Bats 101:

ID, A&P, Handling & Rehabilitation

NCWR January 20-21, 2024

Raleigh, NC

Linda E. Bowen

CT DEEP & USFWS LICENSED

Wildlife Rehabilitator, Falls Village, CT

860-824-5284 Landline linda@cmsincorporated.net

Bats of North Carolina*

Tricolored Bat	*Perimyotis subflavus*	SR
Big Brown Bat	*Eptesicus fuscus*	S5
Evening Bat	*Nycticeius humeralis*	S5
Eastern Red Bat	*Lasiurus borealis*	S5
Hoary Bat	*Lasiurus cinereus*	S3S4
Seminole Bat	*Lasiurus seminolus*	S3
Northern Yellow Bat	*Lasiurus intermedius*	S1
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*	SC/S3
Townsend's aka Virginia Big-eared Bat	*Corynorhinus townsendii*	E/S1
Southeastern Bat	*Myotis austroriparius*	SC/S2
Gray Bat	*Myotis grisescens*	E/S1
Eastern Small-footed Bat	*Myotis leibii*	SC/S2
Little Brown Bat	*Myotis lucifugus*	SR/S3
Northern Long-eared Bat	*Myotis septentrionalis*	T/S2
Indiana Bat	*Myotis sodalis*	E/S1S2
Silver-haired Bat	*Lasionycteris noctivagans*	S4
Mexican Free-tailed Bat	*Tadarida brasiliensis*	S4

*Source: http://www.dpr.ncparks.gov

Status:	
NC:	E = Endangered; legal status as designated by the NC Wildlife Resources Commission
	T = Threatened; legal status as designated by the NC Wildlife Resources Commission
	SC = Special Concern; legal status as designated by the NC Wildlife Resources Commission
	SR = Significantly Rare; non-legal status as given by the NC Natural Heritage Program
	W = Watch List; non-legal status as given by the NC Natural Heritage Program
US:	E = Endangered; legal status as designated by the US Fish & Wildlife Service
	T = Threatened; legal status as designated by the US Fish & Wildlife Service
	PE = Proposed Endangered; designation by the US Fish & Wildlife Service
	FSC = Federal Species of Concern; designation by the US Fish & Wildlife Service
Rank:	NatureServe gives ech plant and animal species a global rank of rarity, and each state Natural Heritage Program gives each species occurring within its borders a state rank of rarity. Thus, each species has a global and state rank. For each species, the S# varies from state to state, depending on rarity (number of records, threats, etc.).

State:		
Rank	Number of Extant Populations	
S1	1-5	Critically imperiled in North Carolina because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from North Carolina.
S2	6-20	Imperiled in North Carolina because of rarity or because of some other factor(s) making it very vulnerable to extirpation from North Carolina.
S3	21-100	Rare or uncommon in North Carolina.
S4	101-1000	Apparently secure in North Carolina, though it may be quite rare in parts of its range, especially at the periphery.
S5	1001+	Demonstrably secure in North Carolina, though it may be quite rare in parts of its range, especially at the periphery.
S#M	1-1001+	Migratory, or with extensive movements (used here only for aquatic species – whales, dolphins, porpoises, seals, and manatee).
SU	1+	Status and abundance uncertain; need more information.
SA	1?	Accidental or casual; one to several records for North Carolina, but the state is outside the normal range of the species.
SE	1-1001+	Exotic; not native to North Carolina.
SH	0	Of historical occurrence, perhaps not having been verified in the past 20 years, and suspected to be still extant.
SX	0	Presumed extirpated -- believed to be extirpated in North Carolina.

*Source: http://www.dpr.ncparks.gov

Migratory Bats:

Red Bat, *Lasiurus borealis*

Hoary Bat, *Lasiurus cinereus*

Silver-haired Bat, *Lasyionicterius noctivagans*

Seminole Bat, *Lasiurus seminolus*

Evening Bat, *Nycticeius humeralis**

Mexican Free-Tailed Bat, *Tadarida brasiliensis*


Red


Evening, TPWD©


Mexican Free-tailed

J Summers, K Chandler: 2018-02-26 Chatham County


Silver haired


Hoary


Seminole

Photo by: ASH, S. Bland

* Believed to be migratory

- Used to be referred to as “tree” bats
- Do not typically enter caves or mines or form large colonies
- Harder to study
- Many tend to roost singly from branches
- Silver-haired bats may form small colonies and use crevices and hollows in trees but may also be found in caves and structures. In CT, they are frequently found inside homes
- Mexican free-tailed bats may form large colonies in structures
- Cave bats have one young per year, hoaries and silver-haired bats typically have two; reds as many as three or four

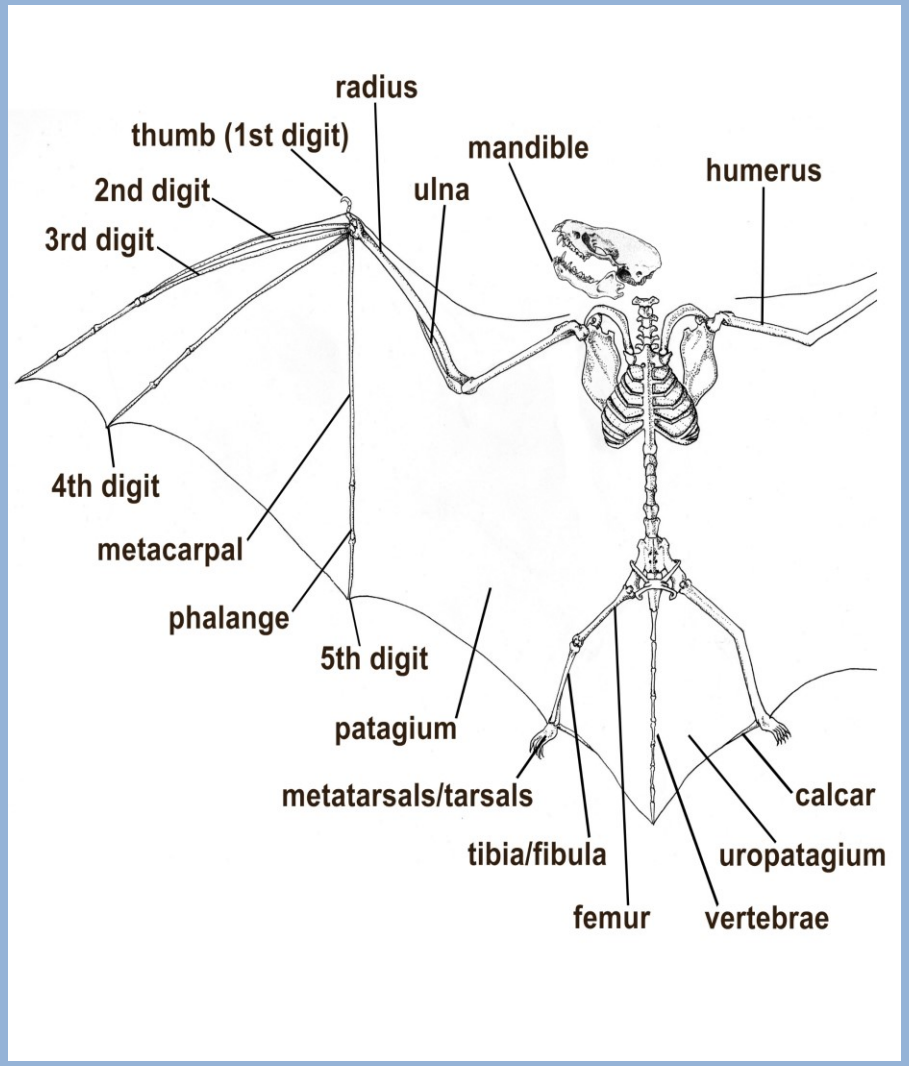


Illustration V. Campbell

Top: keeled calcar; bottom: calcar not keeled

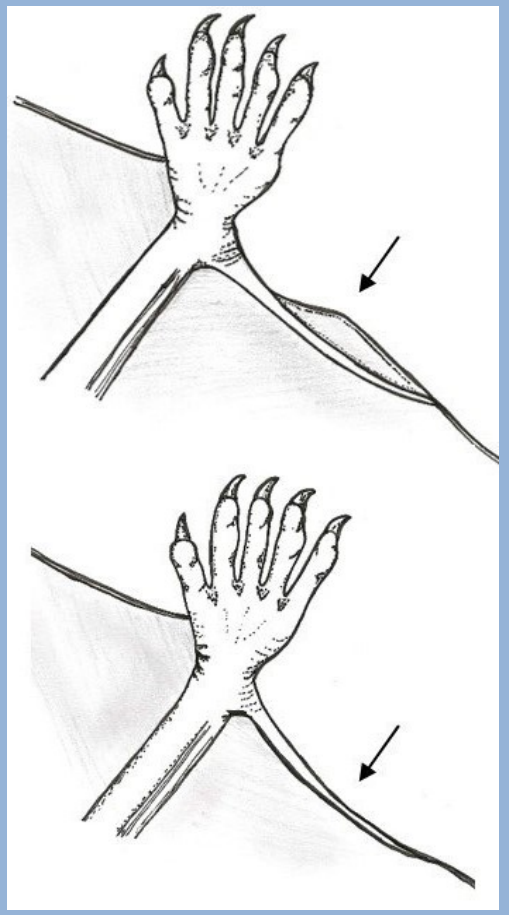
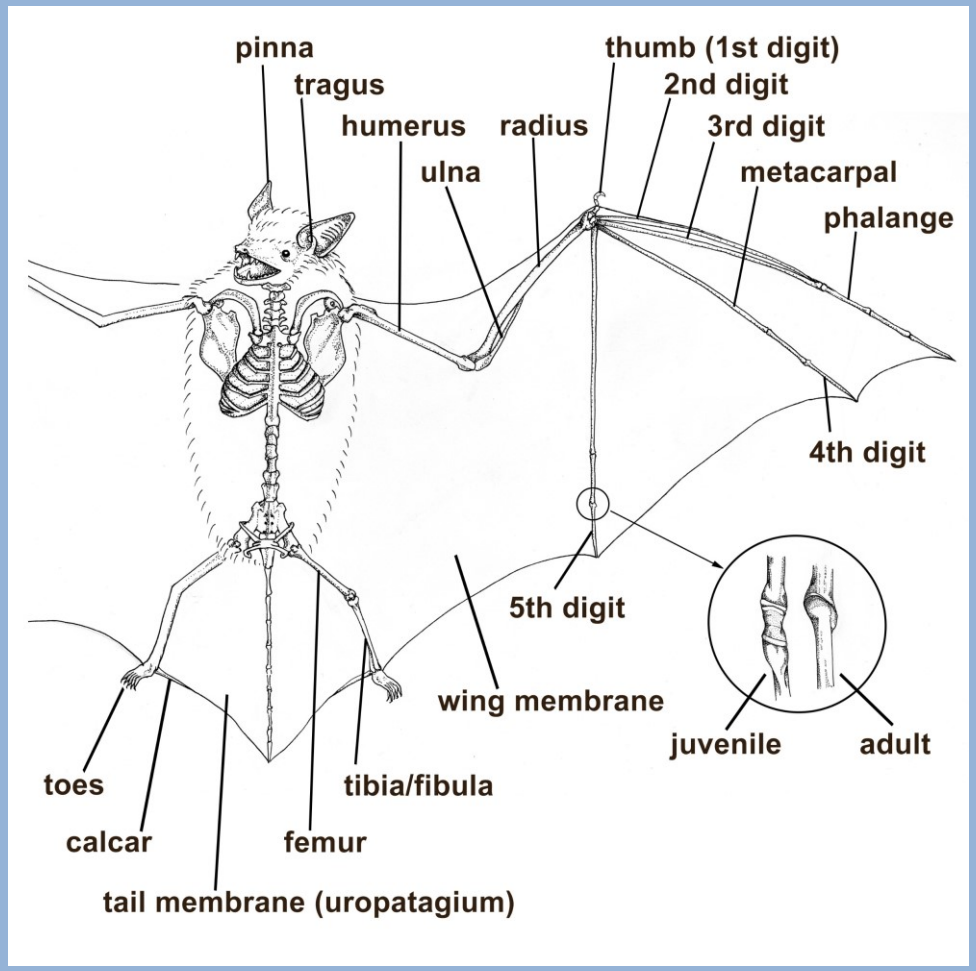
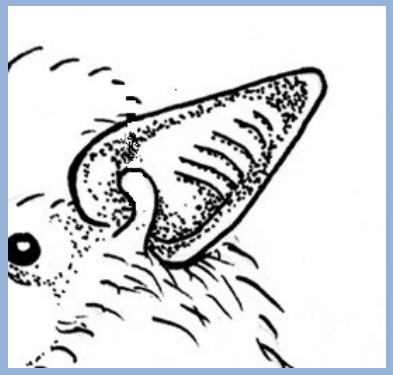
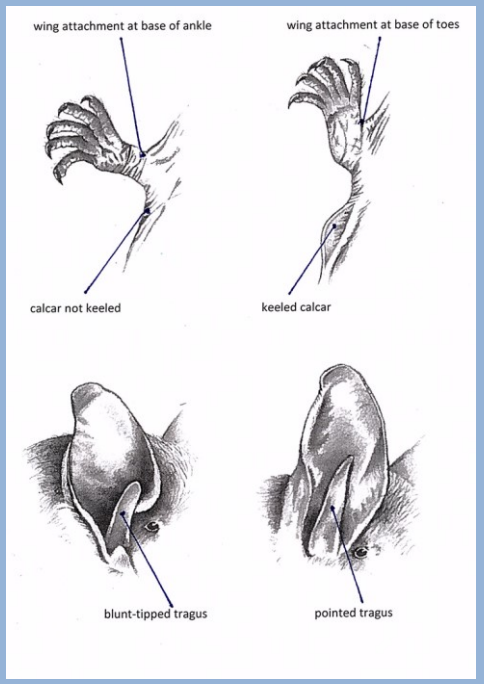


Illustration by Krysta Demere







Illustrations, V. Campbell

Illustration by Rick Hill, KDFWR after Schwartz

Anatomical Structures and Measurements Helpful for ID:

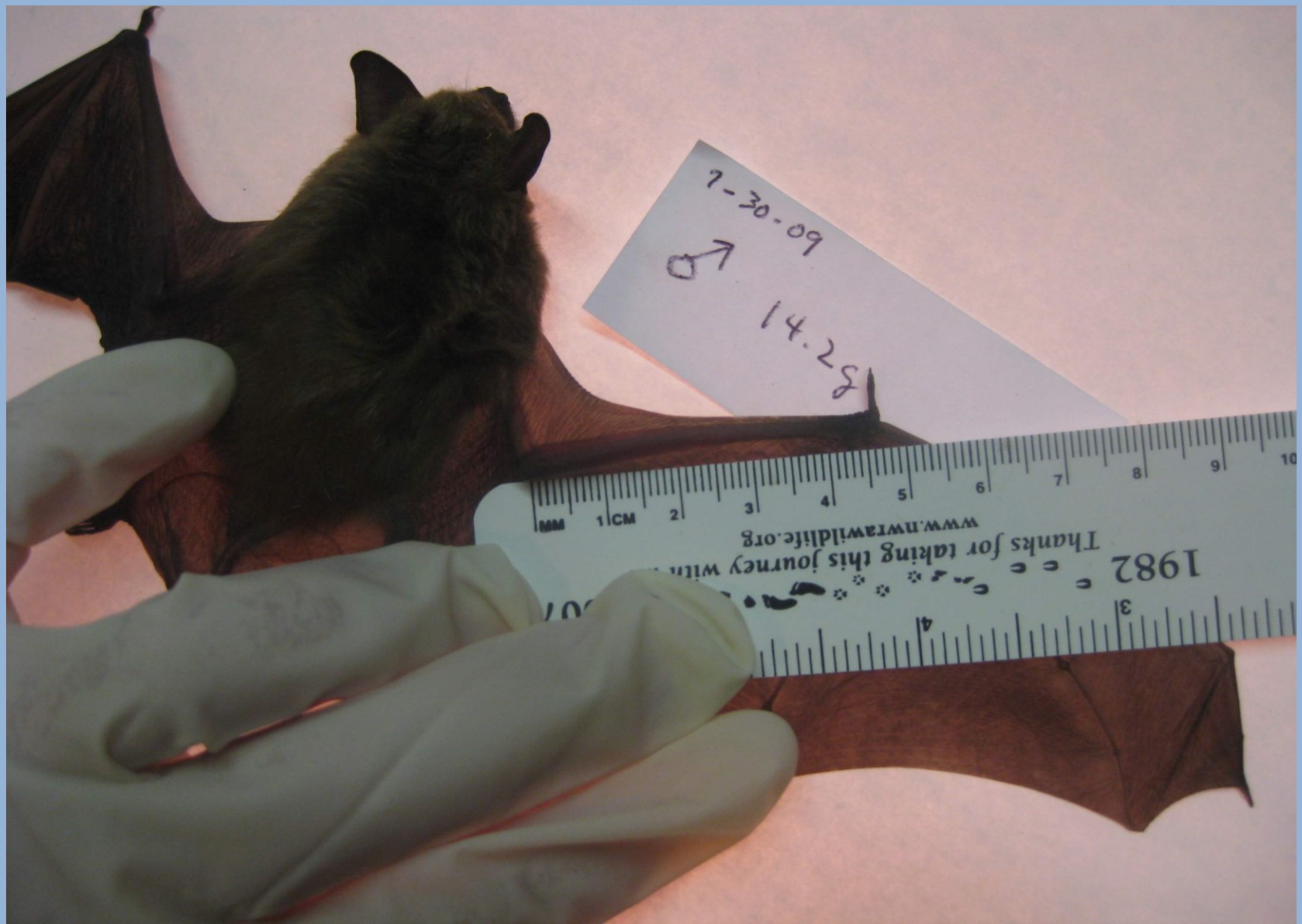
- Weight of bat
- Tragus, shape and length
- Forearm length
- Fur color and texture (vague and widely variable)
- Toe hair
- Calcar; keeled or not keeled
- Attachment of wing membrane (ankle or toes)
- Dental configuration
- Overall size or length of pinna

Intake

- Open container in small room with door closed
- Observe bat in enclosure first
- Examine using cloth and/or heavy gloves to prevent bites (wild bats ***WILL*** bite when handled)
- Examine carefully for injuries.

Hold onto the body of the bat with one hand, with the thumb or forefinger under the chin to keep the head away from the hand examining the bat.

Weigh bat, measure forearm and record



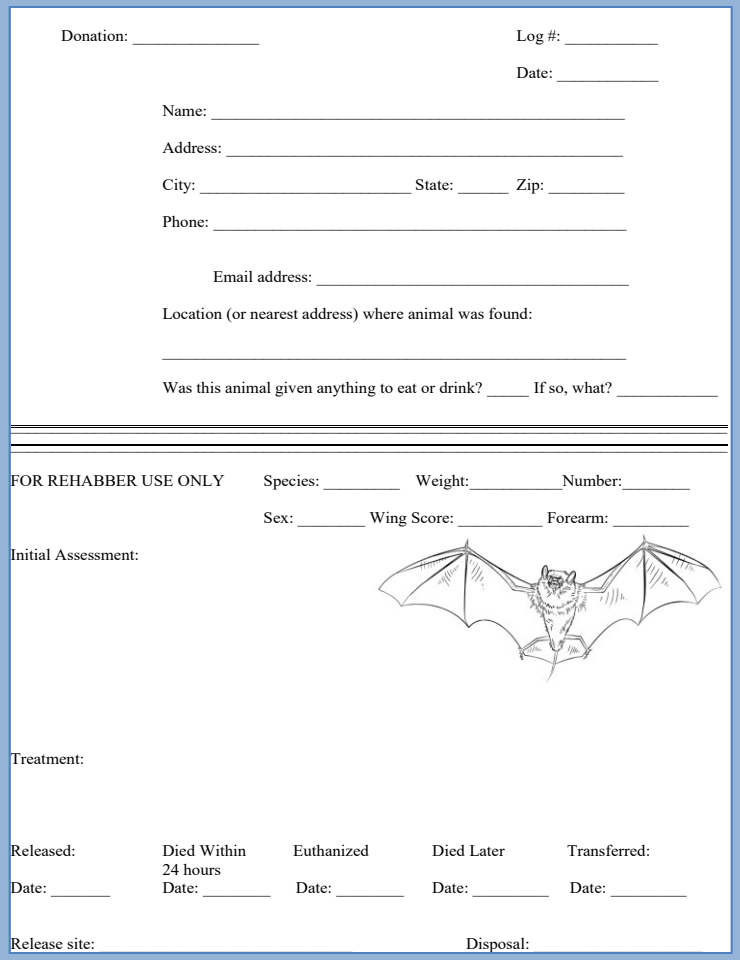
Wing Score based on Reichard Wing Scoring Method

0= No damage or less than 5 small areas

1= Light damage, less than 50% of wing has splotchy areas

2= Moderate damage, more than 50% of wing has splotchy areas and damage

3= Heavy damage, wing deterioration; necrosis



Donation: _____ Log #: _____

Date: _____

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____

Email address: _____

Location (or nearest address) where animal was found:

_____

Was this animal given anything to eat or drink? _____ If so, what? _____

FOR REHABBER USE ONLY Species: _____ Weight:_____Number:_____

Sex: _____ Wing Score: _____ Forearm: _____

Initial Assessment:

Treatment:

Released:	Died Within 24 hours	Euthanized	Died Later	Transferred:
Date: _____	Date: _____	Date: _____	Date: _____	Date: _____

Release site: Disposal:

https://www.fws.gov/northeast/PDF/Reichard_Scarring%20index%20bat%20wings.pdf

What is this???

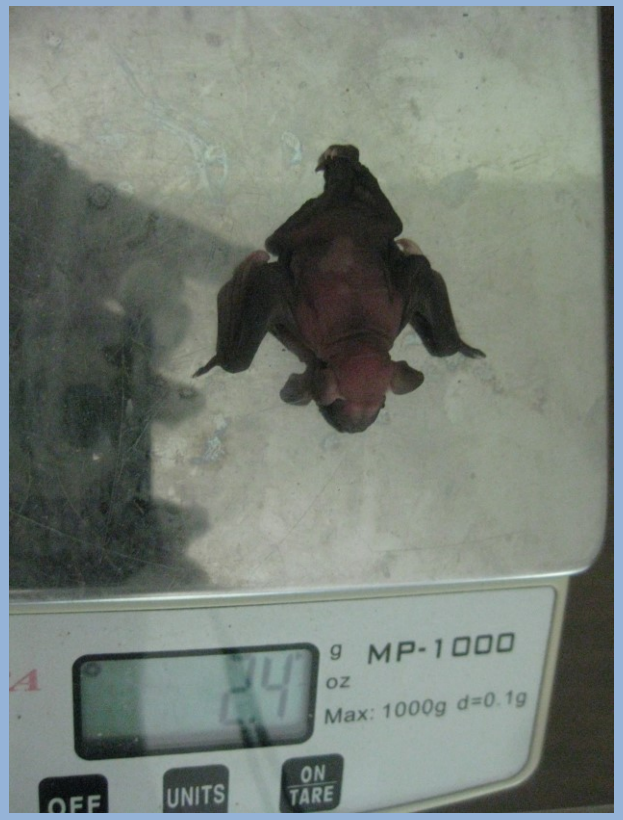
NOTES:

FYI, as in other rehab situations, males should be housed separately from females.

“Cave” bats breed in the fall prior to hibernating; migratory bats also breed in the fall often while flying.

In late spring the stored sperm will be released for fertilization. Most of our bats will have a gestational period of approximately 50-60 days, some species are longer.

Rehabbing bats during winter at higher temperatures may cause bats to give birth up to 2 months earlier in the year.



Scales weighing to tenths are preferred.

DON’T FORGET to get a tare weight on your container and cloths!!!!!

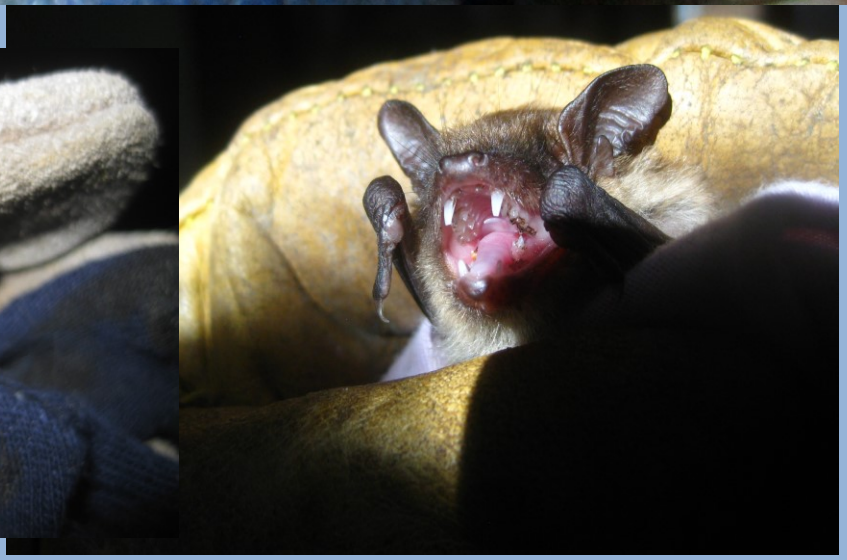
Extend each wing out to it’s natural open position to examine for wing tears or fractures. DO NOT pull on the tip of the wing to open, rather open at the elbow and forearm to reduce bone stress. Using back lighting can help to illuminate abnormalities.

DO NOT PICK UP A BAT BY THE SCRUFF AND DO NOT HOLD BY THE WINGS!!!!!

Once you are in control of the bat, you may remove one glove to be able to examine the bat more easily.

Extend each leg to examine for injuries

Mouth and Teeth



Linda Bowen CT DEEP & US FWS Licensed Wildlife Rehabilitator
linda@cmsincorporated.net www.bats101.info 860-824-5284

Stabilization…ANIMAL MUST BE WARM!!!!

•Assume all rescued bats have some degree of dehydration, begin SQ injections. A bolus dose of 1.0cc for most bats are better than several smaller injections (25-28ga needles usually work well for most bats, including pups)

•LRS©, Plasmalyte©, Normasol©, etc.

•Injection site is either rump or between shoulder blades, or wherever access is easier

Offer water PO but do not give PRN water.

BEFORE FEEDING, MAKE SURE THE BAT IS WELL HYDRATED AND WARM…

ALWAYS

ALWAYS…

ALWAYS…!!!!!!!

******Highly recommend keeping *Oxbow* Carnivore Care on hand for problem eaters or emaciated bats******

External Parasites

Fly eggs

May remove by hand if small amount

Lice

Remove by hand if small amount. Use moistened cotton swab, try to avoid using chemicals. Avian bird mite spray; Revolution©; use very sparingly. Provide ADEQUATE air flow after applying.

Bat bugs, lice, mite eggs

Adult Housing

- Provide roost area, lose weave fabric make good hiding areas; tshirt fabric
- Keep housing covered on 3 sides
- Provide shallow, non tippable dishes for water & mwms
- Do not put heat on bottom for adults unless wing bruising or injuries are noted

Housing for adult with wing or foot injury, do not allow the bat to hang.

•REMEMBER that wild bats must be trained to eat mwms from a dish

•Start bat with guts and move to killed mwms. Keep bat's head extremely close to mwms while offering. Make the "connection" to the dish+mwms=food.

•DO NOT use vitamins in water (not necessary if mwms are fortified properly)

Feeding Mealworms

Food for approximately 10,000 mealworms:

Mwm Supplement Powder (see below)	50-75g
Leafy greens (unchopped dandelion greens, kale, beet greens, romaine-no cruciferous vegetables or spinach)	1 cup
Sweet potato and/or apple	1/2 sliced

Mwm Supplement Powder:

Cornmeal	210g
Oat bran	90g
Wheat bran	65g
*Vionate© (MiracleCorp Products, Dayton, OH) vitamin/mineral powder	215g
Calcium carbonate	215g

NOTE: Do not feed mwms to bats that contain morphed mwms (beetles). When receiving fresh mwms, discard bedding and make fresh to eliminate contamination with quinones. Feed mwms for a few days prior to feeding to bats (From Bats In Captivity, Vol. 3 Susan Barnard)

*Avi-Era© by Lafeber can be substituted for the Vionate© although it does not have the fillers that the Vionate does but the fillers are not necessary if above bedding is used

Flight Cage:

20’ long x 7’ high x 10’ wide

Ginormous reptarium made with 1 ¼” PVC pipe, 30% shadecloth and ½” vinyl hardware cloth “windows.”

Hibernation

Many bats spend the colder winter months in a long state of torpor, often between 3 & 6 months.

Bats must be in very good health and at good weights to be allowed to go into torpor. Food and water must be provided during the hibernation period.

ONLY BATS THAT WOULD HIBERNATE IN THE WILD SHOULD BE CONSIDERED AS CANDIDATES FOR HIBERNATION.

Colder temps and lack of food will trigger long term torpor (hibernation)

It is highly recommended that bats be self feeding prior to being allowed into hibernation.

It is not recommended that a refrigerator be used. For most hibernating bats, temps of 40-48F will provide the correct environment. Humidity may or may not be added, depending on the species.

References

Bats in Captivity, Volume 1: Biological and Medical Aspects. Susan M. Barnard, Editor, Logos Press 2009

Bats in Captivity, Volume 2: Aspects of Rehabilitation. Susan M. Barnard, Editor, Logos Press 2010

Bats in Captivity, Volume 3: Diet and Feeding – Environment and Housing. Susan M. Barnard, Editor, Logos Press 2011

https://www.fws.gov/northeast/PDF/Reichard_Scarring%20index%20bat%20wings.pdf

Medical Management of Wildlife Species, S. M. Hernandez DVM, et all Editors. Chapter 27, (Linda Bowen), pp 353-362. Wiley-Blackwell Publishing, 2019.

References (con't)

Topics in Wildlife Medicine: Orthopedics. R. Duerr DVM, G.J. Purdin DVM, Editors. Vol 4, 2017, Chapter 15 , (Linda Bowen), pp 169-174. Published by NWRA, 2017.

Manual for Rehabilitating Bats with White Nose Syndrome, Susan M. Barnard, Linda E. Bowen. Available for free download: www.bats101.info

Resources

https://fw.ky.gov/Wildlife/Pages/Bats-of-Kentucky.aspx

http://www.dpr.ncparks.gov/mammals/view.php?species_id=27

https://www.tn.gov/twra/wildlife/mammals/mammals-bats.html

https://www.dgif.virginia.gov/wildlife/information/?t=2

http://www.batcon.org/resources/media-education/species-profiles

Pete Pattavina
Bat Biologist/Southeast White-nose Syndrome Coordinator
U.S. Fish and Wildlife Service
Email: Pete_Pattavina@fws.gov

Phone: 706-613-9493 ext. 236

PLEASE, PLEASE, PLEASE…

ONLY USE reputable sites for identification or natural history ie: State, University or government web sites.

DO NOT use Wikipedia or other sites found online due to inaccuracies in information. Do not take recommendations from people who are not specifically trained in bat care.

Always make sure there are references to scientifically based information that can be verified. Information that is not based in science may only be one person's opinion and may be faulty.

Strive to be the best rehabilitator you can be, do not be the weak link who takes inaccurate information as gospel and teaches it to someone else.

Strengthen the profession, do not dilute it.

West End Animal Hospital

15318 W. Newberry Rd.
Newberry, FL 32669
352.472.7626
www.westendanimalhospital.com

Drug/Strength as Purchased	Dose per kg	Dose per 10 g
Acepromazine 10mg/ml (inject)	0.5 mg/kg	0.005 mg
Albendazole (oral) 113mg/ml	50 mg/kg	0.5 mg
Amikacin 50 mg/ml (inject)	20 mg/kg	0.2 mg
Amoxicillin drops 50 mg/ml (oral)	10 mg/kg	0.1 mg
Atropine 0.5 mg/ml (inject)	0.03 mg/kg	0.0003 mg
Azithromycin 250 mg tablet (oral)	20 mg/kg	0.2 mg
Beuthanasia (inject)	variable	0.1 ml
Buprenorphine (Buprenex) 0.3 mg/ml (inject)	0.1 mg/kg	0.001 mg
Butorphanol 2 mg/ml (inject)	0.4 mg/kg	0.004 mg
Cefadroxil 50 mg/ml (oral)	5 mg/kg	0.05 mg
Clavamox Drops 50 mg/ml (oral)	10 mg/kg	0.1 mg
Clindamycin Suspension 25mg/ml (oral)	20 mg/kg	0.2 mg
Dexamethasone 2 mg/ml (inject)	1 mg/kg	0.01 mg
Diphenhydramine 50 mg/ml (inject)	2 mg/kg	0.02 mg
Enrofloxacin (Baytril) 22.3 mg/ml (inject)	10 mg/kg	0.1 mg
Epinephrine 1:10,000 (0.1mg/ml) (inject)	0.02 mg/kg	0.0002 mg

Drug/Strength as Purchased	Dose per kg	Dose per 10 g
Fenbendazole 100 mg/ml (oral)	50 mg/kg	0.5 mg
Furosemide 50 mg/ml (inject)	2 mg/kg	0.02 mg
Ivermectin 10,000 mcg/ml (inject)	100 mcg/kg	1.0 mcg
Ketoconazole 200 mg oral tablet	10 mg/kg	0.1 mg
Meloxicam Low Dose 0.5 mg/ml (oral)	0.1 mg/kg	0.001 mg
Prednisolone 50 mg/ml (inject)	2 mg/kg	0.02 mg
Trimethoprim/Sulfa (Bactrim) Susp 48 mg/ml (oral)	30 mg/kg	0.3 mg
xylazine 20 mg/ml (inject)	2 mg/kg	0.02 mg

Dilutions

Acepromazine: Mix 0.1 ml in 9.9 ml sterile water to get 0.01 mg/ml solution.
Dose at 0.05 ml per 10 grams body weight subcutaneously or orally for about 4 hours of sedation. Commonly used in conjunction with butorphanol for sedation and pain control.

Albendazole: Mix 1 ml of the cattle dewormer with 9 ml of water to get 11 mg/ml. Dose at 0.04 ml per 10 grams of body weight orally. For liver flukes, this dose is once daily for 21 days.

Amikacin: Mix 0.1 ml in 0.9 ml sterile water to get 5 mg/ml solution.
Dose at 0.04 ml per 10 grams body weight subcutaneously once daily for 5-7 days.

Amoxicillin: Mix 0.1 ml in 4.9 ml water to get 1 mg/ml solution. Dose at 0.1 ml per 10 grams body weight orally twice daily for 7 to 10 days.

Atropine: Mix 0.1 ml in 9.9 ml sterile water to get .005 mg/ml solution. Dose at 0.06 ml per 10 grams bw subcutaneously. Repeat as needed.

Azithromycin: Dissolve one 250 mg tablet in 50 ml water to get 5 mg/ml. Dose at 0.04 ml per 10 grams bw orally.

Beuthanasia: Can be used full strength. For euthanasia, give 0.1 ml orally for pain and stress relief, then follow in fifteen minutes with 0.1 ml subcutaneously. Or, give acepromazine/butorphanol followed in fifteen minutes by beuthanasia. In many cases, the oral dose alone is enough for peaceful death.

Buprenorphine: Mix 0.1 ml in 4.9 ml sterile water to get 0.006 mg/ml solution. Dose at 0.16 ml per 10 grams bw subcutaneously or orally twice daily.

Butorphanol: Mix 0.1 ml with 1.9 ml sterile water to get 0.1 mg/ml solution. Dose at 0.04 ml per 10 grams bw subcutaneously or orally three times daily.

Cefadroxil: Mix 0.1 ml in 9.9 ml water to make 0.5 mg/ml solution. Dose at 0.1 ml per 10 grams bw orally twice daily.

Clavamox: Mix 0.1 ml in 4.9 ml water to make 1 mg/ml solution.
Dose at 0.1 ml per 10 grams bw orally twice daily for seven to ten days.

Clindamycin: Mix 1 ml of clindamycin drops in 9 ml of water to get 2.5 mg/ml. Dose at 0.08 ml per 10 grams bw orally twice daily.

Dexamethasone: Mix 0.1 ml with 0.9 ml sterile water to get 0.2 mg/ml solution. Dose at 0.05 ml per 10 grams bw subcutaneously or orally.

Diphenhydramine: Mix 0.1 ml in 9.9 ml sterile water to get 0.5mg/ml solution. Dose at 0.04 ml per 10 grams bw subcutaneously or orally.

Enrofloxacin: Mix 0.1 ml in 0.9 ml sterile water to get 2 mg/ml solution. Dose at 0.05 ml per 10 grams bw subcutaneously or orally once daily.

Epinephrine: Mix 0.1 ml in 4.9 ml sterile water to get 0.02 mg/ ml solution.
Dose at 0.04 ml per 10 grams bw subcutaneously.

Furosemide: Mix 0.1 ml in 9.9 ml sterile water to get 0.5 mg/ml. Dose at 0.05 ml per 10 grams bw orally or subcutaneously**.**

Ivermectin: Mix 0.1 ml in 9.9 ml oil to get 10 micrograms/ml solution. Dose at 0.1 ml per 10 grams bw orally.

Ketoconazole: Dilute one 200 mg tablet in 200 ml water.
Dose at 0.1 ml per 10 grams bw orally twice daily for two weeks.

Meloxicam: Low Dose suspension is 0.5 mg/ml, which translates to 0.02 mg/drop (using the dropper that comes with the box). So, one drop of Low Dose Mel in 19 drops of water or juice gives us a suspension of 0.001 mg /drop.
Dose at 1 drop per 10 grams of body weght of the diluted suspension.
For short-term use (less than one week) like post-op or acute trauma, you can double the dose.

Prednisolone: Mix 0.1 ml in 9.9 ml sterile water to get 0.5 mg/ml solution. Dose at 0.04 ml per 10 grams bw subcutaneously or orally.

Trimethoprim/Sulfa: Mix 1 ml of oral suspension in 9 ml of water to get 4.8 mg/ml. Dose at 0.06 ml per 10 grams bw orally once daily.

Xylazine: Dilute 0.1 ml in 9 ml sterile water to get 0.2 mg/ml. Dose at 0.1 ml per 10 grams bw subcutaneously or orally. May be repeated at double dose if not sufficient effect in 15 minutes.

Notes:
If you intend to use one of these drug orally ONLY, and not by injection, you may substitute Ferretone or juice for sterile water to increase palatability. Ivermectin 1% injectable is not water-soluble. If you try to mix it in an aqueous solution, it will not suspend evenly. It should only be mixed in propylene glycol, ferretone, cooking oil, or similar oil-based liquid. If mixed with p.g. the shelf-life is about one year. If mixed with Ferretone or cooking oil, it's only about one month.

These are recommended starting doses that should work for any insectivorous species. Since I don't work with fruit bats, I cannot guarantee these will work the same way for them.

Deborah Cottrell DVM

Note from L Bowen: adding agave to bitter medication helps enormously to achieve patient compliance; however always make sure patient receives full dose of medication. D Cottrell acknowledged that using agave is probably better than some of the above suggestions (pers. comm. January, 2020). Diluting meloxicam with agave & water allows the medication to go into solution better than plain water or other substances but shortens the shelf life, so always mix small quantities.

Questions????

Linda E. Bowen

CT DEEP & USFWS LICENSED

Wildlife Rehabilitator, Falls Village, CT

860-824-5284 Landline/860-318-1199 cell (text only)

linda@cmsincorporated.net