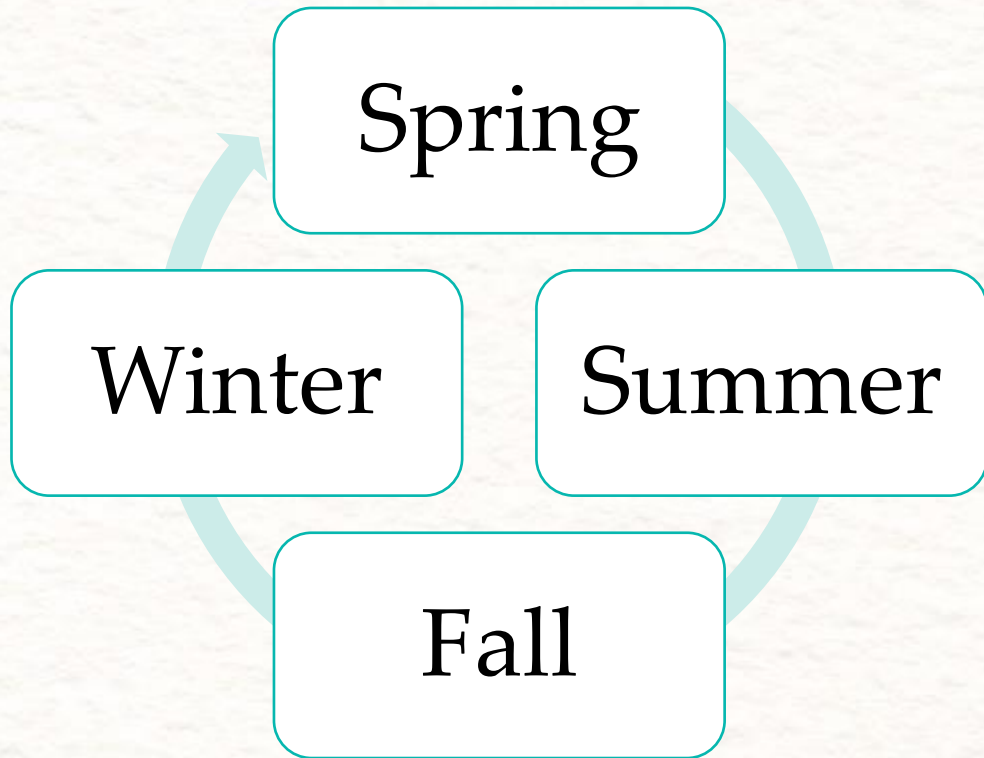


Pups of the Eastern US

Leslie Sturges, BCRV

Bat Rehab by Season



- Return migration, onset of pregnancy
 - grounding, car strike, WNS damage, very pregnant females
- pups, pups, pups, juveniles
 - downed pups, pup falls, lost pups, wandering juveniles, true orphans
- Migration & Mating
 - grounding, car strike, roosting in weird places
- Hibernation-ish
 - Trapped indoors, poor choice of hibernacula

What's likely, when

- April – May
 - Adults; pregnant females



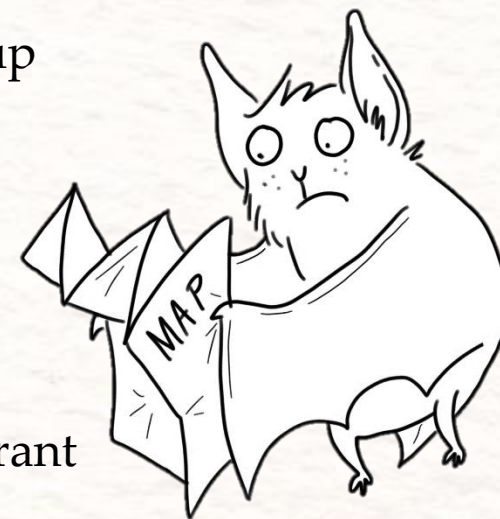
- June
 - Adult or dependent pup



- July – August
 - Adult or dependent juvenile



- September – March
 - First year or adult migrant or hibernator



Pups

- Bat pups are built to take a fall, and they can climb from just a few days old.
- They have an incredibly fast growth rate—more similar to songbirds than for similarly long lived mammals.
- Pups start practice flying at 3—4 weeks, but they nurse until they can forage adequately for themselves at 6—8 weeks
- High parental investment: Pups nurse all day on very nutritionally dense milk, and mothers may return as often as every 15 min to nurse at night when pups are very young.



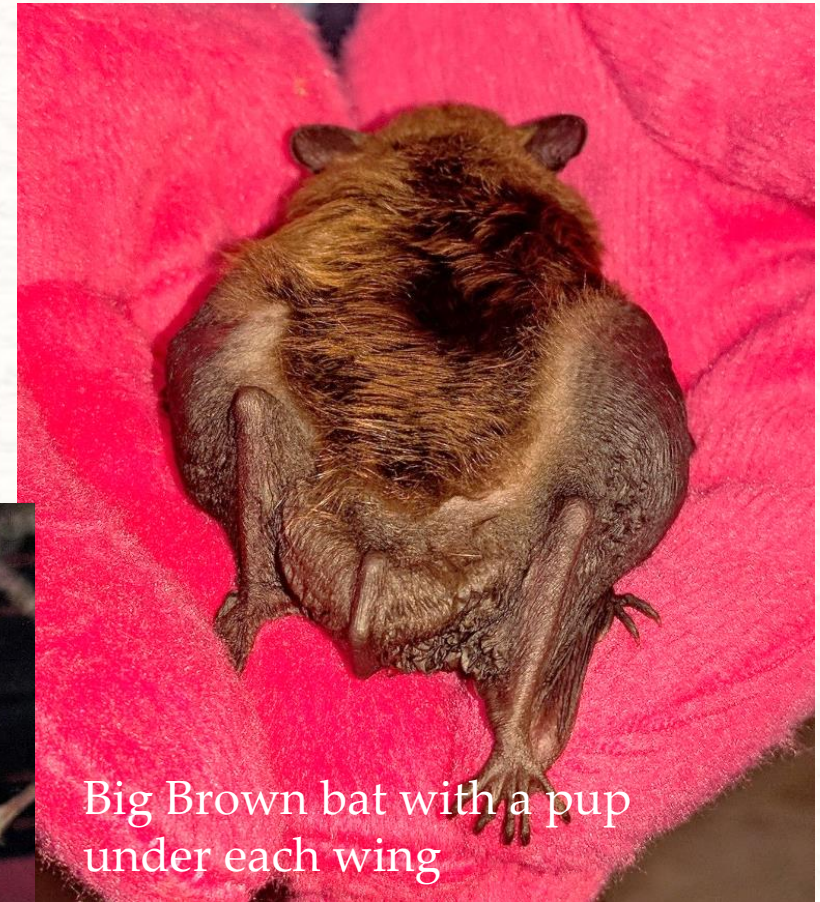
Day 11

Early Environment

- Warm
- Humid
- Constant contact
- Hanging!



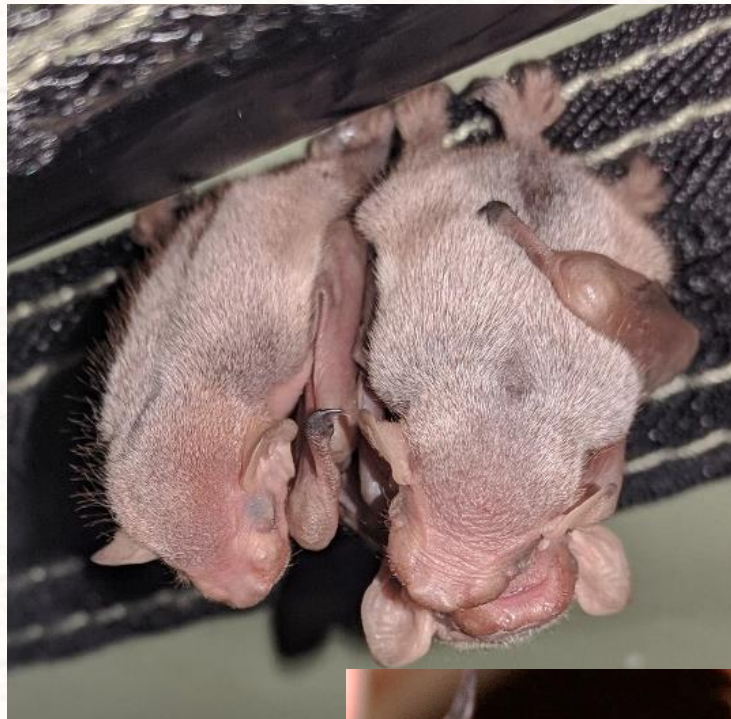
Eastern red bat with a pile of pups



Big Brown bat with a pup under each wing

What sort of pup is it?

- Light pink, rounded ears?
 - Tree bat, most likely a red bat
- Gray-ish, rounded ears, ears have black rims
 - Tree bat--hoary
- Dark pink, dark wings, ears folded to head or long ears
 - Colonial crevice bat
 - Differ in size
 - 3g + naked = big brown
 - 3g + fur = myotis, evening, tricolor, etc.

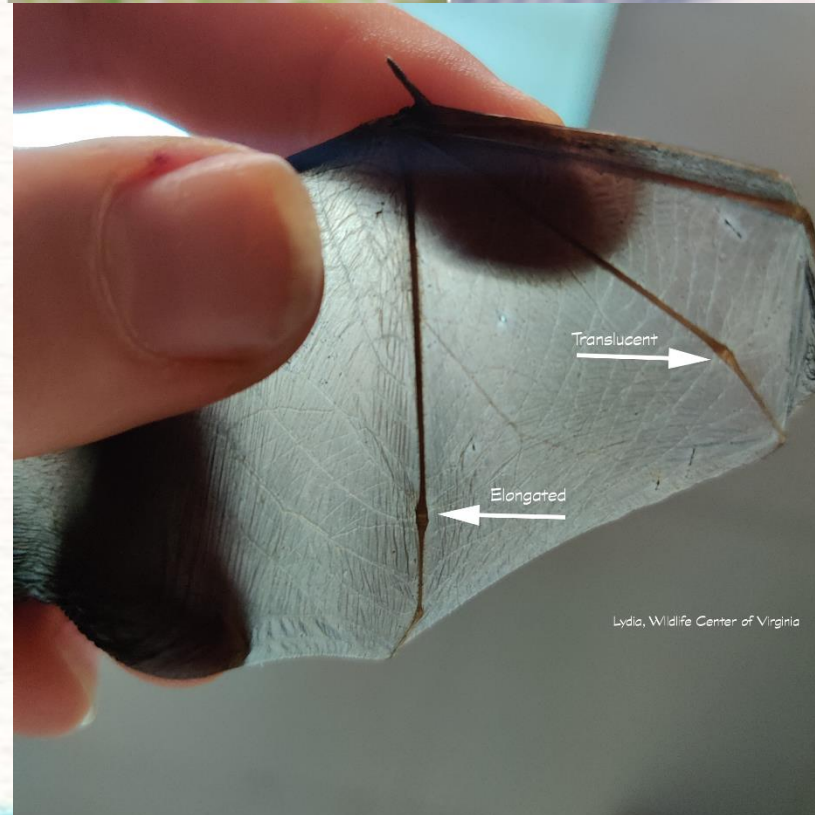


Resource: *Meet Virginia's Bats* <https://tinyurl.com/32juuzww>

Aging pups

Pup/Juvenile

- Naked or lightly furred
- Furred with visible 'neck'
- Joints in wing are elongated and translucent
- Juveniles may or may not be flighted!!
- Still need support from mom until able to forage well enough to feed themselves



Red Bat Age Progression



When to attempt reunion

- ANY dependent pup found alone with NO ADULT BATS present needs rehab ASAP. This means “put it on a tree so its mom can find it” is incorrect advice.
- BUT, a dependent bat pup found under a known or visible colony that has a visible milk line or that appears healthy goes back!
- LOOK UP!!
 - Adult bats visible?
 - Other pups near an opening?
 - Opening with “mammal smear”?
 - Pup clump in a tree or shrub?
- Look around
 - Guano?
 - Other pups?
 - Circling adult?



Assess Condition

Thin?

May be hard to determine if furred

- Indoors for any length of time
- Observed in same place outdoors
- Late summer (failing juveniles)
- Near roads or windows
- Look for a V vs. a U



Ectoparasites?

Bats are very clean. Heavy parasite load indicates no maternal care.

- Mites
- Bat Bugs
- Ticks
- Chiggers



Assess Condition

Dehydrated?

- Look like raisins
- Indoors for any length of time
- Observed in same place outdoors
- Dusty



Injured?

- Visible scratches
- Bruising
- Fractures



Reunion

Lift & Return--Red Bats

Mothers may be found grounded with pups attached or nearby

Getting the family up to safety, without causing the mother to abandon the pups is crucial

Lift into a shrub nearby cover with a twig. Do not breathe or speak!

If the mother leaves, try the ladder reunion method

From Bat World Sanctuary
<https://batworld.org/what-to-do-if-you-found-a-bat/>
With a helpful video!!



Resource: <https://www.savelucythebat.org/bat-rescue/>

Reunion

Lift & Return

Mothers WILL NOT come to the ground if doing so will expose them to danger

Getting pups back up quickly is important for their health and safety

Lift with a pool skimmer, window squeegee, spatula taped to a painter pole, whatever



Resource: *Guide to Reuniting Pups*

<https://www.flipsnack.com/7EA7D96BDC9/reuniting-bat-pups.html>

Reunion

Ladder Method

If colony is inaccessible but location is known; use the ladder method

Has also been successful with tree bat reunion



- Ladder
- Heat source
- Directly in flight path

- Place towel over heat source
- Hang pup on towel on or near heat source just before dark
- Observe from a distance



Reunion

Successful ladder reunion requires time and attention

Appears to work for red bats too!

Need volunteers to watch if property owner can't!



J. Sajecki



Welcome to rehab little ones

What bat pups need

- Appropriate environment for age
- Each other
- Good nutrition
- Sunshine
- Exercise
- Experience
- Practice
- Release



Appropriate Environment

Incubators for neonates



Enrichment and space for juveniles



Each Other



Mixed age class red bats



Unrelated juvenile big brown bats



Colony companions hunting

Good Nutrition

- Very little is known
- There is no one perfect formula
- Species are not closely related

A little rant: Just because recommended formulas are complicated doesn't mean you can feed whatever you have on hand.

"I don't have that" "I only have 32/40" is not an excuse. These are fast growing mammals that need something that supports their growth and development.

Find something appropriate, or find someone who has it and transfer the pup(s).

We get angry at the public for feeding whatever they have or buy at the pet store. Rehabbers must not be guilty of the same thing.

Bats deserve the same nutritional support as any other animal.



Nutrition, cont.

- It is not possible to compare formulas if everyone is using different measurements. We need standardized measures.
 - Zoologic is the only manufacturer to give weight equivalents for volume based mixing instructions. But, say the recommendation for XX/XX is a 1:2 ratio using a provided scoop. The actual weight ratio given is 6.2 g powder to 14 ml water—that is not a one part to two parts ratio.
 - Fox Valley does not give weight equivalents. How do you know that a volunteer's scoop is the same as yours?
- What are the actual ingredients? What IS “vegetable oil”?
- What is the fatty acid profile of the “vegetable oil”? Is it good for bats?
- What is the optimal water temperature for mixing?



- We need to TALK to each other about formulas.
- We need to understand that products change and be prepared to make adjustments
- We cannot demand “easy” when we’re raising BABIES of any species
- If you “don’t have time for all that,” don’t do bats!!

- Hi Fat (Big Browns, maybe evenings?)

Current Formula

Based on the very few studies that exist

STEP 2

Choose the products and ingredients
Each of the cells below is a drop-down menu with a variety of milk replacer products and other ingredients. To enter your own ingredients, go to the "User Input" tab.

Esbilac (2021)		
FV34/40 (2018)		
Carb-Light Corn Syrup USDA		
FV30/50 (2019)		17.00
Milk-Goat, Whole, powder Meyenberg		1.50
FVUltraBoost (2019)		
MannaPro Kid Milk Replacer		
User Product # 1 Coconut oil USDA		
Milk-Yogurt, Whole fresh USDA		2.50
Heavy whipping cream		6.00
Water		96.00

STEP 3

Enter your portions below either (A) in volume (parts) OR (B) in weight (grams).

But not both!!

- B -
Weight
Volume or in grams
in parts of portion

Formula Components	Wet matter basis (as fed)		Your Recipe as a % of Mother's Milk (see note below)
	Your Recipe	Mother's Milk	
Solid	16.5%	25.1%	66%
Protein	4.3%	6.2%	70%
Fat	9.0%	16.4%	55% ←
Carbs.	1.8%	2.5%	72%
ME kcal/cc	1.06	1.82	58% (circled)
AAFCO kcals	0.99		
Ca	0.18%		
P	0.13%		
Ca:P ratio	1.36		

General Note:

Nutrition publications explain that milk from mother animal is naturally more easily and completely digestible than a manufactured replacer. Rehabilitator experience confirms that formulas exceeding 100% solids is too thick, causing slow or incomplete digestion, as well as other GI issues. Experience suggests a formula in the **65-75%** range for solids yields more successful results. Additionally, to maintain the same ratio as seen in mother's milk of protein, fat and carbs, values for those components should be within 10-15% of each other.

Current Formula 2

- Lo Fat (Myotis, Reds?)

ingredients
Each of the cells below is a drop-down menu with a variety of milk replacer products and other ingredients. To enter your own ingredients, go to the "User Input" tab.

Esbilac (2021)		8.00
FV32/40 (2021)		S
FV34/40 (2018)		
FV30/50 (2019)		11.50
FVUltraBoost (2019)		
Milk-Goat, Whole, powder Meyenberg		3.00
Heavy whipping cream		2.50
Water		85.00

either (A) in volume (parts)
OR
(B) in weight (grams).
But not both!!

- B -
Weight
or in grams
Volume or in parts
of portion

Formula Components	Your Recipe	Mother's Milk	Mother's Milk (see note below)
Solid	20.3%	28.3%	72%
Protein	6.3%	8.5%	74%
Fat	9.6%	15.8%	61%
Carbs.	2.7%	4.0%	69%
ME kcal/cc	1.23	1.92	64%
AAFCO kcals	1.14		
Ca	0.21%		
P	0.15%		
Ca:P ratio	1.41		

General Note:
Nutrition publications explain that milk from mother animal is naturally more easily and completely digestible than a manufactured replacer. Rehabilitator experience confirms that formulas exceeding 100% solids is too thick, causing slow or incomplete digestion, as well as other GI issues. Experience suggests a formula in the **65-75%** range for solids yields more successful results. Additionally, to maintain the same ratio as seen in mother's milk of protein, fat and carbs, values for those components should be within 10-15% of each other.

A Word About Mealworms

- Mealworms are nutritionally deficient
- High in fat; deficient in chitin
- They are easy to procure, easy to manage, easy to gutload
 - Use a GOOD substrate, either homemade or commercial
 - Clean before serving
 - Choose vendor with care
- North American insectivorous bats do not eat larvae in the wild
- Are there useful alternatives?
 - Waxworms—very fatty, but a nice supplement for fast growing juveniles
 - Soldier fly larvae—palatability is questionable
 - Crickets—very nutritious; hard to keep in serving containers; legs on adults have dangerous spines
 - Dubia roaches—palatability issues
 - Would love to hear about others



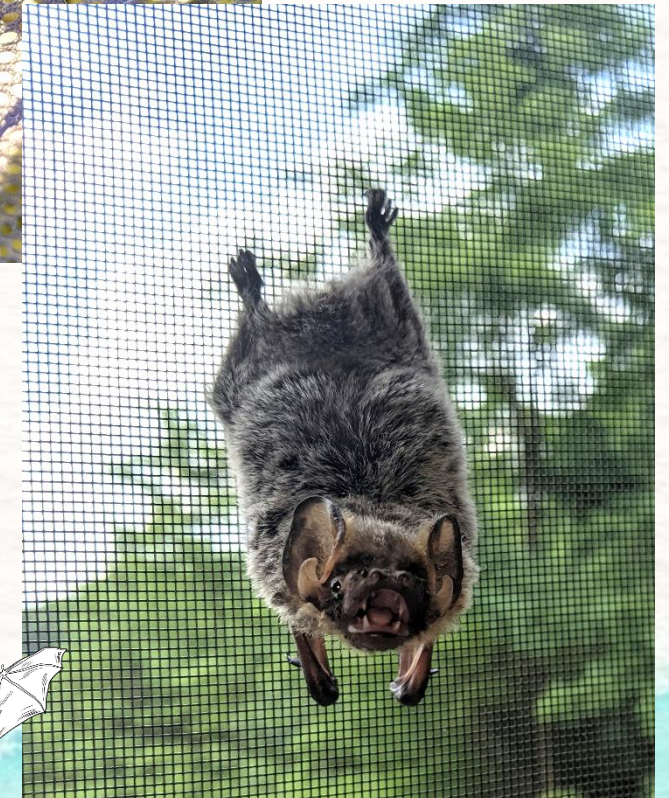
Transitions

- Introduce mealworms early
- Give them the idea that they can feed themselves
 - Please give them the gift of independence
- Wean them in a “normal” time frame—by 8 weeks at most
- There are several methods
 - Introduce viscera during formula feeds; graduate to headless, then whole
 - Make formula/mealworm slurry
 - Bowl train to formula and/or slurry



Sunshine! Really!

- In general, we do not understand calcium pathways in nocturnal animals
- Bats are not well studied in this arena
- It is known that many don't manufacture their own vit C
Cui, J., Yuan, X., Wang, L., Jones, G., & Zhang, S. (2011). Recent loss of vitamin C biosynthesis ability in bats. *PloS one*, 6(11), e27114.
- It is unknown what their vit D requirements are
- We DO know that tree bats live in filtered sunlight
- We have some evidence that some crevice bats spend time in light zones of roosts
- Calcium supplementation plus 'sunshine therapy' has reversed early signs of MBD in pups



Exercise

- What will they need to do?
 - Fly
 - Climb
 - Hide
- Go big!
- Lots of surfaces
- Variation in height
- Conspecifics
- Encourage motion



Motion!



Experience

- Let them be challenged
- Open windows
- Natural temperature variation
- SPACE!!
 - Enough space to explore and learn
 - Enough space to fly and crash
- Each other
- They need to know the night
- Go outside!!



Flight Caging

- BIG!!
- Mesh to let insects IN
- UV light to attract insects
- Food placed appropriately
- Accessible water
- Appropriate roosts
- Safe from predators



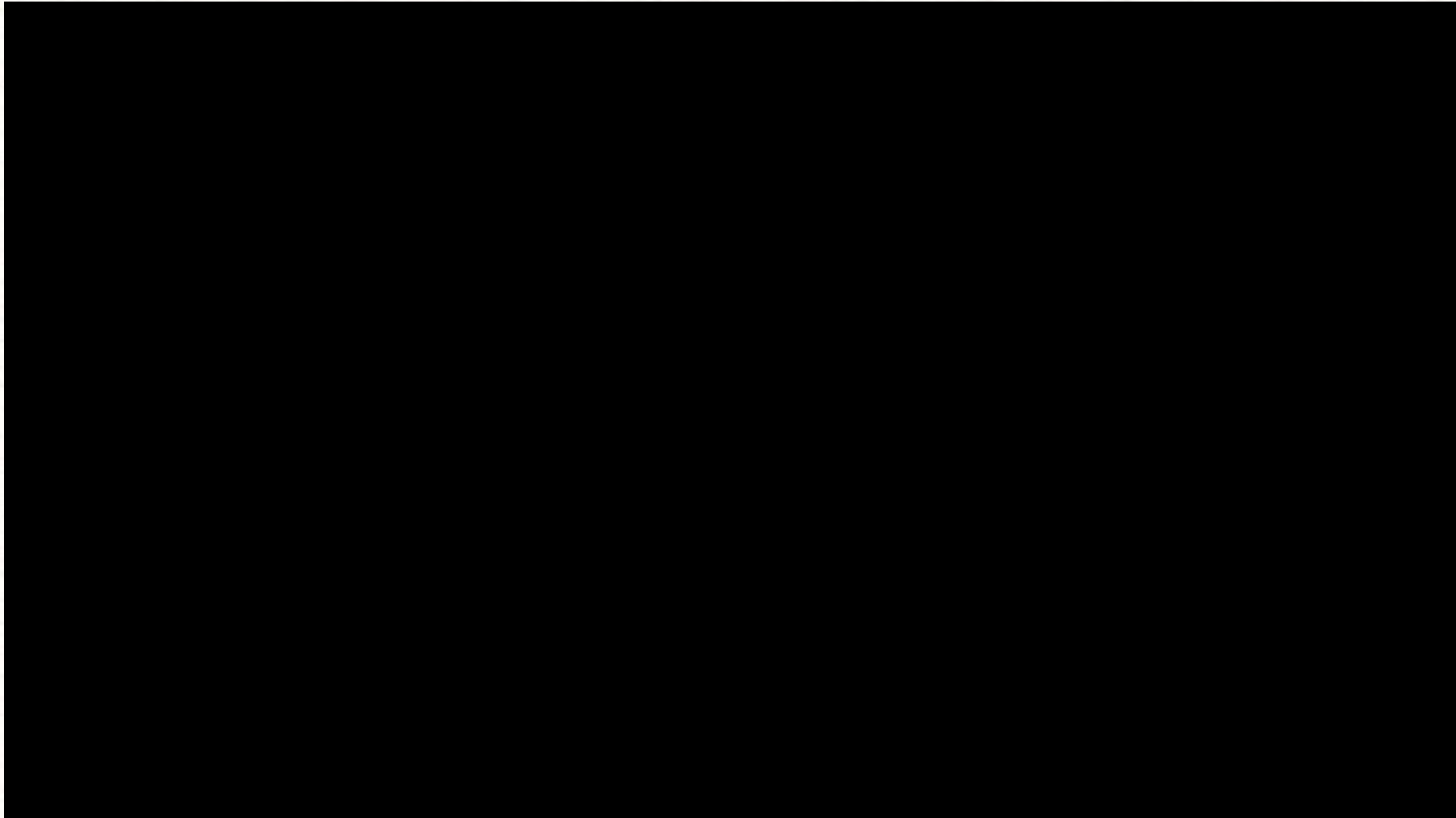
Release

- Look for bug parts in flight space
- Look for changes in guano
- Observe sustained flight
- Can they make altitude changes?
- Do they “flip” to land?
- Can they take off from the ground?
- Do they dislike you?
- PLEASE don't hard release colonial bat juveniles
 - Soft release on site with a cohort
 - Release into a known colony



Pertinent Points:

- Once a pup comes into rehab: Hydrate first; feed, treat for ectoparasites.
- Determine species; Feed accordingly (as best possible).
- Bat pups are big--for bats, but not to us. The largest species pups are just 3g at birth. Be prepared for the tiny (invest in a magnifying lens with light).
- Bat pups need heat and humidity. They live attached to their mothers in colonies or in sibling groups. They cannot stay warm on their own. Need incubators until furred.
- Neonates eat every 3 hours around the clock. They do not sleep overnight. Pool resources and work in shifts if possible
- DO NOT REAR PUPS ALONE! Bats have very high social intelligence and NEED conspecifics.
- As soon as they can interact with the world, give them a world. OUT of the incubator and INTO an enriched, large world. They need to explore, interact, climb, and flap. Aquaria or critter keepers lined with diapers are ABSOLUTELY inadequate.
- They MUST have adequate flight space and enough time to learn to fly and hunt. They need access to flying insects. They are not hard wired; they are very smart mammals that learn by doing. They need safe outdoor space 24/7 while they learn.
- Let them go! We need more bats!



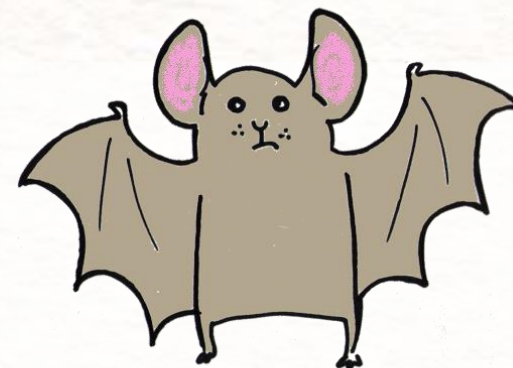
Resources

- Leslie Sturges
Bat Conservation & Rescue of Virginia
lsturges@VirginiaBats.org
- Bat World Sanctuary
www.batworld.org
- Bat Conservation & Management; *ID Key*, Eastern US & Canada
batmanagement.com/products/id-key-eastern-us-canadian-bats
- Texas Technical University, Natural Science Research Laboratory, *Field Identification Key and Guide for Bats of the United States of America*
<https://bit.ly/2UAgpfs>
- Neighbourhood Bat Watch (great info for NE bats)
<https://batwatch.ca/>



Books to have

- *Bats: Biology & Behavior*
John D Altringham,
Oxford University Press,
1996
- *Bats: From Evolution to Conservation*, 2nd edition
John D. Altringham, Oxford University Press, 2011
- *Bats of the United States & Canada*
Michael J. Harvey, et al.
The Johns Hopkins
University Press, 2011
- *The Rehabilitation and Captive Care of Insectivorous Bats*
Amanda Lollar
Bat World Sanctuary,



Unless otherwise noted, illustrations are by David Chapman, Kim O'Keefe, and Zoe Kudernak for the Save Lucy Campaign. All rights reserved. Photos and video by BCRV unless otherwise attributed.



- We want to help you succeed
- No one has all the answers
- There is no “only way”
- There is so much more to learn
- Bats are cool!

THANK YOU FOR ALL YOU DO!!!

