the feeder in the trap. Caution, do not use feeders with T perches, they will get hung up in the netting and are very difficult to take out.
4. Four pieces of cord about 14" long.
5. One large hook for hanging trap
6. Two small hooks for each end of the cord used to hang a feeder in the trap.
7. Spool of 20-30 lb (~9-13 kg) Monofilament fishing line or heavy duty thread to lace the netting to the hoops.

C.5.2 Construction:

1. Use a piece of monofilament or thread to lace the 17" square pieces of mesh to top and bottom pieces. It may be easier if you use a couple of clothespins to hold the netting in place as you work with it. Overlap the netting about 1/2" in the middle of the piece to start and lace the monofilament through every 2 or 3 squares of mesh. Keep the line taut as you work your way around the hoop and tie it off securely when completed.
2. When the end pieces are finished it will be much easier to sew the sides to the trap if you attach the top and bottom to a 20" board.
3. Secure one corner of the 20" X 55" netting to the hoop, tying the monofilament line or thread through both parts.

4. Lace the side piece of netting around the top of the trap. It will overlap by about 5". Lace the bottom in the opposite direction, making sure the overlap is the same on the top and bottom. It needs to be perfectly straight so that it does not leave a gap when being used.
5. Tie three lengths of cord about 120 degrees apart to the top of the trap. Attach the cords to the large hook for hanging the trap. Be sure the knots are securely tightened so they will not come loose when being used.
6. Put the two small hooks that will go through the mesh on each end of the remaining piece of cord. Opposite the overlap, cut a small "door". The bottom of the cut should be 4" from the bottom and should be 5" by 3". Cut only the bottom and sides. Bend the cut material up and clip it to form the "door".

C.5.3 Use:

These traps work best if hung away from trapping operations. Hang the trap and insert the feeder through the overlap. Remember, feeders without T style perches are much easier to use. Use the cord with hooks on both ends to hang the feeder inside the trap. Run the cord through the top of the trap at the X and attach it to one of the metal bars. Feeder ports should be at the level of the opening for hummingbirds to find their way into the trap. In use they will normally circle the trap at the port level until they find the opening. When they are frightened they usually go to the top looking for a way out. Birds should be removed through the door rather than the overlap on the side.



Cindy Cartwright photos.

C.6. Mist Net (Russell) Trap

C.6.1. Materials list

- 1 mist net: 6-m length, preferably 24 mm mesh
- 1 piece of mist net. Use a second net or a part of a net, 8-10 ft (about 2.4-3.0 m) long; (~3 m) nets may be available
- 10 poles: 10 poles, each about 5 ft (1.5 m); or four 7-ft (2.13-m) poles and two shorter poles (about 4-5 ft [1.2-1.5 m])
- 4 pole joiners (sleeves): each a 12-inch (30.5-cm) section of copper tubing, slightly crimped in center
- 2 sugar-water feeders
- 2 hooks made of stiff wire, to hold feeders on top of poles
- several 15-cm smooth sticks (plastic swizzle sticks work well)

C.6.2. Tools needed

- Pole pounder or other means of fixing poles in the ground

C.6.3. Instructions

Set up the net with three sides, the back just over 2 m long, and both sides a little less than 2 m long and converging slightly toward the front. Galvanized electrical EMT tubing with 0.5 inch (inside diameter) works well for the supporting poles, but any smooth pole that can be set upright will serve. Cover the top with the second net, running it from one side to the other and fastening it to the lower net in the corners to prevent escapes. Use small smooth sticks about 15 cm long to interlace the two nets at the top to seal openings where birds might escape. The lower edge of the net need not be close to the ground; hummingbirds tend to fly upward when trying to escape. The top should be within comfortable arm's reach of the person who will be removing the

birds. Place two feeders about a meter above the ground on poles inside the trap; one about 0.5 m from the back and the other just inside the entrance.

C.7. Modified Mist Net Trap

C.7.1. Materials and tools

As for Russell trap.

C.7.2. Instructions

Set up the sides as in Mist Net trap, but with the back of the trap facing the hummingbirds' preferred escape direction. Center the second net (roof net) horizontally on top of the other net; a portion of the top net should extend over the trap entrance and drop down about two feet. Place the remaining netting over the back of the trap. This provides a barrier at the top of the front of the trap where hummingbirds will encounter it when they try to exit by flying up. A few birds will fly down and out. The overlap on the back and sides needs to be secured; the top net may be placed over the corner poles.

C.8. Collapsible Netting Trap

C.8.1 Materials list:

8. Two round metal "hoop style tomato cages" available at garden centers. The 16-inch diameter works well. Cut one of the stakes that come with them and bend it to form an X in the center of the top of the trap.
9. Two 17" square pieces of 3/8" bird netting to cover the top and bottom of the trap.
10. One 20" X 55" piece of 3/8" bird netting for the side of the trap. This length will overlap about 5" and is used to place the feeder in the trap. Caution, do not use feeders with T perches, they will get hung up in the netting and are very difficult to take out.
11. Four pieces of cord about 14" long.
12. One large hook for hanging trap
13. Two small hooks for each end of the cord used to hang a feeder in the trap.
14. Spool of 20-30 lb (~9-13 kg) Monofilament fishing line to lace the netting to the hoops.

C.8.2 Construction:

6. Use a piece of monofilament to lace the 17" square pieces of mesh to top and bottom pieces. It may be easier if you use a couple of clothespins to hold the netting in place as you work with it. Overlap the netting about 1/2" in the middle of the piece to start and lace the monofilament through every 2 or 3 squares of mesh. Keep the line taut as you work your way around the hoop and tie it off securely when completed.
7. When the end pieces are finished it will be much easier to sew the sides to the trap if you attach the top and bottom to a 20" board.
8. Secure one corner of the 20" X 55" netting to the hoop, tying the monofilament line through both parts.
9. Lace the side piece of netting around the top of the trap. It will overlap by about 5". Lace the bottom in the opposite direction, making sure the overlap is the same on the top and bottom. It needs to be perfectly straight so that it does not leave a gap when being used.
10. Tie three lengths of cord about 120 degrees apart to the top of the trap. Attach the cords to the large hook for hanging the trap. Be sure the knots are securely tightened so they will not come loose when being used.
11. Put the two small hooks that will go through the mesh on each end of the remaining piece of cord. Opposite the overlap, cut a small "door". The bottom of the cut should be 4" from the bottom and should be 5" by 3". Cut only the bottom and sides. Bend the cut material up and clip it to form the "door".

C.8.3 Use:

Traps work best if hung away from trapping operations. Hang the trap and insert the feeder through the overlap. Remember, feeders without T style perches are much easier to use. Use the cord with hooks on both ends to hang the feeder inside the trap. Run the cord through the top of the trap at the X and attach it to one of the metal bars. Feeder ports should be at the level of the opening for hummingbirds to find their way into the trap. In use they will normally circle the trap at the port level until they find the opening. When they are frightened they usually go to the top looking for a way out. Birds should be removed through the door rather than the overlap on the side.

C.7. Bags, Holding

C.7.1. Materials

- netting
- soft nylon twine
- one cord lock (spring-loaded closure common on jacket drawstrings) for each bag
- bodkin or large safety pin

C.7.2. Directions for sewing net bags

Finished bags are approximately 20 cm wide, 23 cm high. Durable fish net material can be ordered from Nichols Net & Twine Co., Inc., see Appendix B. For one bag, cut a piece of netting about 40 x 25 cm. Along one 40-cm side, fold the edge under 6 mm, and then again 19 mm, as with a hem. Stitch the hem. Fold the short edges together and stitch around the two open unhemmed sides to form a bag. A zigzag stitch lasts longer. Do not stitch across the openings to the hem. Measure and cut a 64-cm piece of nylon twine, sealing the ends with a flame as soon as it is cut. Attach a bodkin or a large safety pin to one end, and work the pin with attached twine through the hem. Thread the two ends of twine through the hole in the closure and tie them in a knot.

Option: to reinforce bottom seam of each bag and easily identify the bags if you use similar bags for larger birds, fold brightly colored seam tape over the bottom seam and sew with a zig-zag stitch.

C.7.3 Holding Bags from Lingerie Wash Bags

Alternately, holding bags may be made by modifying fabric bags known as lingerie wash bags or mesh wash bags; these are sold in department stores. They are made of polyester mesh measuring 5x5 mm, and the wash bags themselves come in different sizes depending on brand, i.e., 11.25 x 15.25 in (29 x 39 cm), 15 x 18 in (38 x 46 cm), 18.5 x 23.5 in (47 x 60 cm), or in the case of the one depicted here 16 x 20 in (40 x 50 cm) which yields six holding bags 6.5 x 6.5 in (16 x 16 cm). Wash bags of the other sizes can be employed using altered dimensions for whatever ultimate bag size one wants.

Referring to figure below, with the wash bag on a flat surface make Cut 1 with sharp scissors, then Cut 2, discarding the top portion of the wash bag with zipper. Then make Cuts 3 and 4.

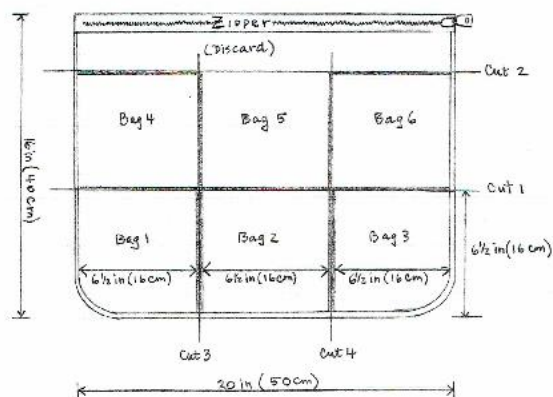
From a 6-ft (183 cm) long piece of ½-in (1.3 cm) wide bias tape (sold in fabric shops) cut 11 pieces 6.5 in (16 cm) long. Starting with Bag 1 which retains its left and bottom sides from the original wash bag, fold the bias tape lengthwise along the right side so that half the tape is on the upper side, half on the lower side and sew using a zig-zag stitch to close the side, leaving open the top of the bag. Bag 2 requires bias tape on its right and left sides leaving open its top, and Bag 3 requires bias tape on its left side leaving open its top.

Bag 4 requires bias tape on its top and bottom sides leaving its right side open as a top. Bag 5 requires bias tape on three sides: left, bottom and right, leaving the top open; and Bag 6 requires bias tape on top and bottom leaving its left side open as a top.

The pull strings on the bags are shoe laces from sport shoes such as tennis shoes measuring 24 or 27 in (61 or 69 cm) in length. Start at one open corner of a bag and thread the shoe lace through every fourth or fifth mesh along the top until the entire top of the bag is threaded, then pass the two ends of the shoe laces through the cord lock tying together the two lace ends in a manner depicted in Figure F.

When necessary after use, the bags may be hand washed in a dishpan with warm water and a drop or two of mild detergent, thoroughly rinsed and dried. One bag may be used as the container for the other five bags.

Figure F. Holding Bag.



C.8. Cages, Holding

Holding cages are suitable for short-term storing of a few hummingbirds awaiting processing. Do not use them unless someone watches them almost constantly to be sure all birds are feeding and in good condition. Usually birds confined in the small cages are not aggressive and all birds are able to feed.

These cages are light-weight wooden frames covered with netting. They should be about 40 to 46 cm on a side. Make the frame of 0.5- x 0.75-inch (1.3- x 1.9-cm) molding (or anything similar). The corners may be cut to fit together and secured by a screw or glue. Use any sort of durable fine transparent mesh cloth (obtainable at outdoor supply or fabric stores), wash with fabric softener, and fit and staple it to the wooden frame. One side must have an opening through which to transfer the hummingbirds. On this side, use two pieces of netting, each piece covering about two-thirds of the side and allowing for overlap in the center. The upper piece should overlap the lower one on the outside and their edges should be hemmed to resist wear. Secure the edges with clothespins when birds are in the cage. Make a small hole in the center of the top and suspend a feeder hung on a dowel placed across the top of the cage. Perches of thin branches can be inserted just prior to use and held in place by the pressure of the net sides. Birds can perch on the branches or cling to the soft net sides.

APPENDIX D. BANDING ASSOCIATIONS AND MEETINGS.

Refer to Appendix A of the Banders' Study Guide for a list of associations and bird observatories. To be informed of various training opportunities as they arise, join a regional banding association, or monitor the "BIRDBAND" listserv group <http://www2004.1soft.se/scripts/wl.exe?SL1=BIRDBAND&H=KSU.EDU>. Once you are a permitted hummingbird bander (Master or sub-permittee, consider joining the "HUMBAND" listserv, specifically for hummingbird banders' to discuss techniques and share ideas. Send a request to join along with your permit number, state/province where you are permitted to band FROM the email address you wish to use to post and receive messages from Humband. Send the request to routledges@bellsouth.net or orsusan.heath888@gmail.com. You will receive an email to confirm your request.

APPENDIX E. LONG-TERM CARE AND REHABILITATION OF HUMMINGBIRDS

Much of this section is for the benefit of avian rehabilitators who have had little experience with hummingbirds. Banders may not hold birds for longer than 24 hours without special permission.

E.1. Injured Birds

In the case of long-term care due to a head injury, add a steroid such as Decadron to the sugar water feeding to keep the brain from swelling and to control shock. Place one small drop of Decadron in a feeder with 3 cc of sugar water twice daily for 2 days. Decrease the dosage by half on days three and four. Do not give Decadron on the fifth day.

If the bird has difficulty perching, restrict its movements. Cut a paper towel into four equal squares. Fold one square twice to form another smaller square, and cut a tiny triangular piece off its inside corner. When opened it is now a square with a small central hole. Place the bird's head through the hole and wrap the paper towel around its body. Secure the wrap with a paper clip, slipped up the back, or a piece of tape. Place the wrapped bird in a tiny cup, such as a small Dixie cup, or very small clay flower pot, so its head sticks up over the top. This confines the bird, helping to reduce stress and energy use. Place a feeder directly in front of the bird slightly below bill level so it has access to food at all times. Change the wrap several times each day as needed.

Wing injuries require care similar to head injuries. Confine the bird to cause no further injury. A broken wing can heal, depending on the severity and location, but requires at least 7 days and as many as 10 days without movement. After the wing has healed, place the bird in a cage about 30 cm square with plenty of perches so it can slowly regain strength. When it is healthy, move it to a cage about 60 x 90 x 60 cm or greater, until it is strong and flying well. Be aware that birds with wing injuries are difficult to rehabilitate and rarely survive.

A hummingbird cannot survive for long on sugar water alone. You must add protein if you keep it for more than a few days. For short-term, quick protein, you can dissolve dried tubifex worms (available at aquarium supply stores) in sugar water at the rate of one cube of worms to one cup sugar water. For birds held long term, protein in the form of fruit flies (*Drosophila*), is easily raised by putting a banana peel in a small open-mouthed jar. Place the jar in front of the hummingbird, and it will catch the insects as they hatch and fly. You can buy a fruit fly growing kit for minimal cost (see Appendix B. Foods, special). Nektar Plus, from the Nekton company (see Appendix B. Foods, special), is an expensive, but quality, proven, long-term food. It contains all the nutrients hummingbirds need. Feed six parts water to one part powder for birds in rehabilitation, and still add fruit flies to their diet.

E.2. Long-term Care

At the Arizona-Sonora Desert Museum in Tucson, Arizona, captive hummingbirds are healthy and long-lived. They have three sources of food; the primary source is Nektar-Plus, a commercial food composed of carbohydrates, protein, fats, vitamins, minerals, and trace elements. They also have a variety of nectar-rich plants, and an ample supply of *Drosophila*. During molting and nesting, the birds require increasing numbers of the latter.

In addition to the required foods, hummingbirds housed outdoors need bushes and trees for secure roost areas. They should have sufficient shade in the summer, and cover and warmth in the winter. A heat lamp may be used to provide warmth, but the birds must have the choice of sitting in front of the lamp or not. In harsh climates hummingbirds should not be housed outdoors in winter. They bathe regularly and should be given daily opportunities to do so. Hose vegetation lightly or use a spray bottle. Some birds will bathe on the wet leaves of the vegetation, but others will let you gently spray them with the bottle. The bathing helps keep feathers conditioned. All holding areas, indoors or outside, should allow ample flying space. If housing more than one bird, provide ample room as they may be aggressive and perhaps territorial. Females get along together better than males. Always provide more feeders than birds; a good rule of thumb is two feeders per bird. Watch for any problems among the birds; a bird being chased by others and not being allowed to feed can perish quickly. If you see such behavior, remove the harassed bird. Captive hummingbirds provided with their basic needs should do well, but be aware of possible aggression if two or more birds are housed together. Do not assume they will get along well together; they need the opportunity to set up territories. Your good observation skills will help avoid problems.

APPENDIX F. SKILLS AND KNOWLEDGE EXPECTED OF HUMMINGBIRD BANDERS

Following is a checklist of the skills and knowledge you should have before requesting a permit to band hummingbirds. It is based upon The Bander's Report Card in the Banders' Study Guide and has been amended to include categories unique to hummingbirds. Because hummingbird banders must be familiar with the handling and care of birds other than hummingbirds that may enter their traps or nets, the checklist includes skills that apply to other birds also.

Not all categories need to be checked (initialed) for a banding permit. Some categories are fundamental, however, and need to be assessed for all prospective banders. These are identified by an asterisk. Items with double asterisks are essential elements for prospective Master Permittees.

BACKGROUND MATERIAL

- * Understand the ethics of banding birds
- * Understand how banding fits into scientific studies

CHECKLIST OF PRACTICAL SKILLS

PROCESSING

Identification and handling

- * Recognize all target species. Know the circumstances under which a bird should be released unbanded. Know how to report hybrids.
- * Appreciate the importance of minimizing handling time while not compromising safety
- * Use the bander's grip on a variety of species
- * Use the photographer's grip safely
- * Use the "Finger-tip Holds" safely
- * Transfer a bird from hand to hand safely
- * Handle a variety of awkward species
- * Release a variety of species correctly
- * Effectively deal with escaped birds in an enclosed space
- * Remove hummingbirds from traps (and nets, if used) without jeopardizing their safety
- * Handle and transfer hummingbirds correctly
- * Identify which grips are not acceptable for hummingbirds and rationale.
- * Identify concerns associated with banders' grip and hummingbirds
- * Use the fingertip grip safely

Banding

- * Strip and prepare bands of the correct sizes
- * Make bands without sharp edges and abut them squarely
- * Place bands on hummingbirds without trauma to them
- * Close bands properly
- * Process birds within reasonable time after capture, to reduce stress
- * Read band numbers correctly
- * Recognize when and how to correct an improperly applied band
- * Know when and how to remove a band safely

Holding and carrying birds

- * Use the appropriate method to temporarily hold hummingbirds
- * Place birds in bags and carry and hang them correctly
- * Recommend when bags or boxes need cleaning

Field data collection

- * Record data clearly, legibly, and accurately on field sheets or in computer data base
- * Recognize and document rarities or unusual birds
- * Maintain complete and accurate daily logs

Biometrics

- * Use and accurately read measuring devices (rules, balances, calipers, dividers)
- * Understand how to correctly calibrate measuring devices
- * Correctly, consistently, and accurately measure various anatomical features
- * Assess simple wing formulae
- * Assess and record molt accurately on a molt card
- * Accurately score fat deposits

Ageing and sexing

- * Correctly use guides for ageing and sexing immature hummingbirds
- * Correctly use other characteristics for age determination
- * Understand and assign correct age codes

SPECIAL AUTHORIZATION FOR MIST NETTING

Erecting, opening, and closing nets

- * Choose an appropriate netting or trapping site and appropriate net
- * Correctly set up nets unaided, including traps utilizing nets
- * Furl and unfurl nets properly
- * Take in and store nets and associated equipment properly

Operation and extraction

- * Judge how many nets to use safely and check them frequently and carefully
- * Demonstrate an astute, accommodating approach to extraction

- * Extract hummingbirds (and any other birds captured) quickly and safely
- Deal proficiently with tricky situations
- Recognize and maintain nets that are in poor condition

TRAPS

- * Know a range of traps and their target species
- * Operate traps properly and safely
- * Identify and understand the concerns & cautions associated with each type of trap

ETHICS AND INJURIES

- * Know and practice the Bander's Code of Ethics
- * Show excellent awareness of injury and shock prevention
- * Show familiarity with shock and the most common injuries and their causes
- * Demonstrate ability to treat minor injuries and shock
- * Recognize the necessity for euthanasia, and be able to demonstrate appropriately
- * Assess whether a specimen is worth preserving
- * Record details of any injury or casualty
- * Demonstrate appropriate techniques for feeding hummingbirds held in the hand
- * Recognize signs of stress and promptly treat them

HEALTH AND SAFETY OF BANDERS

- * Demonstrate a responsible attitude towards potential injuries from birds
- * Demonstrate a responsible attitude towards physical hazards in the banding area

DATA MANAGEMENT

- ** Proof and correct banding sheets
- ** Complete data submissions via Bandit® properly without assistance
- ** Handle other paperwork correctly and promptly

PUBLIC RELATIONS

- * Communicate effectively with the public about banding
- * Communicate effectively using banding data (reports, articles etc.)

OTHER SPECIAL AUTHORIZATIONS

Demonstrate proficiency in any special authorizations (specify):

FINAL ASSESSMENT

- * Ethics
- * Processing
- * Special Authorization for Mist Netting
- * Traps
- * Injuries to Birds
- * Health and Safety of Banders
- * Record Keeping
- * Public Relations

APPENDIX G. AN INSTRUCTOR'S GUIDE TO TRAINING HUMMINGBIRD BANDERS

To collect accurate and reproducible banding data, properly trained people versed in correct and acceptable banding techniques are needed. This assures quality data and also that the birds receive proper and respectful care they rightly deserve during the banding process. See the NABC's *The Instructor's Guide to Training Passerine Bird Banders in North America* for general guidelines.

G.1. Training and Conditions Needed for Training Sessions

G.1.1. Trainers

Trainers should be hummingbird banders with an in-depth knowledge of hummingbird banding and sufficient experience to be adept at handling the birds and skilled in the techniques used to band them. They also must have an outgoing presence, with an ability to teach, explain, answer questions, and be able to give honest feedback to trainees on how well they are doing.

G.1.2. Duration of training

The duration depends on the capabilities of trainees; their individual time commitments, and the availability of adequate numbers of birds. Training may take anywhere from a few days to several months or even years, depending on the specific situation.

G.1.3. Location of training site

The site should assure enough hummingbirds for trainees to handle an adequate number to be decided on by the trainers. This number should be adequate to allow the trainee to handle the minimum number of hummingbirds designated by the BBO/BBL and any additional numbers deemed appropriate by the trainers.

G.2. Who Should be Accepted and Requirements Needed for Trainee

Anyone who wishes to band hummingbirds should have no physical limitations that might prevent their careful handling, as the birds' welfare must always be the primary concern. Good closeup vision is necessary. If you cannot see tiny, 3 gram birds clearly using glasses or a magnifying visor, you should not handle them because you could injure them. You also need infinite patience, steady hands, and manual dexterity.

Training and experience banding passerines provides a basic understanding of data collection, holding birds in hand and in cages, using mist nets, handling stressed birds, and how to avoid stressing them. Although none of these is an absolute prerequisite, they provide experience and may increase the probability of your becoming a successful hummingbird bander.

G.3. Steps in How to Train

G.3.1. Observation of banding

Trainees should first observe hummingbird banding for a specified period of time. You need to see more than just someone holding and talking about hummingbirds, perhaps a whole morning of a busy banding session. The trainer should assess the visual ability and manual dexterity of a potential trainee before proceeding.

G.3.2. Holding birds; instructions for extracting birds from traps and nets

Trainees should first become comfortable holding hummingbirds. Several ways of holding should be explained, and careful instruction given on how to remove all birds from mist nets and traps. How bands are formed and readied for use needs to be explained in detail.

G.3.3. Background information

Include brief background information on hummingbird life cycle, molt, breeding, etc. Explain data sheet and information collection. Trainee to start recording data.

G.3.4. Initial tasks

Since learning to band one bird from start to finish takes a long time, and probably would be too stressful for individual hummingbirds, trainees could do a few steps and the trainer finish the bird reasonably quickly. Gradually the number of banding steps the trainees undertake should be increased until they have completed the whole procedure.

G.3.5. Assess trainee's capabilities

The trainer must continually check on the trainee's capabilities, then either give an organized mid-session assessment or personally discuss how well the trainee is doing. Remember that the trainee may never have held a bird previously and is probably very nervous. Praise when something is well done, then any later criticism will be accepted more readily.

G.3.6. Trainer's judgment

At the beginning, the trainees should be told that if, at any time during training, the trainer finds them to be ill-suited to band hummingbirds, they will be informed that they will need to make serious changes or be disqualified.

An example training process by a Trainer

1. Trainee watches throughout process and listens to explanations
2. Trainer completely process birds and trainee practices various grips before releasing. Also discuss signs of stress at same time.
3. Trainer completely process then trainee starts practicing various measurements. Bird is released after reasonable time and trainee practices on another bird. This continues until the trainee can complete all the measurements satisfactorily.
4. Once trainee is obtaining accurate measurements (within 1 mm) consistently, and they can complete all measurements in less than 3 minutes, the Trainer bands and the trainee processes (occasionally Trainer will take a bird when they are done and recheck their measurements to ensure they are remaining accurate)
5. Trainee starts applying bands and processing – Trainer double check bands for fit/good closure and if trainee takes too long, Trainer will finish processing to speed bird's release
6. Eventually Trainee is doing everything with verbal encouragement and supervision. Trainer will still take birds from time to time to double check measurements for accuracy and check bands for fit/closure.

G.3.7. Written test and evaluation

A written test and a practical may be given at the end of the training session, and perhaps a final assessment in case areas need improvement. The knowledge/skill requirements for a hummingbird bander must include the ability to properly produce bands that

can be safely used on the birds. Hence, hummingbird banders must be able to demonstrate the ability to make bands before the BBL will add hummingbird authorization to a banding permit.

APPENDIX H. A KEY TO WESTERN HUMMINGBIRDS

H.1. A Key to Female and Hatching-year Western Hummingbirds

This key is designed to facilitate the identification of adult female and hatching-year hummingbirds in the western United States. It is untested and your comments will be appreciated. Adult male hummingbirds, characterized by a full gorget of iridescent feathers (and/or sometimes an iridescent crown) are not included and should be identified from a field guide. Refer to Pyle (1997) to age and sex females and juveniles of Blue-throated, Magnificent, and Lucifer hummingbirds.

The abbreviation “p” is used for primary and “r” is used for rectrix. Therefore, p10 refers to the outermost primary and r1 refers to the inner (central) tail feather. First determine if bill corrugations (Fig. 20 below, and Fig. 36, section 8) are present, then measure the wing chord (Fig. 32, section 8), tail (Fig. 33 section 8), exposed culmen (Fig. 19 below, and Fig. 34 and 35, section 8), and the width of r5 (Fig. 29, below). The wing chord is the length to nearest millimeter (mm) of the unflattened wing from the anterior edge of the wrist (bend) to the tip of p10 (the longest). If p10 is molting or missing, this measurement is worthless. Measure the tail to the nearest millimeter, from the skin between the two central rectrices to the tip of the longest rectrix. If r5 is missing, the tail measurement will not be useful. Using calipers, measure the top of the culmen to the nearest 0.1 mm, from the tip of the bill to the edge of the feathers. Additionally, on some birds you also must measure (to nearest millimeter) the white at the tip of r3; measure the extent of white along the rachis (length; Fig. 30, below) and the maximum width of the white (Fig. 31, below). When the key calls for an “area” measurement, this is the length times the width of the white in r3. Measurements of very worn feathers may be misleading and not useful in the key. “Grooves” as used in this key refer to bill corrugations or corrugations, but ignore any in the nostril area. The key does not attempt to identify SY hummingbirds because the methods are relatively untested.

Not every bird will “key out” satisfactorily to species, age, and sex. When a bird does not match the key, you may need to make decisions based on several characters and ignore the mismatched character. Consult references, especially Baltosser (1987), Pyle (1997), and Stiles (1972); Table 2, page 135 in Pyle may be helpful. Rarely, perhaps in fewer than 1% of immature or adult female birds, you will not be able to identify the species; report those in doubt as UNHU, Species code 4409, or do not band them. If more than 1% of the immature birds and adult females that you encounter cannot be identified, you should reassess your identification skills.

1a. Bird has complete iridescent gorget and/or crown, and no grooves. The bird is an AHY male, unless it is an adult Violet-crowned Hummingbird in which the sexes are indistinguishable. Use a field guide to identify adult males.

1b. Gorget or crown not completely iridescent. Females or HY.....2

2a. Wing >68 mm; tail >41 mm.....3

2b. Wing <68 mm; tail <41 mm.....4

3a. Forehead feathers do not cover nares. Culmen usually <24.3 mm.

Blue-throated BLUH. See Pyle (1997) for age, sex characters.

3b. Forehead feathers cover nares. Culmen >24.3 mm.

Magnificent MAHU. See Pyle (1997) for age, sex characters.

4a. Outer web of p1-p6 narrower than p7-p10 (“primaries unequal;” Fig. 22).

Archilochus.....5

4b. Outer web of p1-p6 approximately equal in width to p7-p10 (Fig. 23).8

5a. Width of inner web of p10 (measured at point on rachis 5 mm from its tip) <2.5 mm (Figs. 30 and 31, below). This may be a **Ruby-throated RTHU**, a species rarely recorded in the west. If you are in the west and think that you may have a RTHU, check both Baltosser (1987) and Pyle (1997) carefully. Photograph the bird, including closeups of the tips of the primaries (Fig. 36).

5b. Width of inner web of p10 within 5 mm of tip >3.0 mm.

Black-chinned BCHU......6

6a. Bill smooth. Tip of r5 similar to Figure 25A.

AHY Female Black-chinned BCHU.

6b. Grooves present on sides of bill.7

7a. Tip of r5 pointed and/or emarginate (Fig. 25A or B), and tip of p6 pointed (Fig. 24). Little white at tip of r3 (length times

- width <10; (Figs. 28, 29).
HY Male Black-chinned BCHU.
- 7b.** Tip of r5 rounded (Fig. 25C) and tip of p6 rounded, not emarginate (Fig. 24). Considerable white at tip of r3 (length times width >10).
HY Female Black-chinned BCHU.
- 8a.** Bill decurved, without red; culmen >½ wing length.
Lucifer LUHU. See Pyle (1997) to sex and age.
- 8b.** Bill straight, black, or with red; culmen <½ wing length.....**9**
- 9a.** Bill red or reddish at base; culmen >18.5 mm.
Broad-billed BBLH.....**10**
 Note: White-eared improbable, but if culmen <18.5, refer to Pyle (1997).
- 9b.** Bill without red.**12**
- 10a.** Bill smooth. No iridescent blue gorget feathers. r5 usually with much white (Fig. 32).
AHY Female Broad-billed BBLH until 20 August; later, designate them age **U Female BBLH**. Many BBLH (of both sexes) complete the prebasic molt before they migrate, contrary to Pyle (1997), and have lost bill grooves by the end of August. Pyle suggests that if the red of lower mandible blends gradually into the dark tip (instead of having a sharp break between red and black), it is probably HY. This character has not been adequately tested. No known AHY females in Arizona have had any blue in the gorget.
- 10b.** Bill with grooves; with or without some iridescent blue feathers in gorget; r5 with little or no white.**11**
- 11a.** Iridescent blue feathers in gorget; tip of r5 usually with small amount of white, as in Figure 32.
HY Male Broad-billed BBLH Smooth-billed birds with incomplete blue gorgets are **HY Male**. The significance of the amount of white in the tip of r5 is undetermined, contrary to Pyle (1997).
- 11b.** No blue feathers in gorget and tip of r5 usually with considerable white at tip (Fig. 32).
- HY Female Broad-billed BBLH**
- 12a.** Tiny: culmen <16.5 mm, wing <44 mm; no rufous dorsally (but there may be rufous in the tail), r1 is expanded near the tip (spatulate; Fig. 33) and dusky or black at tip.
Calliope CAHU **13**
- 12b.** Not tiny as in 12a, and without spatulate r1; r1 may or may not be black or dusky at tip.**15**
- 13a.** Culmen without grooves. Head and neck feathers not tinged buffy. Rufous may or may not be present in rectrices. A few or no small iridescent rose feathers may be present in gorget.
AHY Female Calliope CAHU
- 13b.** Culmen with grooves, head and neck feathers tinged with buffy.**14**
- 14a.** Some rufous present along edges of r1.
HY Male Calliope CAHU
- 14b.** No rufous in r1.
HY Female Calliope CAHU
- 15a.** Without rufous in tail.
Calypte.....**16**
- 15b.** Rufous in tail
Selasphorus.....**21**
- 16a.** Width of r5 <4.3 mm, wing <46.2 mm.
 Costa's**17**
- 16b.** Width of r5 >4.3 mm, wing >46.5 mm.
 Anna's**19**
- 17a.** Bill smooth. Occasionally a few small iridescent purple feathers in throat.
AHY Female Costa's COHU**18**
- 17b.** Bill with grooves. **HY COHU**.....**18**
- 18a.** Black of r5 does not extend as a point into white at tip (Fig. 26). Area (length times width) (Figs. 30, 31) of white in r3 >10.

HY Female Costa's COHU	
18b. Black of r5 extends as a point into white at tip (Fig. 26). Area (length times width) of white at tip of r3 <8. There may be several purple feathers in gorget, often including ones on the sides (the "ears" of the gorget).	
HY Male Costa's COHU	
19a. Bill smooth; usually 10-20 iridescent red feathers in center of grayish green throat. Occasionally a few reddish feathers in crown.	
AHY Female Anna's ANHU	
Caution: If there are few red feathers in throat, the bird could be HY F . In southern Arizona, ANHU begin to nest in late autumn, thus young birds may have lost their grooves by summer. See Baltosser (1987) and Pyle (1997).	
19b. Bill with grooves.	
HY Anna's ANHU	20
20a. Black of r5 does not extend as a point into white at tip (Fig. 26). There may be a few (up to 5) pinkish red feathers in the gorget.	
HY Female Anna's ANHU	
20b. Black of r5 extends as a point into white at tip (Fig. 26). There may be several pinkish red feathers in the gorget or gorget and crown.	
HY Male Anna's ANHU	
Note: Anna's begin to nest in late autumn in southern Arizona. Young males that are 6-7 months old may have lost their bill grooves and perhaps even molted their rectrices (the tip of r5 will be all black). But these young males lack a complete gorget and the crown will be incompletely red. Identify these individuals as age HY or U ; identifying birds as SY is questionable.	
21a. Wing >46.3 mm	
Broad-tailed	22
21b. Wing <46.6 mm	
Rufous or Allen's	24
Note: If wing >46.3 and <46.6 mm, see Stiles (1972) or Pyle (1997); the bird could be a Broad-tailed or Rufous.	
22a. Culmen without grooves; width of r5 4.3-5.4 mm. Usually no, a few or many magenta-reddish feathers in gorget. r1 is green, usually without dark tip and without rufous on sides near base. NOTE: some banders have documented AHY/F BTLH with as many as 18 small magenta gorget feathers	
AHY Female Broad-tailed BTLH	
22b. Culmen with grooves; width of r5 <4.3 mm. A few adult male-type feathers may or may not be present in gorget. r1 may or may not have some rufous, white tip of r3 is small and somewhat pointed	23
23a. p10 narrow and curved (Figs. 34A, B); no, or only a few, iridescent adult male-type magenta gorget feathers; r1 green without a black tip and with some rufous on sides at base, r3 white tip small, narrower than that of HY/F (<~ 3 mm and somewhat pointed).	
HY Male Broad-tailed BTLH	
23b. p10 rather broad, blunt (Figs. 34C, D); no reddish feathers in gorget; r1 without black tip (although margins near tip may have darker sheen than rest of feather). The edges of the base of r1 do not appear rufous; r2 may have no rufous or only a trace on basal edges, sometimes with a small white tip, wider than that of HY/M (>~ 4 mm) and somewhat rounded.	
HY Female Broad-tailed BTLH	
24a. Proximal portion of r1 mostly rufous (Fig. 35).	25
24b. Proximal portion of r1 with little (<45%) or no rufous.	27
25a. Culmen with grooves.	
HY Male Rufous or Allen's	26
25b. Culmen without grooves. AHY F Rufous or Allen's (few individuals will fit into this category)	28
26a. Width of r5 <2.7 mm. r2 not emarginated or only slightly emarginated.	
HY Male Allen's ALHU	
26b. Width of r5 >2.6 mm. r2 slightly or moderately emarginated.	
HY Male Rufous RUHU	
27a. Culmen with grooves.	
HY Female Allen's or Rufous	28
27b. Culmen without grooves, scattered red gorget feathers.	

- 28a.** Width of r5 <3.3 mm, width of r1 <7.8 mm. r2 not emarginated or only slightly emarginated.
HY Female Allen's ALHU
- 28b.** Width of r5 >3.3 mm, width of r1 >8.2 mm. r2 slightly or moderately emarginated; very few (1-2) or 0 red gorget feathers on a light throat
HY Female Rufous RUHU
- 29a.** Width of r5 <2.8 mm; width of r1 <7.6 mm. r2 not emarginated or only slightly emarginated.
AHY Female Allen's ALHU
- 29b.** Width of r5 >2.7 mm, width of r1 >7.7 mm. r2 slightly or moderately emarginated.
AHY Female Rufous RUHU

Users of this key may find the following references useful.

- Baltosser, W.H. 1987.** Age, species, and sex determination of four North American hummingbirds. *N. Amer. Bird Bander* 12:151-166.
- Baltosser, W.H. 1994.** Age and sex determination in the Calliope Hummingbird. *Western Birds* 25:104-109.
- McKenzie, P.M. and M.B. Robbins. 1999.** Identification of adult male Rufous and Allen's hummingbirds, with specific comments on dorsal coloration. *Western Birds* 30:86-93.
- Pyle, P. 1997.** *Identification Guide to North American Passerines*. Part I. Slate Creek Press, Bolinas, CA.
- Pyle, P., S.G. Howell, and G.M. Yanega. 1997.** Molt, retained flight feathers and age in North American hummingbirds. *In*: R. W. Dickerman, compiler. *The era of Allan R. Phillips: a Festschrift*. Albuquerque, NM.
- Stiles, F. G. 1972.** Age and sex determination in Rufous and Allen hummingbirds. *Condor* 74:25-32.
- Yanega, G.M., P. Pyle, and G.R. Geupel. 1997.** The timing and reliability of bill corrugations for ageing hummingbirds. *Western Birds* 28:13-18.

Figure 19. Measuring the exposed culmen. The recommended method: the "over and under" technique using the smaller set of "jaws". This technique avoids touching the tip of the beak and any tongue that may be sticking out the bill tip (photo Lee Rogers).

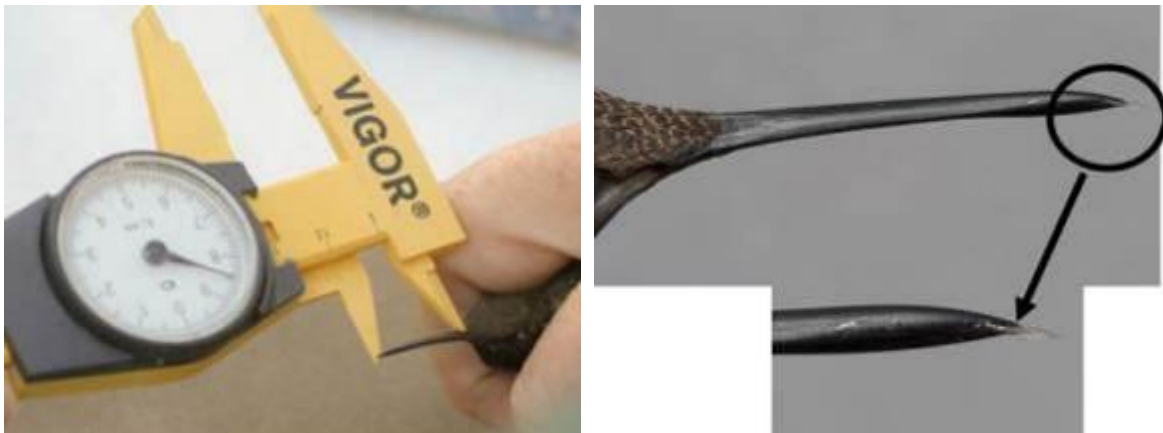


Figure 20. (A) Corrugations on the bill of a very young hummingbird. (B) Corrugations at the base of the culmen of an adult hummingbird; these markings are not useful in determining the age of the bird.

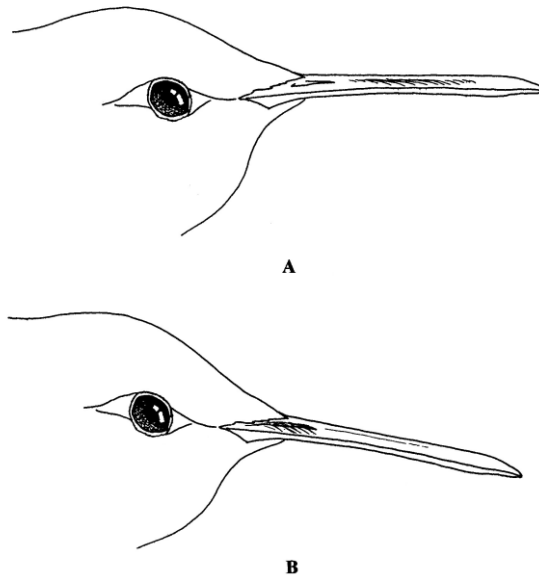


Figure 22. Outer web of inner primaries (p1-6) narrower than that of outer primaries (p7-10). *Archilochus*.

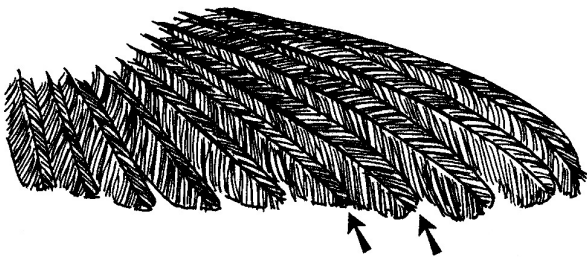


Figure 23. Outer web of all primaries approximately equal in width. *Calypte*.



Figure 24. Variation in the tip of p6 in *A. alexandri*.

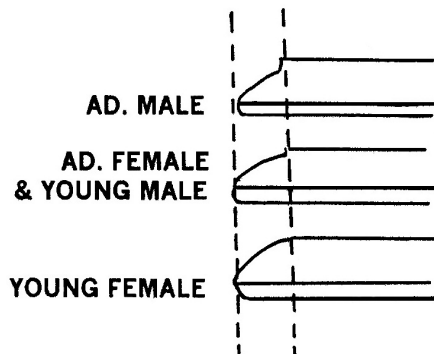


Figure 25. Shape of r5 in *Archilochus alexandri*. (A, B) tip is pointed and/or emarginated in adult female and young male; (C) tip is rounded and not emarginated in young female.

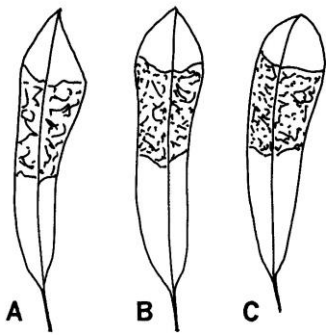


Figure 26. Variation in the pattern of white at the tip of r5 in *Calypte* females and young males (from Pyle 1997).

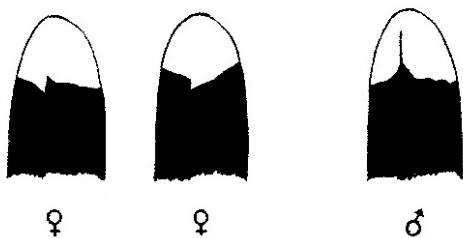


Figure 27. Maximum width of r5 (after Baltosser 1987) - measurement is taken with calipers at the widest part of the distal feather.



Figure 28. Length of white in r3, measured along the rachis (after Baltosser 1987).

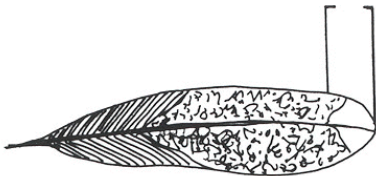


Figure 29. Maximum width of white at tip of r3 (after Baltosser 1987).

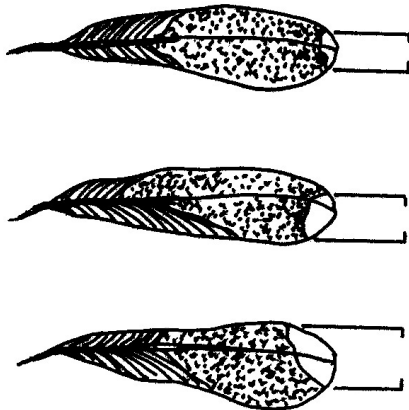


Figure 30. Measurement of width of inner web of p10. Maximum width of inner web of 10th primary (arrows) within 5 mm of tip, as measured along rachis (after Baltosser 1987).

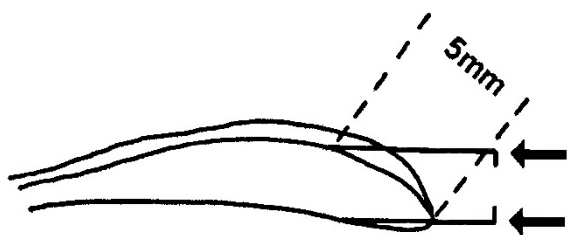


Figure 31. Shape of p10 in (A) *Archilochus alexandri* and (B) *A. colubris* (after Baltosser 1987).

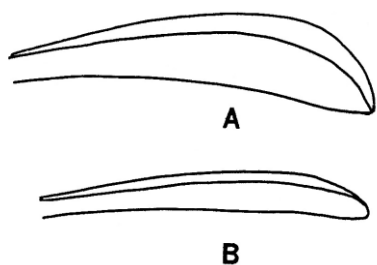


Figure 32. The amount of white in r5 in Broad-billed Hummingbirds, by age and sex (from Pyle 1997).

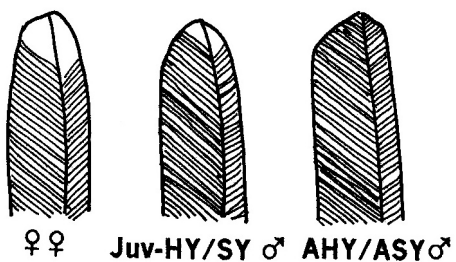


Figure 33. Diagnostic size and shape of r1 in the Calliope Hummingbird (sexes similar) compared to the size and shape of r1 in

other, potentially confusing, hummingbird species (females only). (A) Ruby-throated (*Archilochus colubris*); (B) Black-chinned (*A. alexandri*); (C) Anna's (*Calypte anna*); (D) Costa's (*C. costae*); (E) Calliope (*Stellula calliope*); (F) Bumblebee (*Atthis heloisa*); (G) Broad-tailed (*Selasphorus platycercus*); and (H) Rufous (*S. rufus*) and Allen's (*S. sasin*) (from Baltosser 1994).

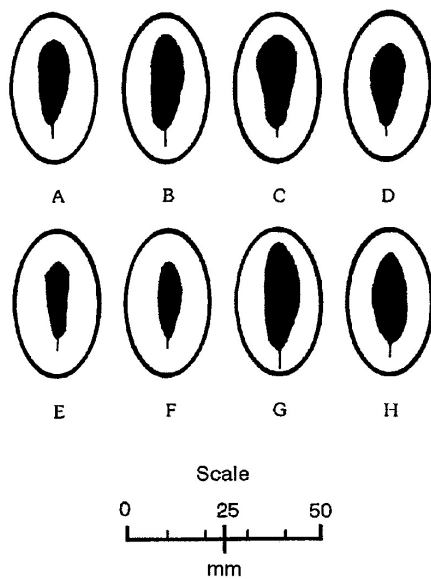


Figure 34. Variation in the width and shape of outer primary in Broad-tailed Hummingbirds. A and B are typical of HY males; C and D are typical of HY females (from Pyle 1997).

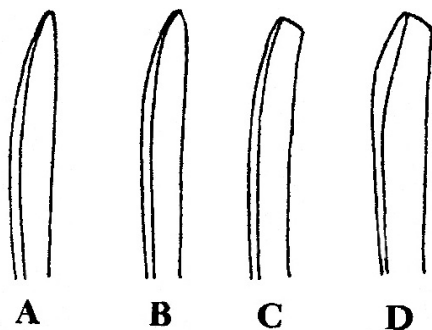


Figure 35. Shape and pattern of r1 in female and young Rufous and Allen's hummingbirds. The light stippling indicates rufous coloration and the dark stippling indicates green (from Pyle 1997).

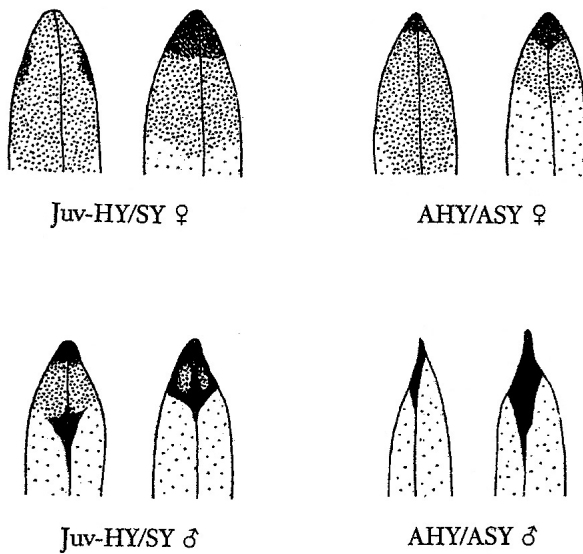
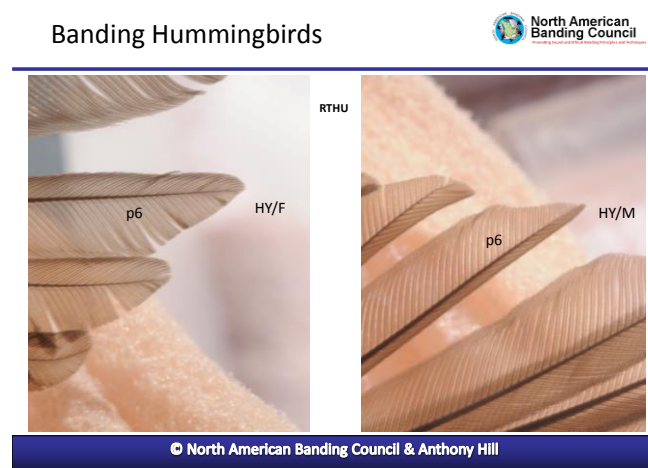


Figure. 36. Comparison of p6 in immature male and female RTHU



APPENDIX I. THE NORTH AMERICAN BANDING COUNCIL

The North American Banding Council (NABC), incorporated in 1998, is a nonprofit group encompassing bird research organizations whose members use bird banding as a tool in ornithological research, conservation, and management (www.facebook.com/NorthAmericanBandingCouncil). The mission of the NABC is to promote sound and ethical bird-banding practices and techniques. To accomplish this, the NABC has developed educational and training materials, including manuals on general banding techniques as well as technique manuals for specialized taxonomic groups accompanied by a three-level certification process (Assistant, Bander, and Trainer). Skill levels of banders will be increased by the preparation and dissemination of standardized training and study materials and the establishment of standards of competence and ethics for banders and trainers.

The immediate objectives are:

- (1) to develop a certification and evaluation program by setting standards for experience, knowledge, and skills that must be attained at each level (Assistant, Bander, and Trainer);
- (2) to produce and update training materials such as manuals and videos;
- (3) to identify and certify an initial pool of trainers; and
- (4) to encourage cooperative efforts in the use of banding in the study and conservation of North American birds.

The NABC consists of 18 to 20 voting members, including one representative that can be appointed by each of the following organizations: American Ornithologists' Society, Association of Field Ornithologists, Colonial Waterbird Society, Eastern Bird Banding Association, Inland Bird Banding Association, Ontario Bird Banding Association, The Pacific Seabird Group, Raptor Research Foundation, Society of Canadian Ornithologists, Western Bird Banding Association, Western Hemisphere Shorebird Reserve Network, and Wilson Ornithological Society; and two representatives appointed by the International Association of Fish and Wildlife Agencies (one from Canada and one from the United States). Other groups have been invited to become affiliated. The NABC also designates from four to six additional at-large members. The directors of the Canadian (BBO) and U. S. Bird Banding (BBL) Offices are nonvoting members of the NABC.

APPENDIX J. OPTIONAL HUMMINGBIRD CHARACTERISTICS

Below is an optional list of fields and their length for coding hummingbird characteristics on forms; asterisked (*) items are required when submitting banding data to the banding offices. This list may be of value in some research contexts.

Field (3 characters)	Explanation
----------------------	-------------

CODE (1).	-- 1 indicates new bird, 2=recap, 0=released unbanded
-----------	---

TIME (3).	-- Time of capture; rounded downward to ten min; e.g., if the time is 9:18 am, enter 091
-----------	--

*BAND (6).	-- Band number; a letter and five numerals
------------	--

WING (2).	-- Wing measurement to nearest millimeter
-----------	---

TAIL (2).	-- Tail measurement to nearest millimeter
-----------	---

CULMEN (4).	-- Culmen measurement to nearest 0.1 mm (or rounded to the nearest millimeter if a rule is used)
-------------	--

GROOVES (1).	-- y (yes) is entered if bill corrugations are conspicuous, s (slight, for a few grooves not near the base), n (no, for no grooves; ignore slight corrugations at bill base)
--------------	--

GORCOLOR (1).	-- Indicates color of metallic gorget feathers: o = orange (Rufous, Allen's), r = red (Anna's, Calliope, Broad-tailed, Ruby-throat), v = violet (Black-chinned), p = purple (Costa's, Lucifer), b = blue (Broad-billed, Blue-throated), w = white (Violet-crowned), you may add codes for other species
---------------	---

GORFCOUNT (3).	-- Count of metallic feathers if fewer than 15 or an estimate of the percentage of full gorget present. E.g.,
----------------	---

a male with half of its gorget feathers present would = 50. A full male gorget would be recorded as 100.

HEADFCOUNT (3). -- If the species has metallic crown feathers, counted as for GORFCOUNT

VENTRAL (1). -- Numeric characters are used if molt is evident in any of the ventral feather tracts exposed when the feathers are gently parted by blowing upon the length of the underside of the bird. The number of pin (sheathed) feathers is recorded as

1 = a few (<6 sheathed feathers);

2 = moderate molt;

3 = many sheathed feathers.

If no molt is seen, wear data is entered as:

F = fresh (no wear; the feather edges are intact);

L = light (feather edges are worn but not frayed or nicked);

M = moderate (fraying and perhaps some small nicks are obvious);

R = ragged (very worn edges, often the tips are worn off or shafts extend beyond the vane). Ventral feathers rarely show wear and are usually entered as F. Some studies may record molt and wear in separate fields. See Section 7.5.2., for suggestions on viewing ventral areas.

FAT (1). -- Subcutaneous fat deposits are checked for in the abdominal and furcular (the midventral depression just anterior to the breast musculature) areas. Express subjective amounts of fat as:

0 = none;

1 = a small amount of fat visible;

2 = moderate levels;

3 = bulging with fat.

See Ralph et al. 1993 for a more detailed system of expressing fat levels.

DORSAL (1). -- The feathers are separated by gentle blowing on the feathers on the dorsum from head to base of tail. Molt or wear is expressed as done for VENTRAL feather tracts.

BUFFYBACK (1). -- May be an indicator of immaturity. Dorsal feathers with light buffy edges, are designated with y = yes or s = some buffy. Otherwise n = no should be used.

PRIMARY (1). -- The newest sheathed or missing primary (p) feather is designated (valid numbers: 1-9; 10 is indicated by a zero; remember that p10 is typically replaced before p9). If there is no molt, wear on the tips should be noted as described under VENTRAL.

PRITIPS (1). -- This is a key character in separating some hummingbirds. If width of p1-p6 is about the same as p7-p10, enter the following: "=" (equal); if width of p1-p6 is not equal to p7-p10, "u" (unequal) is entered (Figs. 22 and 23).

PRIEMARG (1). -- A key character for *Archilochus* only. Nature of the tips of the inner primaries (p1 - p6) are described as emarginate or rounded? Use "e" = emarginate; "r" = rounded (Fig. 24).

SECONDARY (1). -- Evaluated as for PRIMARY, valid numbers = 1-6, or indicate wear.

SECSHAP_CA (1). -- A key character in *Calypte*. What is the shape of the tips of the secondaries? Use "e" if emarginate; "r" if rounded (see Baltosser 1987: 153).

RECTRICES (1). -- Five pairs of rectrices (r) characterize hummingbirds; r1s are in the center, r5s are the outer. The newest sheathed or missing r should be designated by number. If no molt exists, wear on the feather tips should be noted as described under VENTRAL. Valid numbers = 1-5 for molt or indicate wear.

R1RUFIOUS (2). -- A character used to determine sex of some *Selasphorus*. This is an estimate of the amount of rufous in r1, expressed as a percent of an all rufous pattern.

R5SHAPE (1). -- A character useful in determining the sex of immature *Archilochus* (Fig. 25). The shape of r5 is described as "p" for pointed or "r" for rounded.

BL_INTOW (1). -- A useful character in determining the sex of immature *Calypte*. Does black enter the white in the tips of r5? Use "y" for yes; "n" for no (Fig. 26).

R5WIDTH (3). -- A useful character in identifying several species. The widest point of r5 near the tip is measured and recorded to the nearest 0.1 mm.

WEIGHT (3). -- Weight recorded to nearest 0.1 g.

*AGE (1). -- Age codes are recorded after the appropriate age designation is determined. Use "0" = age unknown (a bird that cannot be placed in any of the year classes below. Except in cases during the nesting season where data were not recorded or were lost, only birds banded after the breeding season and before January 1 can be correctly coded "0". "4" should be used for a young bird incapable of sustained flight. After a young bird achieves sustained flight it becomes a "2" until December

31. "1" should be used for a bird known to have hatched before the calendar year of banding. "5" should be used for a bird known to have hatched in the calendar year preceding the year of banding and now in its second calendar year of life. Other age categories are not presently recognizable in hummingbirds.

*SEX (1). -- Use "4" for male, "5" for female, and "0" for sex unknown

*ALPHA (4). -- The alpha species codes are designated by the Banding Offices and can be found in the Bird Banding Manual. Banders should prepare a list of the alpha codes for species likely to be banded; this list should be part of the banding equipment.

*DATE (8). -- Enter as month, day, year.

*LOCATION (2). -- A numeric or alpha code should be designated for each banding site.

COMMENTS. -- This field should provide adequate space for entry of comments on unusual attributes, photo details, etc.

For those banders who use Microsoft Excel ® for their banding data the use of a template for data recording will streamline the process of importing data into Bandit for reporting. Refer to the link at the bottom of this BBL website page: <http://www.pwrc.usgs.gov/BBL/resources/bandit/Documentation/index.cfm>