# An Introduction to Wild Turtle Rehabilitation and Medicine

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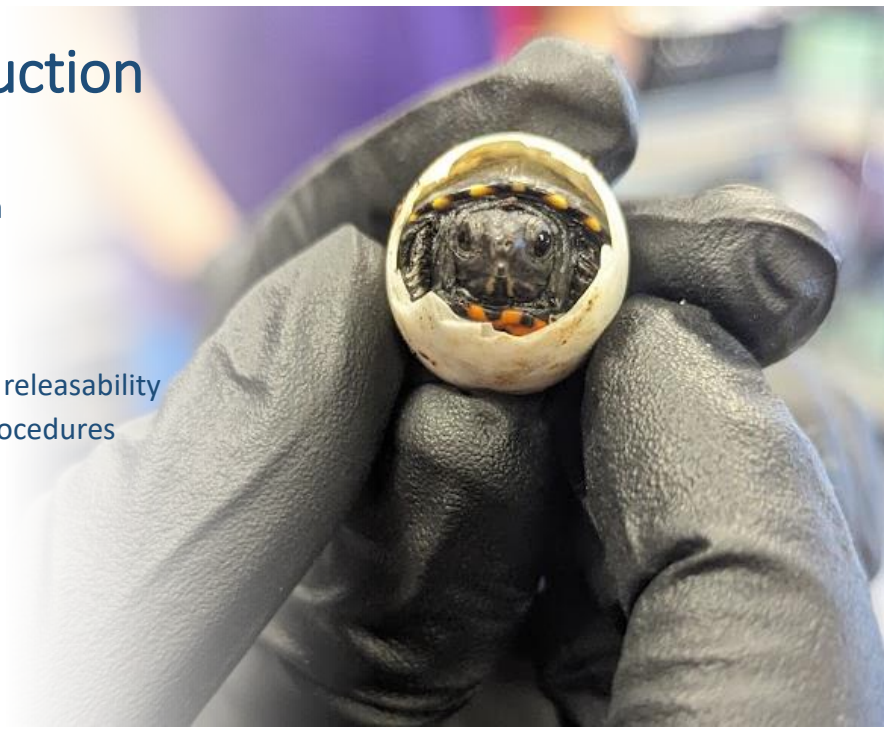
## WRNC Introduction Lecture

- Turtles of North Carolina
- Anatomy
- Husbandry
- Physical examination
- Assessing prognosis and releasability
- Common injuries and procedures
- Venipuncture
- Injections
- Medications
- Sedation/Anesthesia
- Euthanasia



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# Turtles of North Carolina

**There are ~357 recognized species of turtles Worldwide (IUCN)**

**Approximately 50% are threatened**

- North Carolina: **21 species** of turtles: **16 species of non-marine turtles** and **5 species of sea turtles**
  - 14 freshwater semi-aquatic
  - 1 brackish water semi-aquatic (DBT)
  - 1 terrestrial (EBT)
  - 5 sea turtles (Loggerhead, Green, Hawksbill, Kemp's Ridley, Leatherback)

**To learn more about our native species of turtles, visit the herpsofnc.org**

https://herpsofnc.org/turtles/#:~:text=Turtles%20are%20found%20throughout%20North,Box%20Turtle)%20is%20primarily%20terrestrial

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## North Carolina State Endangered Species Act
## US FWS Federal Endangered Species Act

- **Endangered species:**
  - Atlantic hawksbill sea turtle (*Eretmochelys imbricata imbricata*) FE
  - Kemp's ridley sea turtle (*Lepidochelys kempii*) FE
  - Leatherback sea turtle (*Dermochelys coriacea*) FE
- **Threatened species:**
  - Bog turtle (*Glyptemys muhlenbergii*) FT
  - Green sea turtle (*Chelonia mydas*) FT
  - Loggerhead sea turtle (*Caretta caretta*) FT
- **Species of special concern in NC:**
  - Cumberland slider (*Trachemys scripta troostii*)
  - Diamondback terrapin (*Malaclemys terrapin*)
  - Eastern chicken turtle (*Deirochelys reticularia reticularia*)
  - Eastern spiny softshell (*Apalone spinifera spinifera*)
  - Northern map turtle (*Graptemys geographica*)
  - Stripeneck musk turtle (*Sternotherus minor peltifer*)

FE (Federally Endangered), FT (Federally Threatened)

**That's 57% (12/21 species) total or 44% (7/16 species, excluding sea turtles) that are at risk … that we know of!**

## PROTECTED WILDLIFE SPECIES
OF NORTH CAROLINA

North Carolina Wildlife Resources Commission
ncwildlife.org
October 1, 2021

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Common Snapping Turtle
Painted Turtle
Eastern Box Turtle
Common Musk Turtle
Source: Herps of NC

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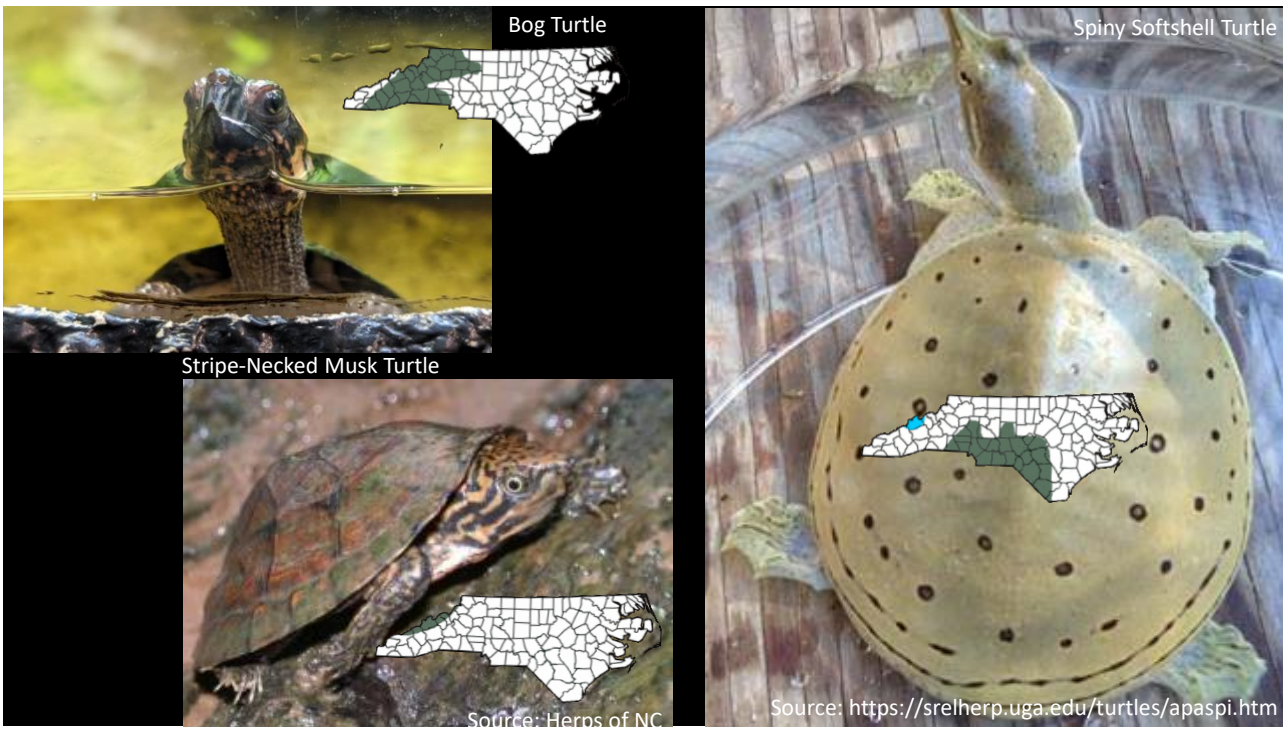
Bog Turtle
Stripe-Necked Musk Turtle
Source: Herps of NC
Spiny Softshell Turtle
Source: https://srelherp.uga.edu/turtles/apaspi.htm

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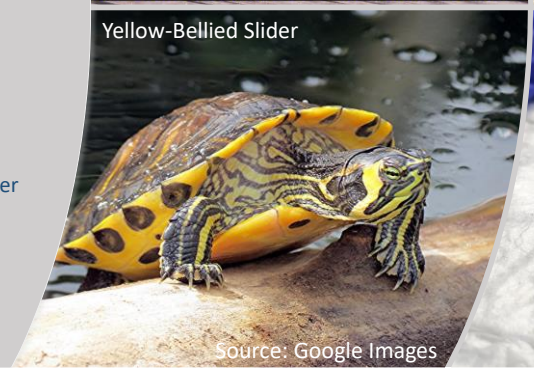
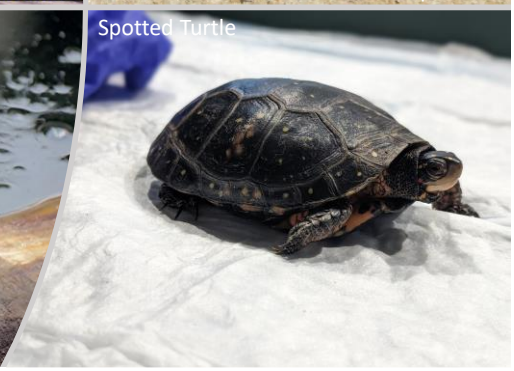
# Eastern NC

The last 9 species are found in the eastern range of NC:

- Spotted Turtle
- Yellow-Bellied Slider
- River Cooter
- Florida Cooter
- Eastern Mud Turtle
- Striped Mud Turtle
- Chicken Turtle
- Northern Red-Bellied Cooter
- Diamondback Terrapin



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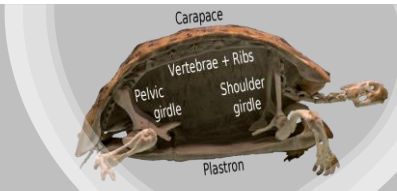
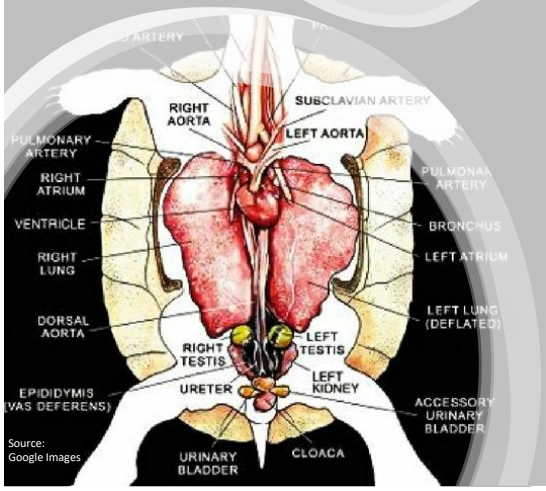
# Turtle Anatomy




The **shell**!

Breathing → **Lack a diaphragm**

- Movement of the paired antagonistic "abdominal" muscles (transverse m. and oblique m.) and use of the pelvic and pectoral limbs change intrapulmonary pressures.

The **vent/cloaca** → "Common opening"

- Three chambers (like in birds)

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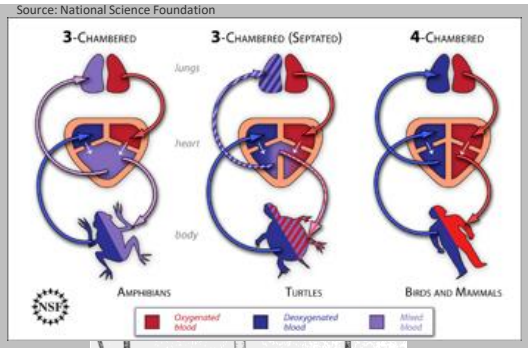
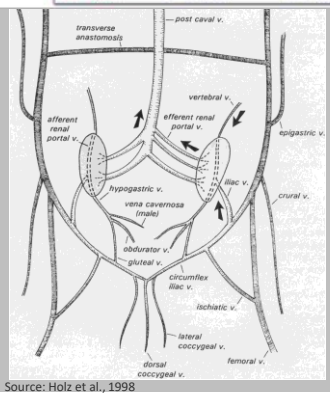
Source: National Science Foundation




Source: Holz et al., 1998

**3-chambered heart**

Video: https://www.youtube.com/watch?v=K3uw9nKQBfw

**Renal portal system**: This system receives veins from the carapace and muscles posterior to the kidneys.

**Due to these differences in caudal** circulatory anatomy, drug injections are recommended to be administered in the cranial half of the body.

Lymphatics → **No lymph nodes**; instead, there's a complex network of perivascular **lymph channels** around major vessels.

**This is why many venipuncture locations** may have lymphatic contamination.

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# Skeletal Anatomy

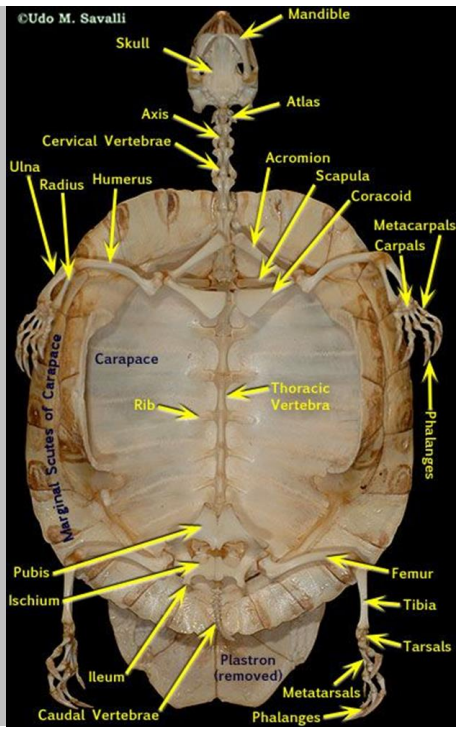
More detailed images of the appendicular skeleton may be found for reviewing carpi/tarsi and the skull.

Here's a link to the anatomy of a snapping turtle skull: https://campus.murraystate.edu/faculty/tderting/anatomyatlas/snapturtskullamy-becky.html

Other helpful anatomy resources:

Skeletal System of the Turtle (murraystate.edu)

Anatomy Atlas MSU (murraystate.edu)

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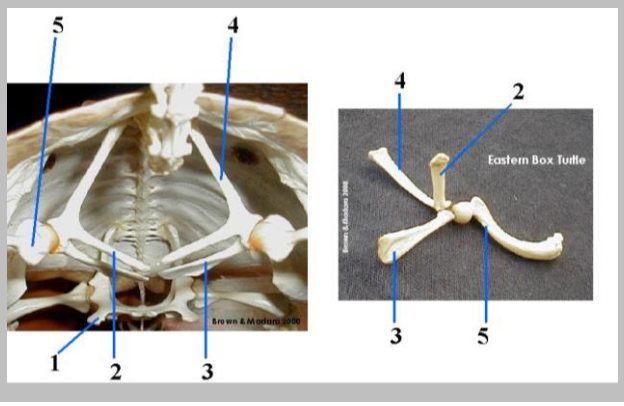
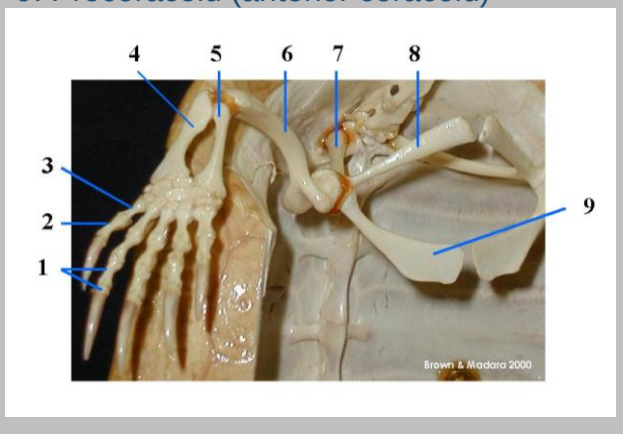
# Pectoral Girdle and Forelimbs

1. Pelvic Girdle 2. Prescapular process (acromium) 3. Procoracoid (anterior coracoid) 4. Scapula 5. Humerus




1 Phalanges 2. Metacarpals
3. Carpals 4. Ulna 5. Radius
6. Humerus 7. Scapula
8. Prescapular Process (acromium)
9. Procoracoid (anterior coracoid)

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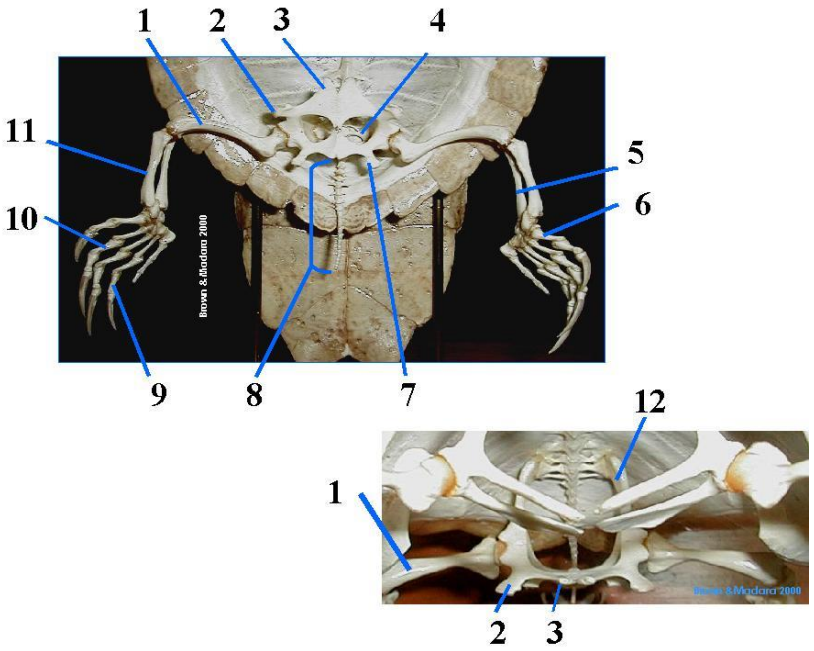
# Pelvic Girdle and Hindlimbs

1. Femur
2. Pubis
3. Epubis
4. Puboischiadic fenestra
5. Fibula
6. Tarsals
7. Ischium
8. Sacral Vertebrae
9. Phalanges
10. Metatarsals
11. Tibia
12. Ilium

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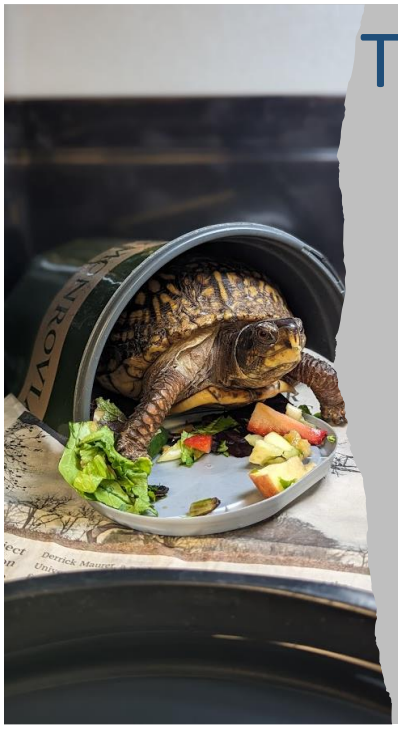

# Turtle Husbandry

**Rehabilitation Setting:**

Enclosures may have more space, a natural substrate, and a private setting for recovery/preparation for release.

**Hospital Setting:**

Smaller enclosure lined with newspaper and items that are easily disinfected daily.

**Recommended for both:**

Heat source

UVB source / Sunshine time

Humidity

Water/Soaking

Food

Hide(s)

+/- Nesting area

+/- Haul-out zone

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## Preferred Optimal Thermal/Temperature Zone (POTZ)

**Temperature is critical for immune function, metabolism, digestion, and overall health**

- Provide a temperature **gradient**
- POTZ are **species-specific**
  - In general, diurnal reptiles here thrive in 75-90F (basking areas 90-95F)
- Reptiles can overheat and get thermal burns!
  - Appropriate monitoring, temperatures, and heat sources are important
  - Heat sources may include under-the-tank heaters (UTH), basking bulbs, heat tapes, radiant/ambient heat, and for aquatics submersible in-water heating elements

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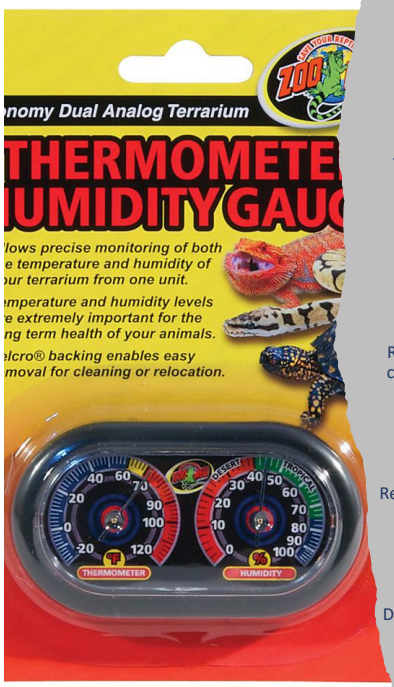


**Check temperatures before feeding and medicating**

**Immune response**

Best when in the ideal to upper range of POTZ

Lower in winter months = susceptible to infections

The end of brumation is a dangerous time where there may be a "post hibernation immunity gap"

**Stress weakens the immune response**

Stress can be caused by injury, pain, abnormal environment in captivity, inappropriate temperatures, lighting, humidity, hiding places, photoperiods, etc..

Reptiles maintained for prolonged periods at 60-70F are often too cold for normal digestion and immune response and too warm for brumation

**Sunlight/UVB**

Recommended for most reptiles to create vitamin D3 and absorb Ca from intestines

Natural light is one of the best resources for captive reptiles

May also stimulate appetite!

Deficiency may result in nutritional secondary hyperparathyroidism (NSHP)


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# Physical Examination

What is recommended?

- You and your turtley awesome skills!
- The turtle pedestal (*angelic music plays*)
- Guitar picks/credit cards/spatulas/wine corks
- Syringe cases/tongue depressors
- Light source
- Doppler
- Surface temperature (laser)
- Syringe/needle/heparin/glass slides for blood work

**Remember to triage your patient!**

A complete examination may only be able to be performed once the turtle is stabilized.

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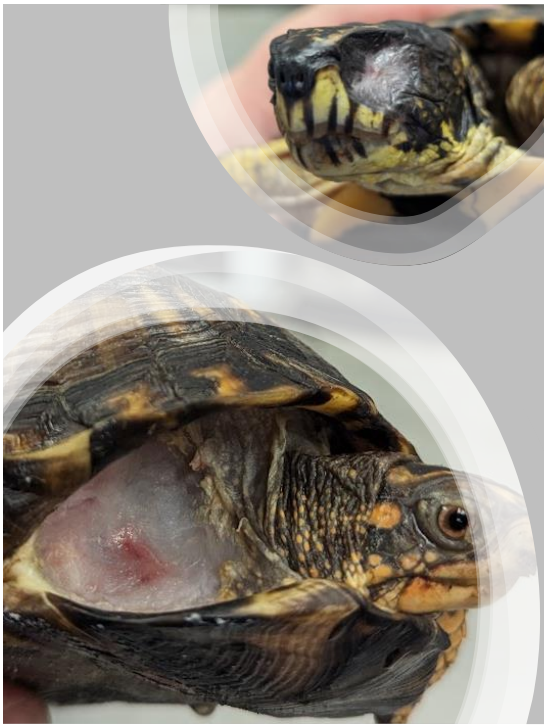

# Prognosis and Releasability

*Before the release of any reptile, many factors must be considered, and compliance reviewed with national, state, and local laws.*

**Humane Euthanasia Considerations:**

Severe head injury

Severe shell fractures with open celomic cavity and organ damage

Bilateral non-treatable eye damage / non-visual

Severe pneumonia, open mouth breathing / dyspnea

Hindlimb paralysis and negative vent tone

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# Prognosis and Releasability

**Considerations for remaining in captivity / deeming non-releasable:**

Non-visual

Multiple amputations that affect ambulation

Severe pelvic/neurological injuries (especially in female turtles due to the risk of dystocia)

***Prior to considering life in captivity, always assess the individual's quality of life as this is a wild animal***

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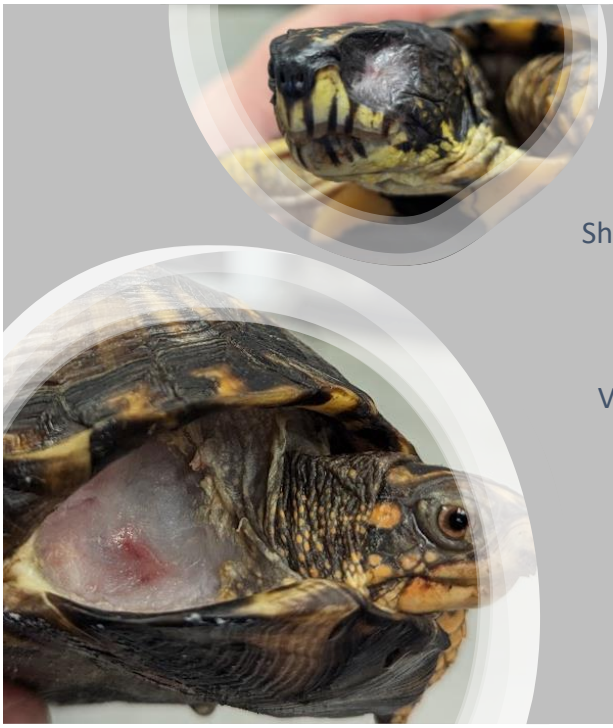

# Prognosis and Releasability

**Releasability:**

Shell repairs: Remove hardware prior to release and ensure the area is stable to provide protection.

Limb amputation(s): May be releasable; assess ambulation on various terrains

Vision: One good eye; assess foraging and natural behaviors

**Releasing:**

****LOCATION AND TIME OF YEAR****

As ectotherms, reptiles should not be released during the winter months

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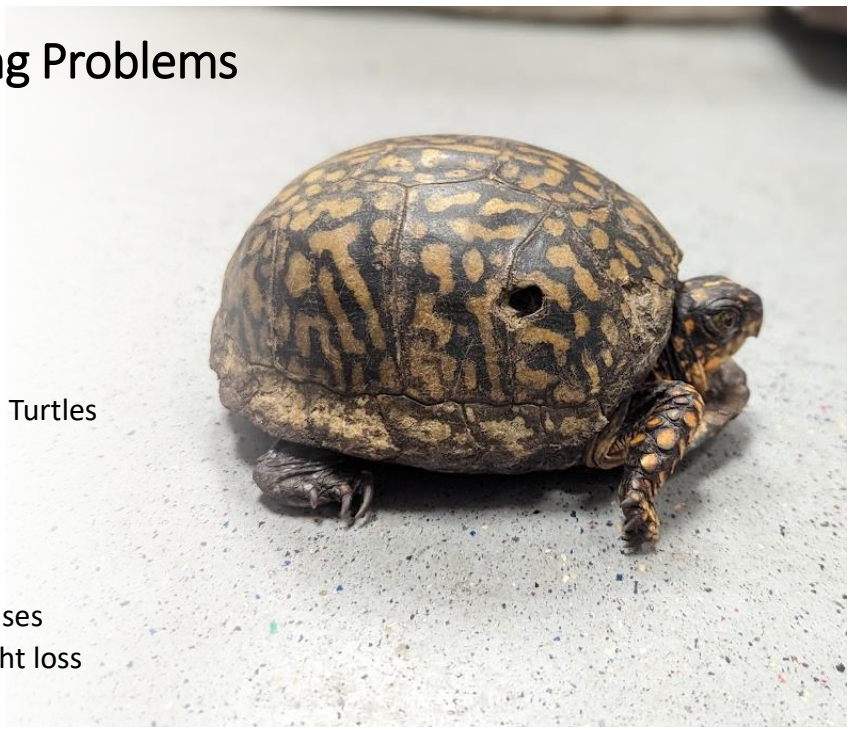
# Common Presenting Problems

- Trauma
  - HBC (Hit By Car)
  - HBM (Hit By Mower)
  - CBD (Chewed By Dog)
  - Fish Hook
- Aural Abscess (AA)
- Respiratory Illness or “Viral” Turtles
  - Oral plaques
  - Ocular plaques
  - Blephroedema
  - Oculonasal discharge
  - Dyspnea, respiratory noises
  - Lethargy, anorexia, weight loss



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# Isolation


- Turtles with upper respiratory signs
- Treated last/separately
- Appropriate biosecurity
- Examples may include:
  - Oral plaques
  - Conjunctivitis/palpebral swelling
  - Ocular and/or nasal discharge
  - Infectious shell lesions
- Biosecurity protocols:
  - Wearing/changing gloves
  - Washing hands
  - Use separate materials specific to isolation (bandaging supplies, eye drops, etc..)
- If a turtle has severe signs these may require additional diagnostics (i.e. radiographs, CT scan) and medications (systemic antibiotics, nebulization, other)

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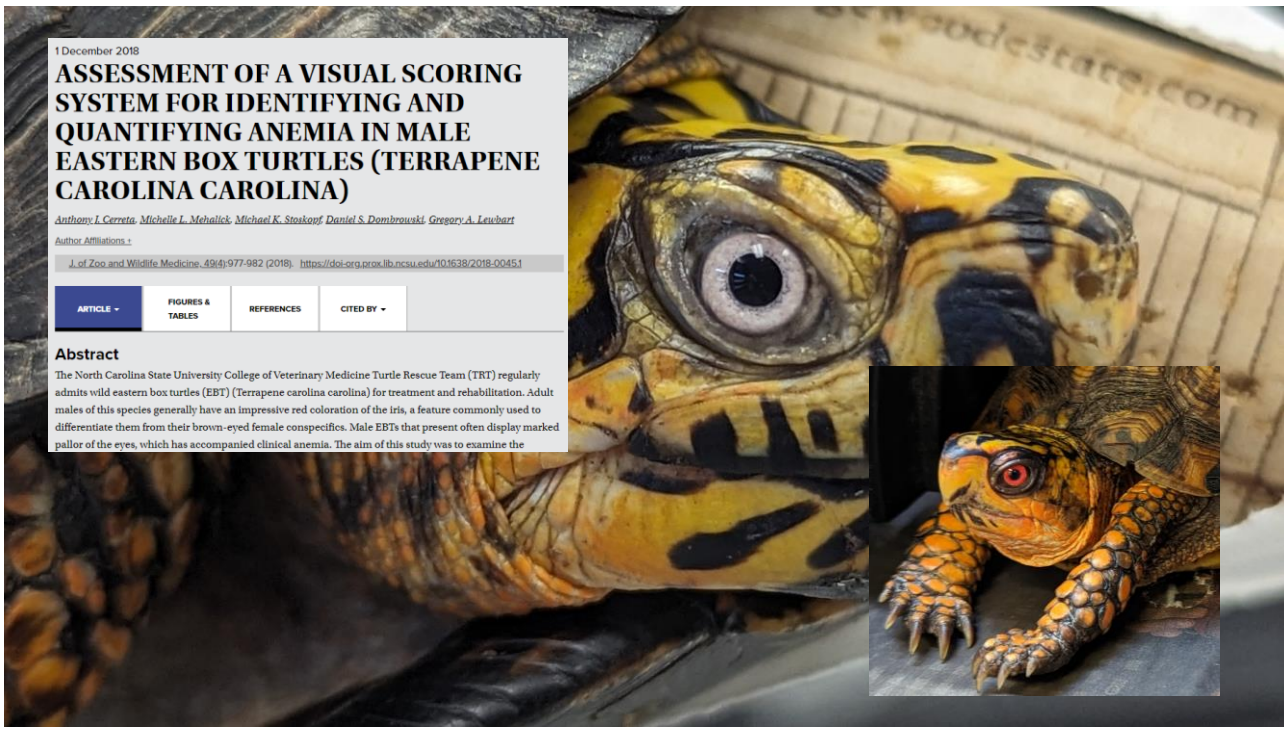


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# Shell Trauma: Initial Management

**Triage → Prognosis → Plan**

Hemostasis, pain control, fluids

Clean and remove debris

**Flush! Dilution is the solution to pollution.**

- Caution with coelomic breeches
- Remove debris and maggots
  - Capstar can be made into a solution and used topically
- Warm sterile saline and dilute betadine
- Moderate pressure to aid in debridement
  - To create the recommended ~8psi use a 1L fluid bag with a cuff pressurized to 300mmHg and an 18g needle

**Sedation? Stabilization vs. Bandage? Now vs. later?**

**Topicals**

- SSD: good for most shell/skin wounds
- TAO (NPB near eyes)
- Medihoney (medical grade leptospermum honey): expensive but can be used for open coelomic cavity wounds and deep shell fractures. Comes in several forms.
- Honey (grocery store)
- Wound gels/sprays: can help maintain a moist and antiseptic environment

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# Shell Fracture Repair

Always consider what your turtle needs prior to repair!

- Pain medications
- Antibiotics
- Sedation
- Dilute betadine / Saline
- Reduce fractures
- Topical cream (SSD, honey, TAO, other)

Supplies:

- Marginal Scute Repair:
  - Dremel with a small drill bit
  - Wire
  - Scalpel blade handle or tongue depressor
  - Needle drivers
- Other Repair:
  - Bra hooks, zip-ties, paperclips
  - Super glue
  - Baking soda
  - Epoxy
  - Wire or suture
  - Needle drivers
  - Mefix tape

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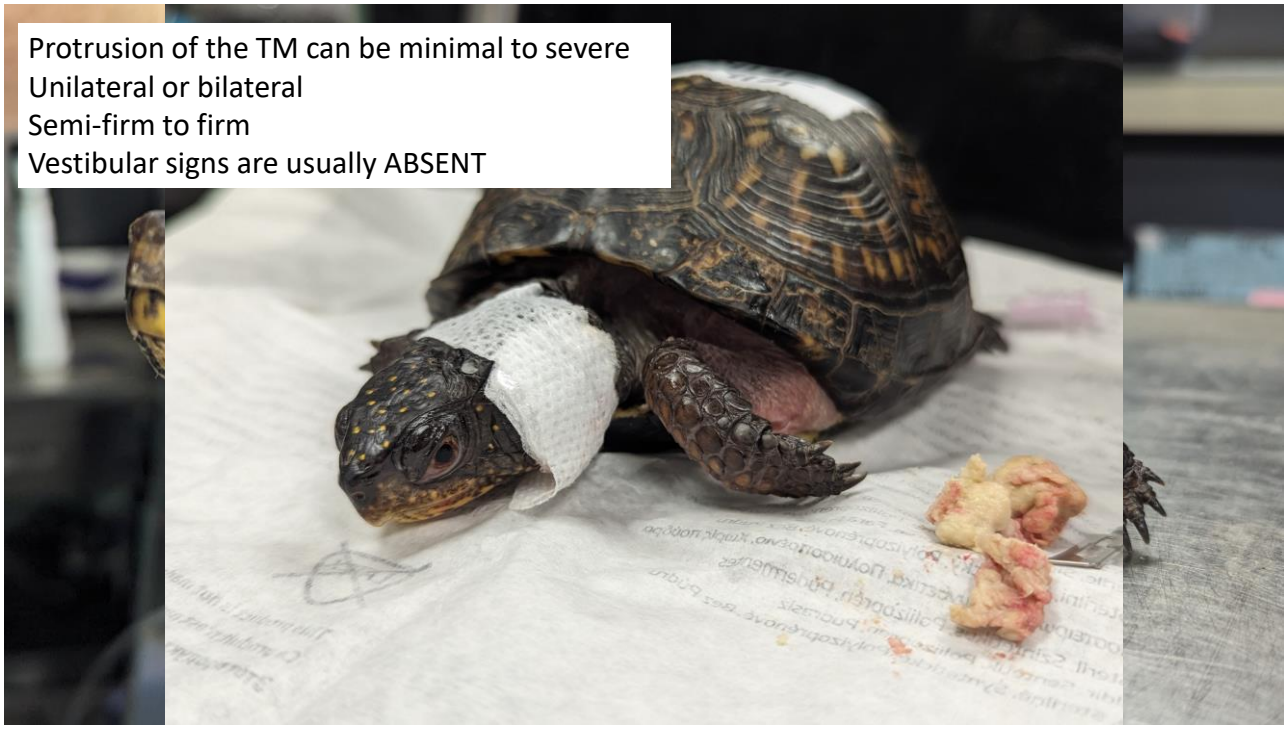


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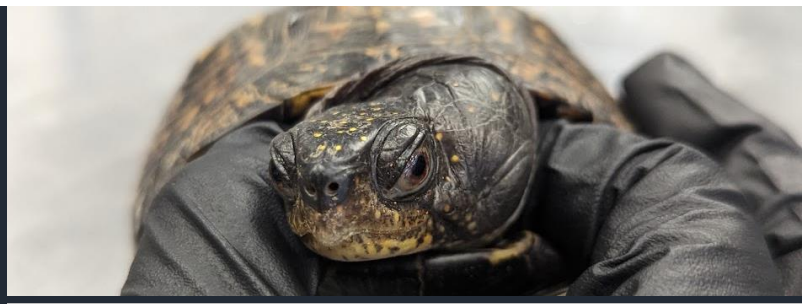
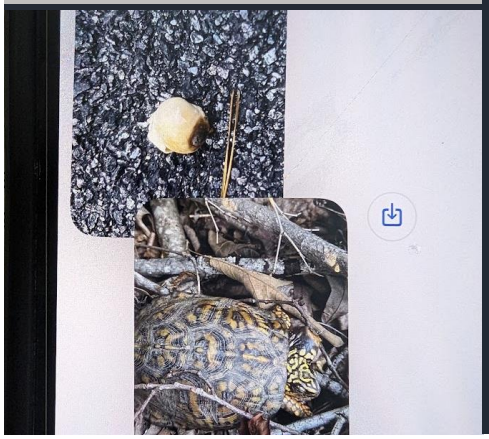
## Aural Abscess Clinical Presentation

Changes range from mild squamous metaplasia and hyperplasia to severe inflammation and osteolysis and remodeling of bone





Treatment:

- Surgical management

Aftercare

- Continue NSAIDs for 3-5 days post-op
- Antibiotics are usually not indicated
- Lavage daily: saline or betadine/saline, then apply TAO
- Will heal by second intention
- Address the suspected inciting cause. Diet? Vitamin A? Environmental?

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# AA Surgery Preparation

- Sedation/Anesthesia
- Prevent aspiration
  - Intubate and provide PPV via GA or Ambu bag
  - Pack oral cavity with gauze
  - Angle patient's head down when flushing
- Aseptic preparation
  - Dilute povidone iodine (not chlorohexidine)
  - Sterile saline
  - Alcohol should be avoided
- Local block → Lidocaine < 10mg/kg
  - Usually < 0.05mL/TM [20mg/ml]
- Surgical approaches vary
  - Horizontal incision
  - Cross incision
  - Partial incision
  - Complete excision of the tympanum (severe cases)
- Complications
  - Bleeding
  - Reoccurrence
  - Ascending infection

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# AA Surgery

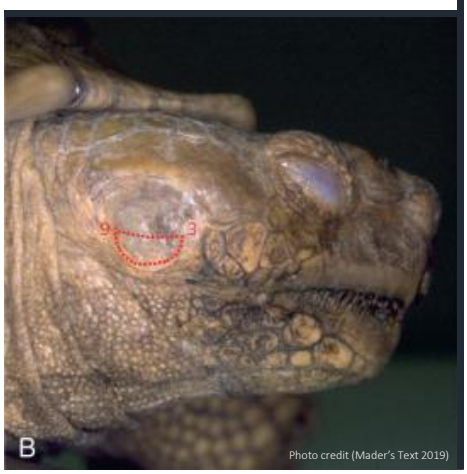

Photo credit (Mader's Text 2019)

**Materials**

- #11 or #15 blade
- Small ear loop curettes
- Fine tip Brown-Atson thumb forceps
- Cotton tip applicators/gauze +/- Gelfoam

**My preferred approach**

- Full thickness incision through the tympanum along the ventral border from ~3 to 9 o'clock
- Gently manipulate and remove the avascular caseous plug in a single ball using ear loop curettes
- Debride inflammatory tissue present in the tympanic cavity carefully to avoid damage to the columella bone
- Check that the Eustachian tube is patent
- Flush/lavage → remember to prevent aspiration!

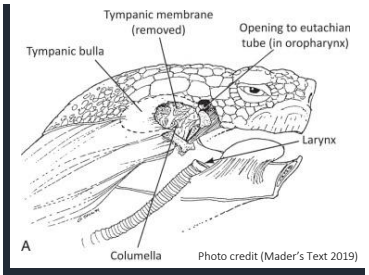

Photo credit (Mader's Text 2019)


Photo credit (Google Images)

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# General Reptile Surgery Tips

- Use **local blocks**
  - Lidocaine: Max of 10mg/kg is recommended to avoid toxicity
    - This is a generally accepted high dose as the toxic dose is currently unknown for different species of chelonians
- Reptile skin **INVERTS** after incision!
- Skin closure: **Everting suture patterns** (i.e. horizontal mattress)
  - Closing internal layers (muscle, other): Always choose an absorbable monofilament suture
  - Closing external layers (skin, sutures, other): Can use a non-absorbable or absorbable suture
- Healing is best if reptiles are maintained in their upper **POTZ**
- **Multimodal** pain therapy

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## Skin Closure: Everting Pattern Interrupted Horizontal Mattress Suture Pattern

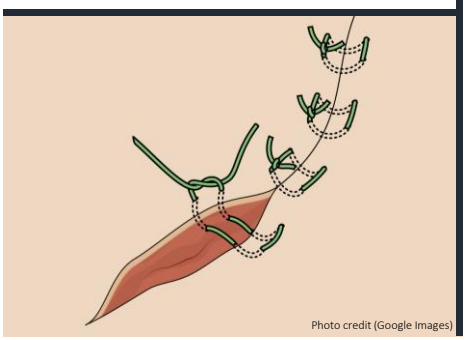

Photo credit (Google Images)

https://www.youtube.com/watch?v=6qF4mxB7KzM

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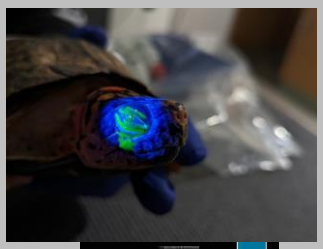
# Medications/Therapies

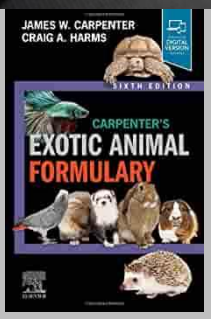
*There are many medications available. These are some of the most utilized medications at TRT.*

- Antibiotics:
  - Ceftazidime 20mg/kg IM q5d (turtles)
  - Amikacin
    - Nephrotoxicity
  - Oxytetracycline
    - DILUTE – TISSUE NECROSIS
  - Enrofloxacin
    - DILUTE – TISSUE NECROSIS
- NSAIDs:
  - Ketoprofen 2mg/kg IM q48h
  - Ketorolac 0.25mg/kg IM q24h up to 5 days
- Eyes:
  - NSAIDs: Diclofenac, Flubiprofen O/S
  - Antibiotics: NeoPolyBAC O/O, Ciprofloxacin, Ofloxacin O/S
  - Lubricants: Blink, Puralube, or OptixCare
  - Flush: Saline/eye wash

**Before using ocular steroids/NSAIDs check for corneal ulcers*

- Systemic Analgesia
  - Opioids
- Topicals
  - TAO
  - SSD
  - Honey
- Local analgesia
  - Lidocaine <10mg/kg SC max
  - Bupivacaine
- Sedation
  - Dexmedetomidine
  - Ketamine
  - Midazolam
  - Alfaxalone
  - Propofol
- Vitamin supplementation
  - Vitamin A (fat-soluble, oral) → Cod Liver Oil
  - Vitamin B Complex (injectable)
- Nebulization
  - Saline or medicated
- Therapies
  - LASER, Acupuncture, PT






*These are dosing recommendations, doses may vary.*
*Consult a veterinarian, research/literature, drug formularies prior to administration of any medications.*

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# Medicine administration

Routes of administration

- IM (intramuscular → into the muscle)
- SC or SQ (subcutaneous → under the skin)
- IV (intravascular → into the vein)

Location:

- Drugs should be administered in the cranial half of the body
  - Forelimb or pectoral musculature for IM injections
- SC Fluids → avoid the dorsal area between the neck and arms as this can lead to accidental fluid administration into the lungs

Always pull back before injecting to ensure there is negative pressure. If blood or excessive air is observed, remove the needle, reassess, and relocate.

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# Medication Tips!

Anyone using drugs in a patient should consider these important factors

General rule for location: give **IM/SC medications in the cranial half of the body** and avoid the caudal half due to hepatic first pass effect and the renal portal system!

ALWAYS!

- Label your syringes or give immediately to avoid mixing medications/patients
- Check your patient's weight
  - Is that weight a month old? Has it lost/gained weight? Adjust your dose!
- Recheck your doses!
  - Does it require dilution due to drug causing tissue necrosis?
  - Does it require dilution to achieve a measurable dose for a small patient
- Check recent literature/formularies or with a veterinarian for dosing available
- Know the route you are administering and document location
- Reassess your patient daily
  - Does it still require pain control, how long has it been on antibiotics, is it responding clinically?
  - Monitoring bloodwork (i.e. known nephrotoxic, hepatotoxic drugs, etc.)
  - Monitoring through imaging
- Withdraw times? Is this a potential food species? Check with FARAD!
- Drug degradation? Does it require refrigeration, freezing, light protection, disposal after X days of opening?

**If you don't know, ask!**

***Remember, no medication is given without risk***

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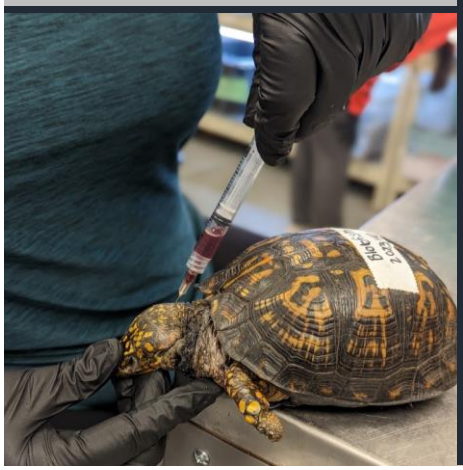
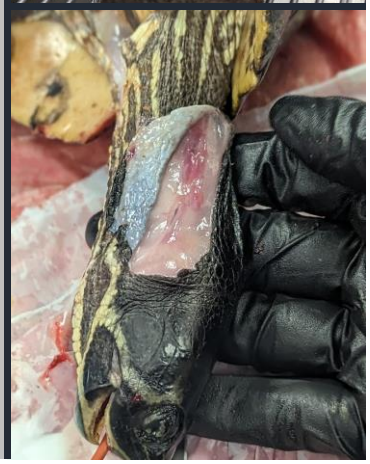
# Venipuncture



Before collecting blood, calculate the **volume needed** and **max volume that can be safely collected**

- **<0.05-1% of body weight (grams)**
- Very important in small and severe trauma/blood loss patients

- Locations:
  - Jugular vein
  - Dorsal coccygeal vein
  - Appendicular limb (femoral/brachial) veins
  - Subcarapacial sinus
  - Post-occipital sinus
- Materials: depends on location and turtle size
  - EBT: 1cc/25-27g +/- heparin
  - YBS: 1-3cc/23-25g +/- heparin
- In-house:
  - Glass slides → blood smear for manual CBC, hemoparasite analysis
  - Microhematocrit tubes → PCV/TS
  - Blood Tube (non-heparinized sample): Green top/heparin tube (not purple top/EDTA)
  - Chemistry: iSTAT or VS2 (check settings and rotor for temperature and species)
  - Lactate meter/strips



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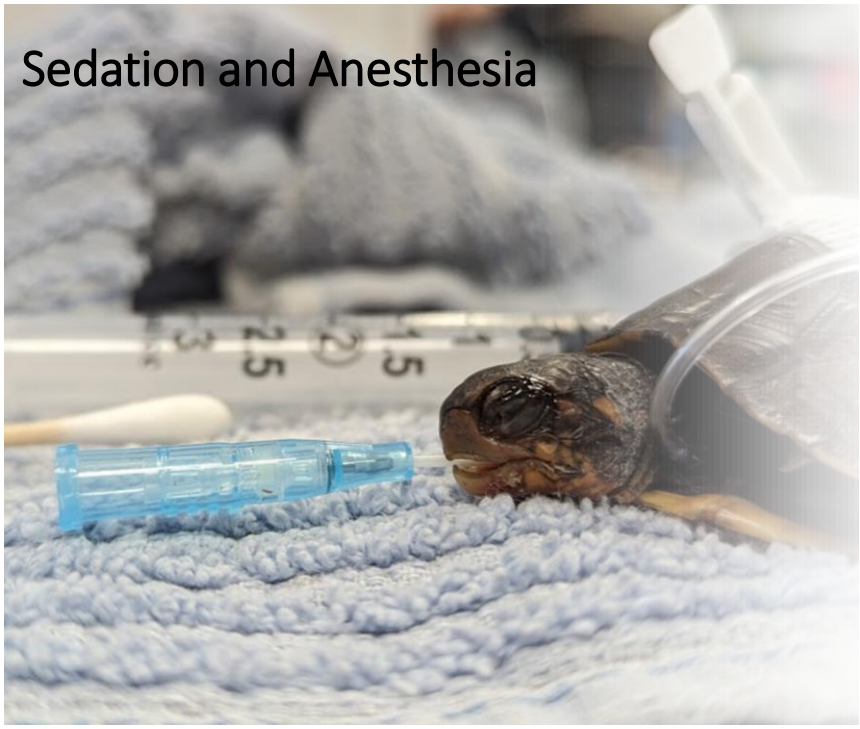

# Sedation and Anesthesia

Quality of sedation is HIGHLY variable in turtles

- Premedication / Induction
  - Dexmedetomidine
  - Ketamine
  - Midazolam
  - Alfaxalone
  - Propofol
- Induction / Maintenance: Gas inhalant with PPV using a non-rebreathing system
  - Turtles tolerate anoxia well and can hold their breath, making gas inhalant induction variable
- Intubation
  - Uncuffed tube
  - Very small patients may need a red-rubber catheter or IVC sheath to be used as an endotracheal tube
  - The turtles we work with often have a shorter trachea with early bifurcation
  - Secure with tape and support (i.e. tongue depressor) and/or bite guard (i.e. syringe case).
- Local block: Lidocaine < 10mg/kg max
- Eye lubricant
- Monitoring
  - Doppler
- Recovery
  - Reversal drugs
  - Ambu bag
  - Heat source

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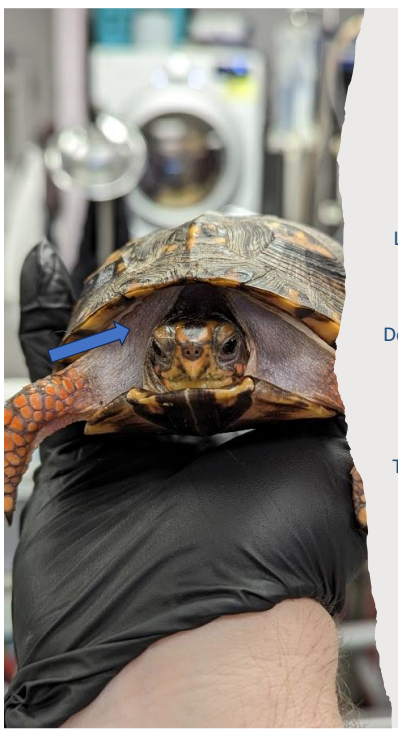


# Fluids and Hydration

**Difficult to detect early dehydration in turtles**

~10% Dehydrated if the eyes are sunken

(Interpret with caution → emaciation vs. dehydration)

LRS or Reptile Ringers (1 part LRS, 1 part 5% dextrose, 1 part 0.9% saline solution)

Amount of **SCF ~1-2% body weight**

Do not administer SCF in the shoulder region, as the lungs are right here!

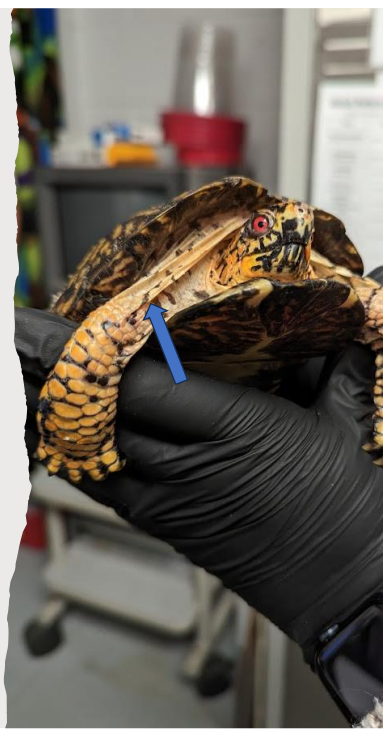
**Notes on dry-docked water turtles:**

They will have a degree of dehydration; fluids should be supplemented (SCF, PO, Soaking)

Monitor weight and clinical status

Water turtles will not eat out of water

Monitor for pressure sores and prevent development using yoga mats or towels for padding



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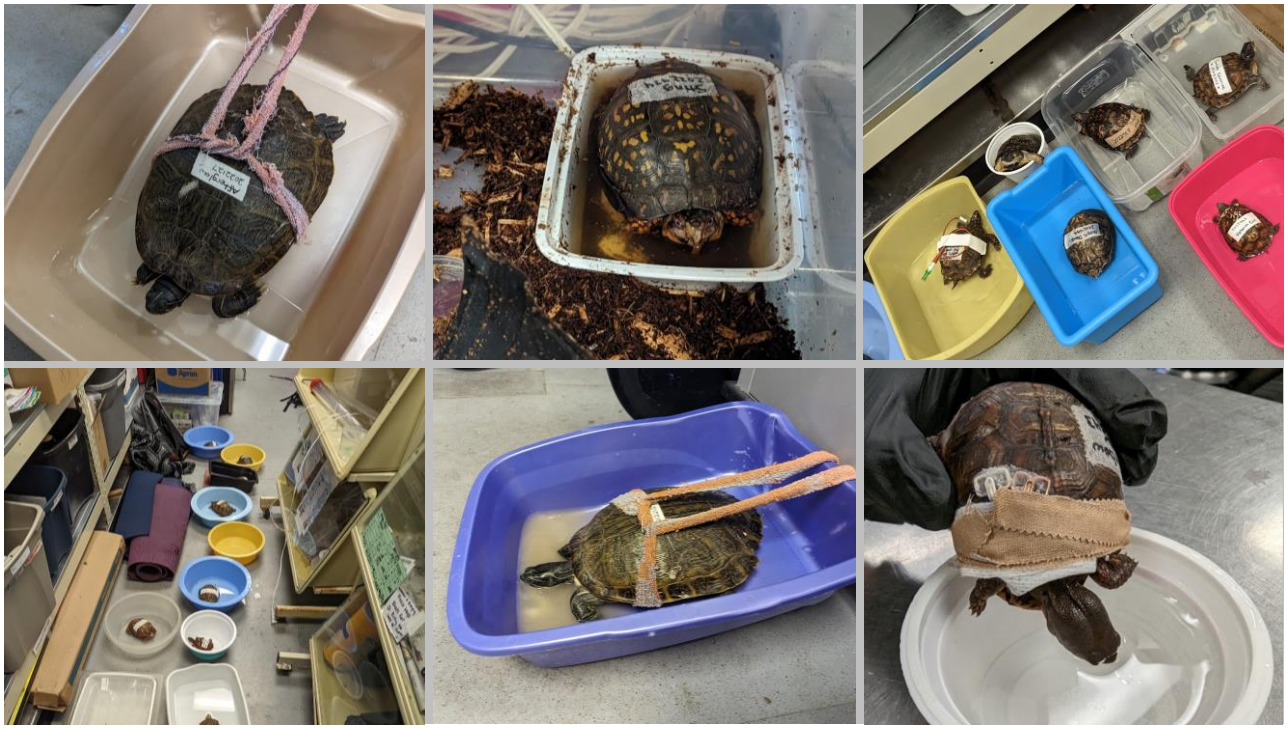

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# When to consider advanced feeding?

**Assist or Gavage Feeding**

- Not eating, losing weight, > 2 weeks without eating
- Assist feeding: Hemostats and mouth-opening instrument (guitar pick, spatula, other)
- Gavage feeding: Red-rubber catheter, syringe, mouth-opening instrument, cup set-up (for holding turtle)
- Most species/appetite stimulant; Vitamin B complex 25 mg thiamine/kg PO q 24 h ×3–7 d8

**Esophagostomy Tube Placement**

- Long-term, critical care, facial fractures, stressed/difficult patient, dry-docked aquatic turtles
- Surgical procedure; requires veterinarian/anesthesia
  - #15 blade
  - Curved hemostats
  - Suture/needle drivers
  - Red-rubber catheter
  - Tape

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# How much does my patient need to eat?

The stomach volume of most chelonians is estimated to be **~2% (20ml/kg)** of body weight.
- The maximum gastric volume for many reptiles is not known
- Stomach volume is reduced with anorexia

Gavage or Esophageal tube feeding:
- Start with **~5ml/kg/feeding (~0.5%)** and slowly increase volume over several days to weeks
- If material is observed in the oral cavity during feeding:
  - Stop feeding, clean the oral cavity, and give the patient a break.
  - Reassess volume vs. speed of administration vs. other.
- Too large volume or too rapid administration risks
  - Regurgitation → aspiration pneumonia → death
- Multiple small feedings >> one large feeding

Anorexic: consider referral for esophagostomy tube placement and intensive nutritional management

Daily maintenance energy/calorie requirement (MER) can be estimated: **10 ($BW^{0.75}$)**
- BW is in kilograms. Units: kcal/day.
- Based on temperature ~86°F (30°C) (Donaghue 2006)
- Caloric needs increase with shell trauma (Donaghue 2006). Bone makes up 15-30% of body weight and requires energy for repair!
- Calculate MER for a 500g EBT
  - MER: 10 (BW^0.75) = 10 x 0.594 = ~6 kcal/day MER
  - Stomach volume: 500g x 0.02 = 10mL
  - General conversion: 1 tablespoon (3 teaspoons) = ~ 15mL
  - Check your critical care formula's directions and kcal contents

There isn't a "one size fits all" formula, and certainly more research is needed as we have ~12,000 species of known reptiles, all unique! K constants may vary based on species/needs.

Other formulas and factors are based on species, life stages, patient requirements, and environmental factors, so consulting with your veterinarian or referral of critical cases is often recommended.


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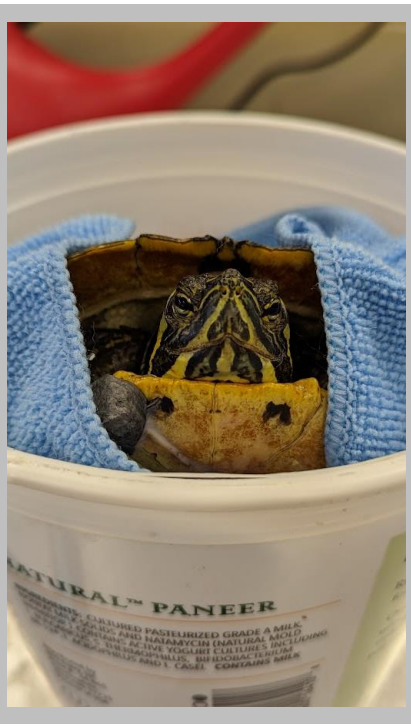


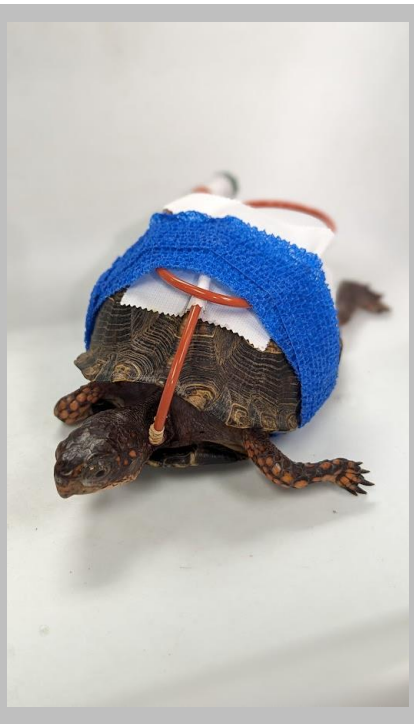


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# Euthanasia

- Sedation:
  - Propofol IV
    - Pros: Typically has a rapid effect with sedation immediately or a couple of minutes after IV administration.
    - Cons: Cannot be given IM. Once opened, Propofol cannot be used in surgical patients due to bacterial growth.
  - Dexmedetomidine or Alfaxalone have provided the second most reliable sedation for euthanasia
    - Pros: Ability to administer IM or IV.
    - Cons: Higher cost. May have less reliable absorption or longer duration until the turtle is sedated in compromised patients.
- Euthanasia:
  - Overdose of barbiturate anesthetic agent
  - Euthasol (pentobarbital sodium and phenytoin sodium):
    - IV is the preferred route
    - May also be administered ICe and intrahepatic
- Secondary Method:
  - Confirm lack of heartbeat (Doppler): Listen for ~5min
  - Physical method: Pithing, Decapitation, Bilateral jugular laceration
- Head trauma and extreme blood loss cases are typically more challenging
- Quick math for Propofol/Euthasol: The patient's body weight in kg = volumes of propofol and euthasol for administration (overcalculation, but effective)
  - I.E. 300g EBT → 0.3kg → 0.3mL of Propofol and 0.3mL (10mg/kg) of Euthasol (~390mg/kg)
- Refer to AVMA Guidelines on Euthanasia : https://www.avma.org/resources-tools/avma-policies/avma-guidelines-euthanasia-animals

**AVMA Guidelines for the Euthanasia of Animals: 2020 Edition***

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# When to refer?

- Concern for dystocia; a female is seeking to nest and has not produced eggs (especially if there is spine or pelvic trauma), lethargic, anorexic, other
  - Check that husbandry requirements such as a nesting box or substrate are appropriate too
- Severe injuries that may require CT scan or advanced surgery
- If you are unsure or want recommendations contact the TRT pager or email.
- We are here to help!

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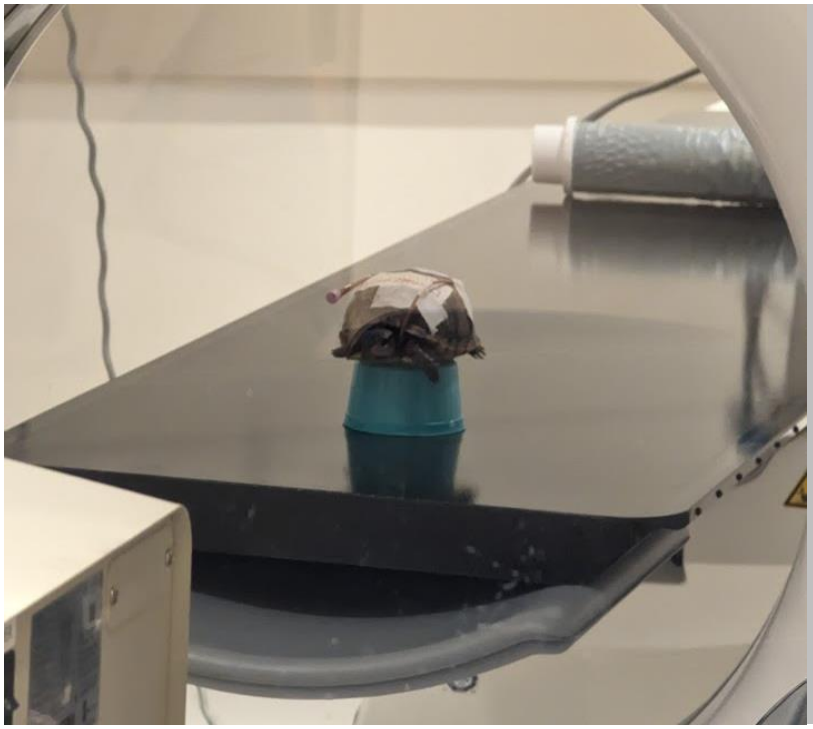

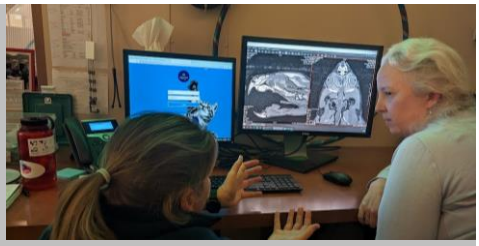

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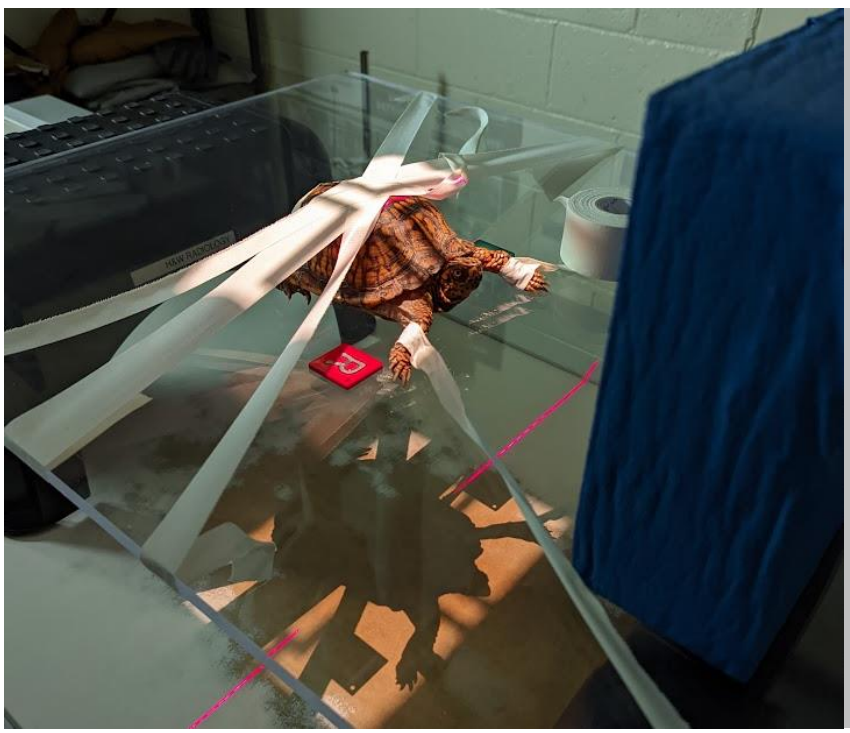

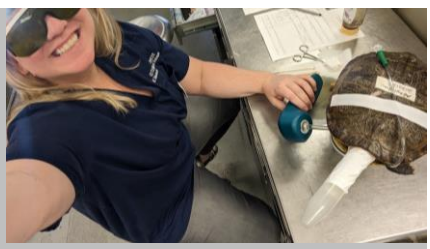

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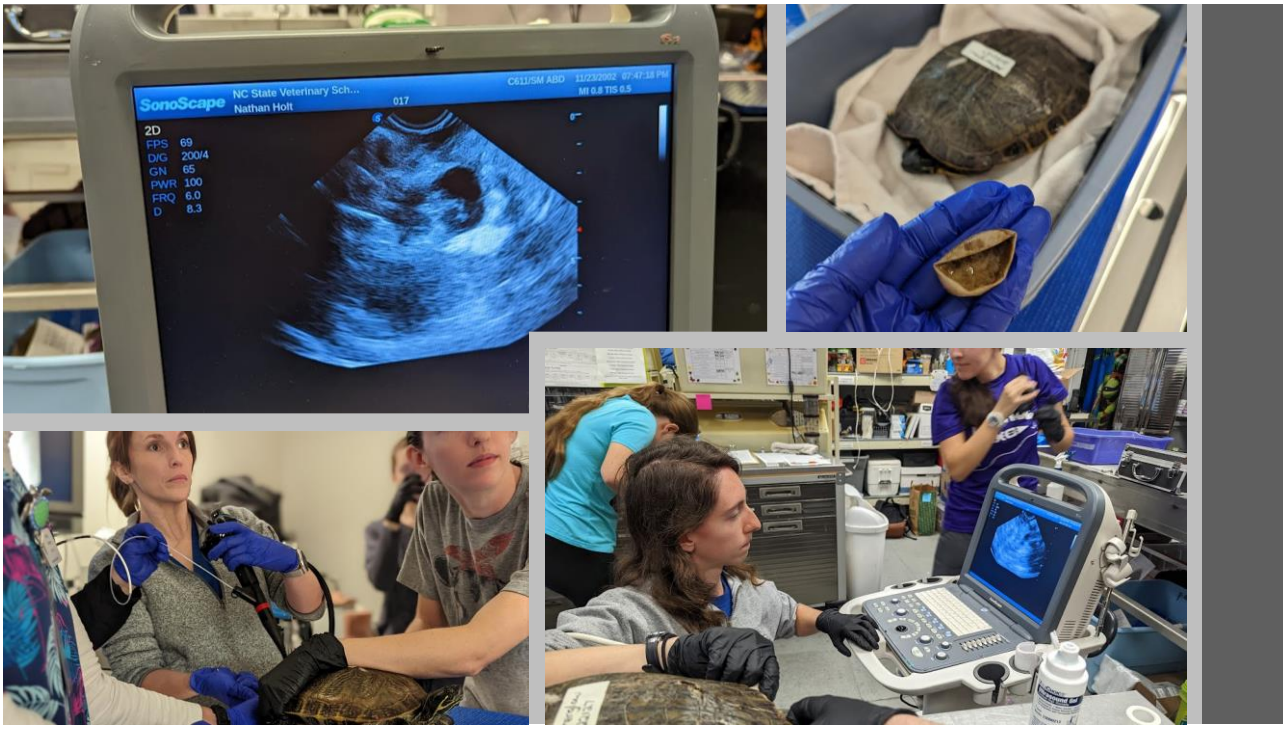
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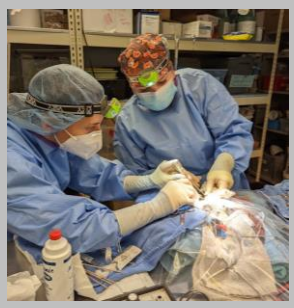

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**THANK YOU ALL for everything you do for wildlife!**

**Turtle Rescue Team:**
**Call**: 919-397-9675
**E-mails**: turtle-rescue-team@ncsu.edu
**Address**:
1060 William Moore Dr.
Raleigh, NC 27607

*As a student-run non-profit organization, the students and volunteers are the heart of TRT!*

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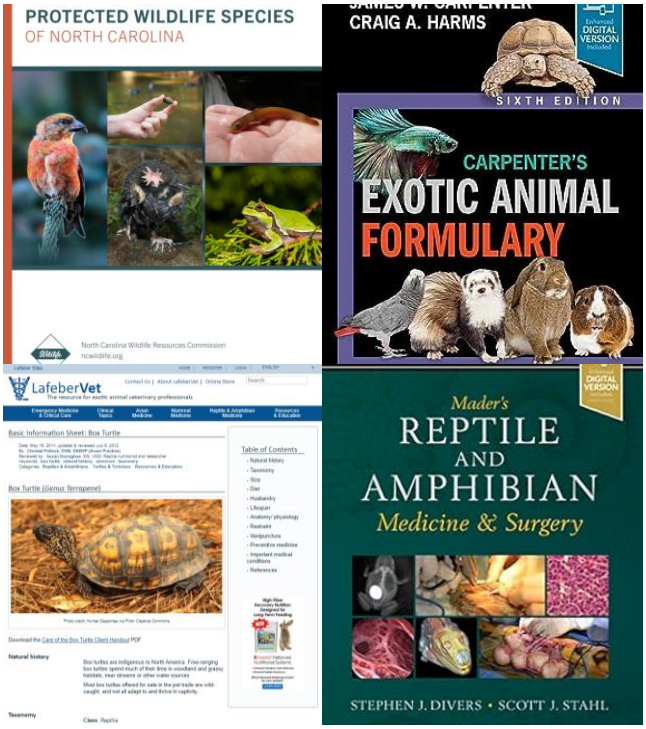
# Helpful Resources

- NCState CVM's Turtle Rescue Team: https://cvm.ncsu.edu/outreach/resources/turtle-rescue-team/
- Turtle Ally Certificate Program Course: https://turtleallyprogram.wordpress.ncsu.edu/access-modules/
- Association of Reptile and Amphibian Veterinarians (ARAV): https://arav.org/
- Journal of Reptile Medicine and Surgery: https://meridian.allenpress.com/jhms
- Mader's Textbook on Reptile and Amphibian Medicine and Surgery
- Carpenter's Exotic Animal Formulary (Currently on 6th edition)
- Lafeber Vet: https://lafeber.com/vet/
- Oxbow Vet: https://lafeber.com/vet/
- EmerAid Vet: https://emeraid.com/vet/
- North Carolina Wildlife Recourses Commission: www.ncwildlife.org
- NCWRC Protected Wildlife Species of North Carolina: https://www.ncwildlife.org/Portals/0/Conserving/documents/Protected-Wildlife-Species-of-NC.pdf
- Turtle Survival Alliance: https://turtlesurvival.org/programs/aza-safe/
- Association of Zoos and Aquariums Turtle Conservancy: https://www.turtleconservancy.org/news/tag/AZA
- Wildlife Disease Association: https://www.wildlifedisease.org/PersonifyEbusiness/Home

Turtle Rescue Team
NC State University

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