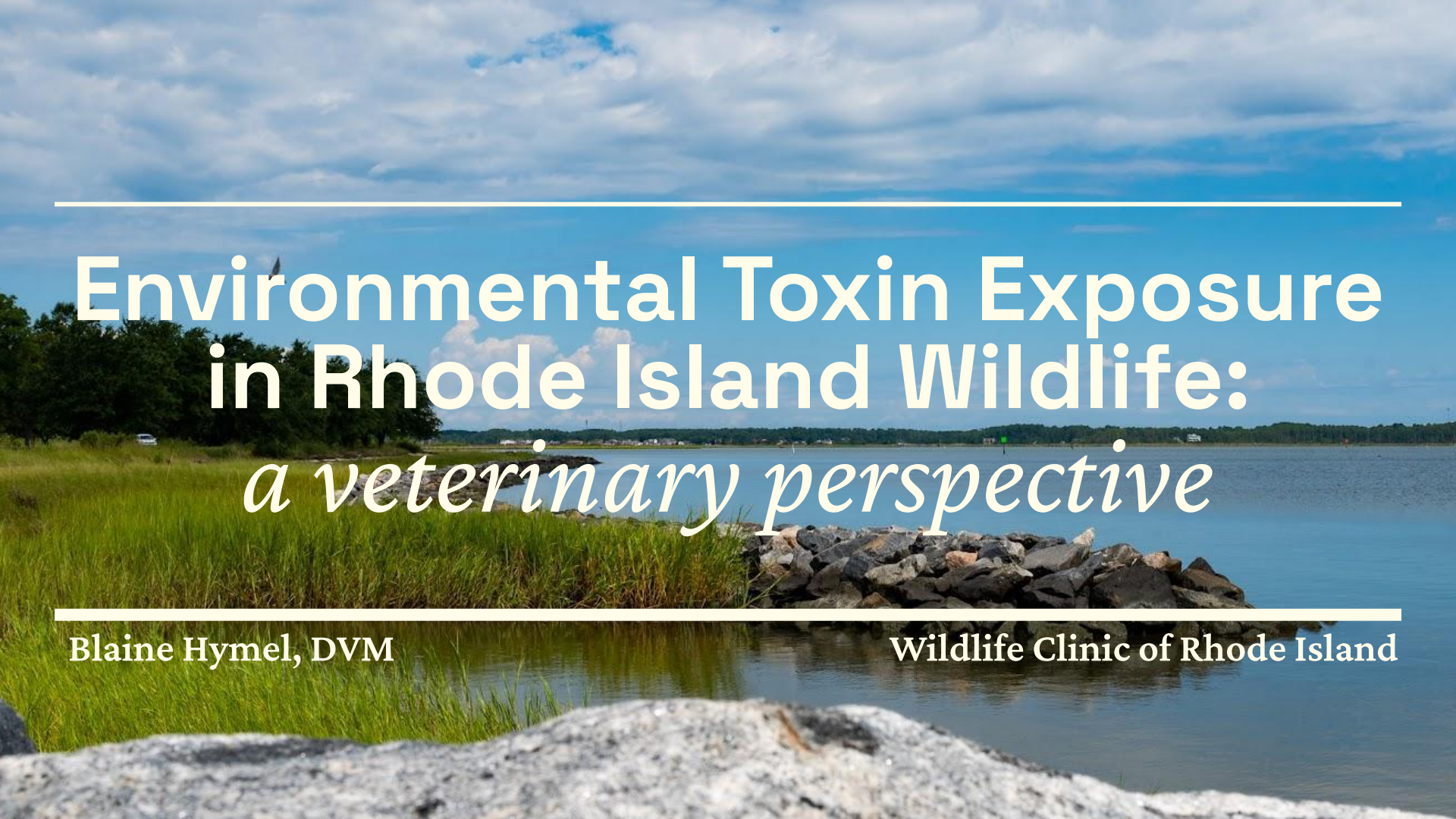


Environmental Toxin Exposure in Rhode Island Wildlife: *a veterinary perspective*

Blaine Hymel, DVM

Wildlife Clinic of Rhode Island

Outline

Introduction:

- The Wildlife Clinic of Rhode Island
- Me, Myself, & I

Common Toxins:

- Natural vs human-made environmental toxins

Deep Dive Into:

- Pesticides - *Rodenticide*
- Heavy Metals - *Lead*

Solutions?

- Educate + Advocate for safer alternatives
- Soil testing + remediation
- Integrative Pest Management

About us

The Wildlife Rehabilitators Association of Rhode Island (d.b.a. Wildlife Clinic of Rhode Island) is a non-profit organization that provides emergency and long-term care to wildlife and serves as a comprehensive support center for wildlife rehabilitation across the state.





- Licensed for all species of native wildlife except marine mammals, sea turtles, and adult deer. We provide care for 6,600+ injured and/or orphaned animals annually.

- As the only wildlife veterinary hospital in the state, we provide essential veterinary services, including diagnostics (x-rays, bloodwork, disease testing), surgery, medications, specialized wildlife formulas/feed and training opportunities at no cost to individual rehabbers partnered with us.


WILDLIFE
CLINIC of RHODE ISLAND


Outdoor Enclosures


Raccoon Enclosure


Large Flight Cages

About us

Wildlife Clinic of RI is Open Daily

Weekdays 9-5; Weekends 9-1
Extended Summer Hours

Wildlife Hotline: (401) 294-6363

We are always looking for additional volunteers and rehabilitators!

About me

- 2013: Volunteer at Wildlife Clinic of RI
- 2014: Licensed home rehabilitator
- 2016: Wildlife Clinic Staff (continued on through second year of vet school)
- 2017: BS from University of Rhode Island
- 2018-2022: Cummings School of Veterinary Medicine at Tufts University
- 2022-2023: Small Animal Rotating Intern at Bulger Veterinary Hospital
- 2023-2024: Associate Veterinarian in Primary Care and Emergency Medicine 2023-2024
- 2024-Present: Full time Lead Wildlife Veterinarian at the Wildlife Clinic of RI



Let’s talk toxins

Toxins vs Toxicants

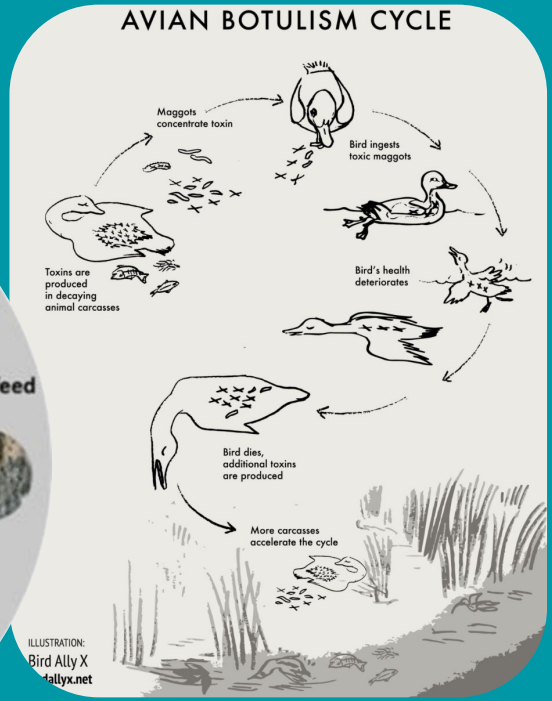
Naturally occurring toxic chemical substances produced by plants, animals, fungi, bacteria that may cause harm to other organisms.

Synthetic or human-made toxic chemical substances introduced into the environment that may cause harm to organisms.

Naturally Occurring Environmental Toxins

Cyanobacteria

Mycotoxins



Botulism

Clinical Signs

Botulism affects the duck's peripheral nerves, resulting in paralysis throughout several body areas.

Attempting to move using it's wings.

Not able to hold head upright (has a limbneck)

Difficulty taking off to fly or going under water.

Droopy eyelids

PoultryDVM

Introduced Environmental Toxins

Petroleum

Heavy metals*

Herbicides + Pesticides


Houston
New Orleans
Jacksonville
BP / Deepwater Horizon Spill
Tampa
Miami
Deep Water Horizon Spill
SKYTRUTH

Deep Water Horizon Spill

Total number of birds affected from the oil spill:

- 1400+ live birds taken into care
- Roughly 5000 dead birds collected, where ~35% were visibly oiled

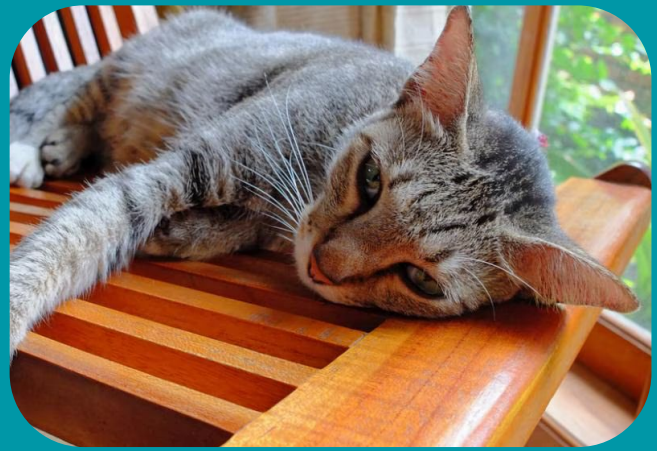
TRI-STATE
BIRD RESCUE &
RESEARCH

INTERNATIONAL
BIRDRESCUE
EVERY BIRD MATTERS™

Deep Water Horizon Spill

Organophosphate (Insecticide) Toxicity

- **MOA:** Interfere with a brain enzyme that breaks down the neurotransmitter acetylcholine
- **Clinical Signs:** Drooling, miosis (constricted pupils), frequent urination, diarrhea, vomiting, difficulty breathing, tremors, weakness, loss of coordination, seizures, respiratory distress, collapse, and death due **to** respiratory muscle paralysis.
- **Diagnosis:** Typically based on clinical signs; analysis of stomach contents ($)
- **Treatment:** Receptor-blocking agents (atropine), cholinesterase reactivators (pralidoxime chloride), and drugs to decrease absorption.



Most common toxins clinically impacting our wildlife?

Rodenticides
(Pesticide)

Lead
(Heavy Metal)

Rodenticide Toxicity

Rodenticides

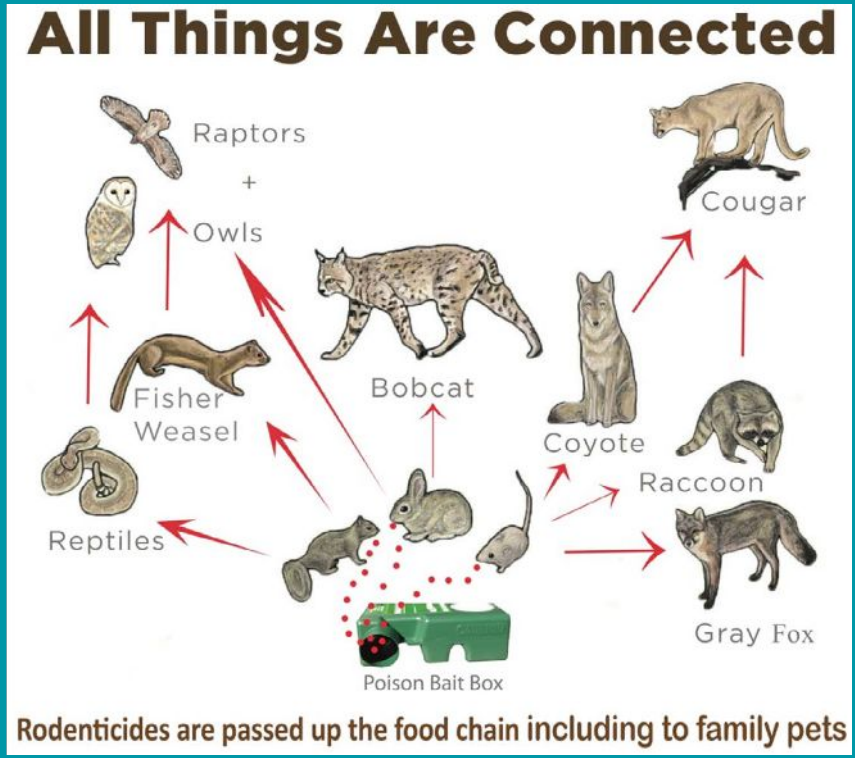
- Pesticides designed to kill rodents (aka rat poison, rat bait)
- Different mechanism of action between types of rodenticides
    - Different types may all look similar
    - Bars are the most common type of bait + often green in color
    - **Knowing which type an animal was exposed to is *crucial* for treatment!**

- Common types in North America include:
    - **Anticoagulants***
    - Neurotoxins
    - Cholecalciferol

Relay Toxicosis (secondary exposure)

Occurs when an animal with poison in its system is consumed by another animal - meaning ***poison is passed up the food chain***!

- **Target species** (intended species)**:** Rats, mice who ingest the bait - Eating the bait is *primary exposure*.
- **Non-target species:** Rabbits, squirrels, dogs, etc. that ingest the bait (*primary* exposure); raptors, carnivores, or cats who ingest a poisoned animal (*secondary exposure*)



Cholecalciferol rodenticide

- Causes an overdose of vitamin D3 which disrupts the calcium/phosphorus ratio in the body, leading to soft tissue mineralization and organ dysfunction
- While acute relay toxicity hasn't been documented, chronic ingestion of affected prey has been shown to lead to mild reversible signs
- Difficult to appropriately diagnose and treat in wildlife, but is seen in pets

Clinical signs: Anorexia, weakness, vomiting, increased thirst and urination, dehydration, widespread mineralization of soft tissues, kidney failure, cardiovascular abnormalities

Diagnosis: Chemistry profile, vit D levels, +/- toxin panel

Treatment: Phosphate binders, steroids, supportive care, long-term management for severely affected domestics

Neurotoxins (Bromethalin)

- Intended to cause death after a single dose (not always the case)
- Cause neurological signs due to swelling in the brain, spinal cord, and interference of nerve conduction

2023: Tufts Wildlife Clinic is first to show bromethalin bioaccumulates in owls and hawks. It may or may not cause issues in each individual raptor (*we still have plenty to learn!*)

Clinical signs: Acute onset of weakness, tremors, seizures

Diagnosis: Clinical Signs? Send out toxin panel?

Treatment: Supportive care, anticonvulsants?

Anticoagulants

- Interferes with blood clotting by affecting vitamin K
  - Results in **delayed death via hemorrhaging**

- First generation anticoagulant rodenticides (FGARs)
  - Extensive use lead to development of genetic resistance - no longer used (e.g. warfarin)

- **Second generation anticoagulant rodenticides (SGARs)**
  - e.g. brodifacoum, bromadiolone, difenacoum
  - Used worldwide, very popular in rat bait boxes
  - **More potent** than FGARs due to a higher affinity for binding sites in liver, which increases toxicity, persistence, and accumulation
  - Death is **prolonged** after ingestion, many rodents may survive for days-weeks

SGAR Toxicosis


Flo Tseng, Tufts Wildlife Clinic


Aycardo Veterinary Center

- Typically due to bioaccumulation of brodifacoum either through primary ingestion (in rats, squirrels, etc.) or secondary exposure (in raptors, carnivores)
  - *SGARs have even been identified in insects, snails, and slugs!*
- **Clinical signs:** Pale mucous membranes, weakness, bruising, blood accumulation in body cavities (mammals), and/or prolonged bleeding from wounds, mouth, or nose
  - *Immune suppression may result in development of secondary infections (e.g. mange)*
- **Diagnostics:** Clotting times, packed red cell volume (PCV), x-rays, +/- CBC/Chem, toxin panel

SGAR Treatment in Wildlife

- ***Vitamin K1*** injection or oral depending on severity
- Supportive care (fluid resuscitation, nutritional support)
- Supplemental oxygen if anemic or respiratory distress
- Treat secondary infections and/or injuries (abx, pain meds)
- +/- Blood transfusion in severe cases

Great Horned Owlet

Trauma with suspected SGAR toxicity

Treated with pain meds, vitamin K, SQ fluids, tube feeding

Great Horned Owlet

After 48 hours of treatment:

Passed a large pellet!
Bruising is improving
Much more alert

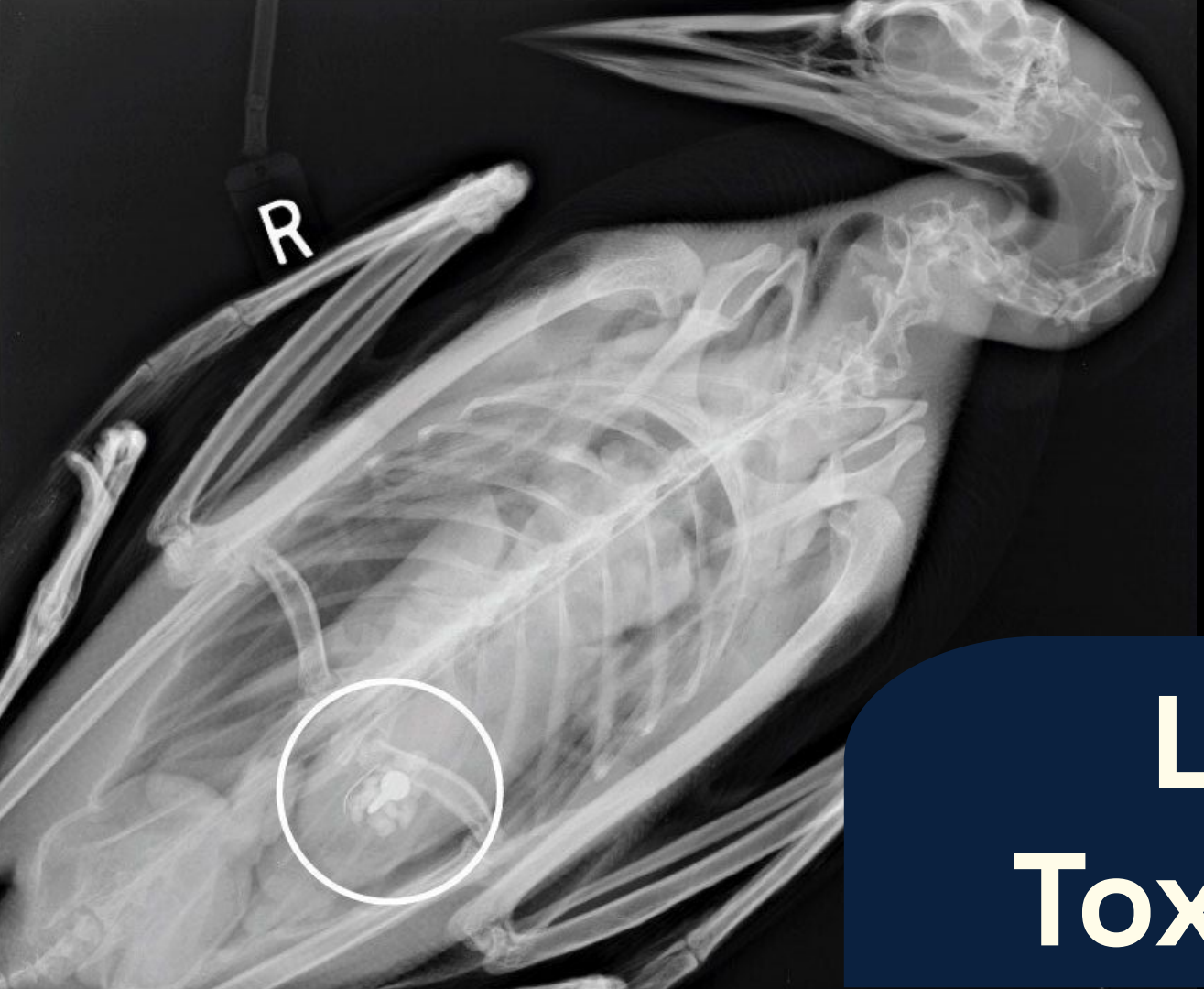
Widespread Effects of Chronic SGAR Exposure:

- Rats with exposure are more likely to harbor zoonotic diseases such as leptospirosis, which can make us, and our pets, critically ill

- Nearly all raptors have levels of SGAR indicating Widespread exposure
  - 100% of tested Red-tailed hawks (TWC, 2020)
  - 83% of bald eagles (nationally)

- 84% of tested fishers in New England had detectable levels of at least one rodenticide

- Mange is more likely to occur in foxes with rodenticide exposure



Lead Toxicosis

Lead Exposure

Soil (+ earthworms)

Hooks, Jigs + Sinkers

Ammunition

Lead Exposure

- Exposure in wildlife **primarily occurs through ingestion of lead**
  - *Rarely*, lead shot imbedded in bone can leach into blood supply

- **Seabirds, Turtles:** Ingest lead sinkers, jigs or hooks

- **Carnivores, Raptors, Scavengers:** Consume prey injured or killed by lead bullets + ingest that lead *or* by relay toxicosis (small mammals with high values, no lead particles)

- **Other Species:** Consume soil/earthworms in contaminated areas; lead paint particles, shiny objects (corvids)

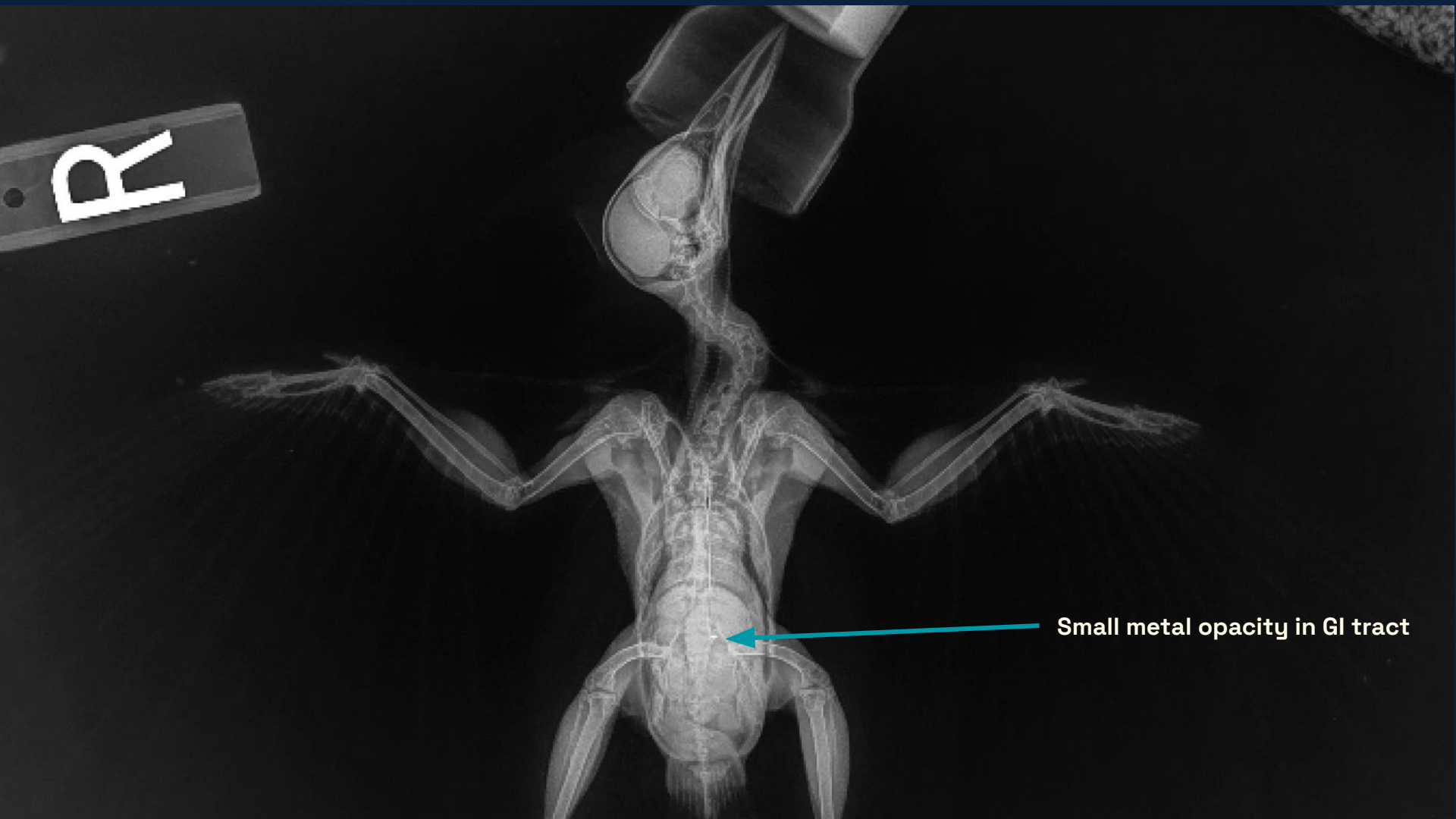
Ingestion of Lead

- Once ingested, lead is broken down in the stomach by the combination of its grinding action and stomach acid
- Absorbed across the GI mucosa and attaches to metal binding protein for distribution through the body – can be stored in bone and soft tissues.
- Circulating levels accumulate either by the ingestion of a large amount in a short period of time or the cumulative effect of chronic ingestion of small amounts (prey with high lead levels - relay toxicosis).
- Once above toxic threshold, **the nervous system + bone marrow** are affected leading to development of clinical signs

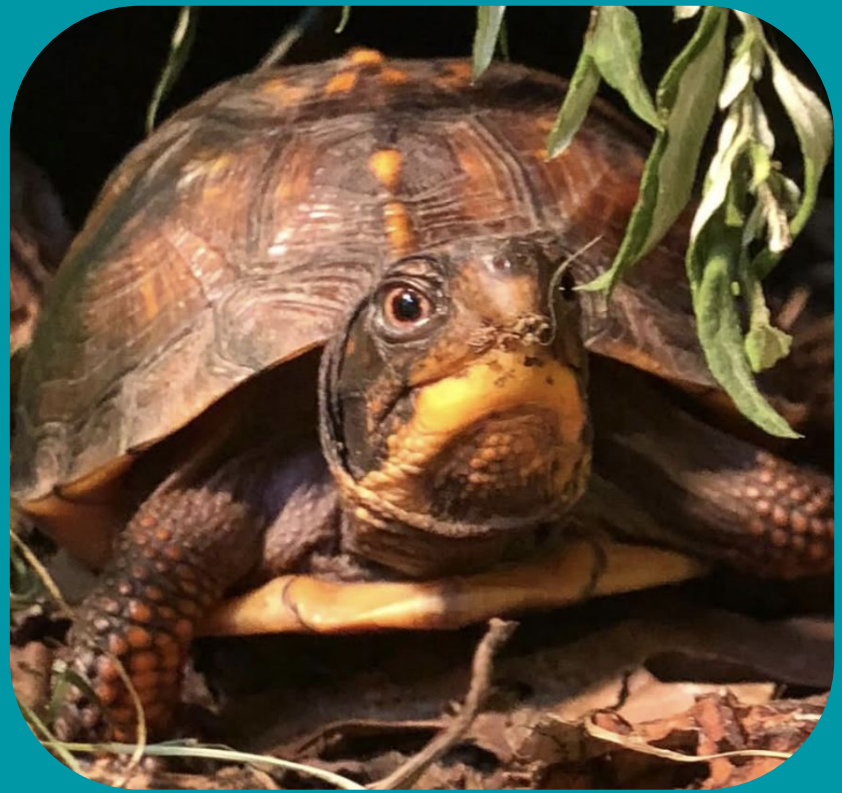
Clinical Signs of Lead Toxicosis

- **Neurologic:** incoordination, stargazing, seizures, blindness, circling, twitching or tremors
- **Musculoskeletal:** weakness, inability to fly, droopy posture, delayed fracture healing
- **GI tract:** crop stasis, regurgitation, vomiting, inappetence
- **Reproductive:** Possible egg retention

Diagnosis: Lead testing (in-house), bloodwork (PCV/TS, +/- CBC/chem), x-ray to look for metal in GI tract


R
Small metal opacity in GI tract


Small metal opacity in GI tract
(superimposed over femur)



Eastern Box Turtle 24-5481
Found in Coventry; in care for right hind limb fracture due to unknown trauma.

No metallic objects were noted in his GI tract on initial x-rays, but due to delayed healing of his fracture, lead was tested and demonstrated exposure!

He is currently undergoing chelating therapy.

Lead toxicosis treatment

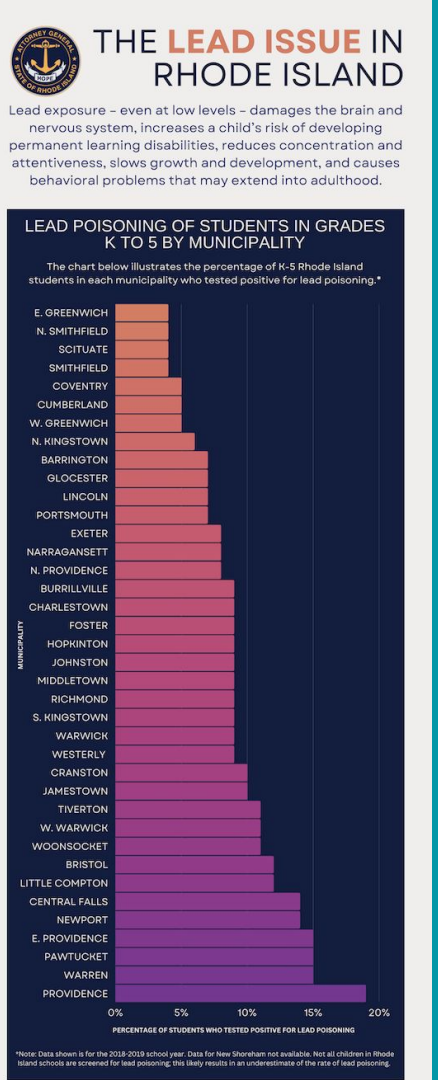
- Supportive care - fluids, nutritional support as needed
- ***Chelation therapy (Calcium EDTA, DMSA)*** **-** bind lead
  - treatment length varies based on clinical signs and lead level
  - Repeat doses may be needed
- Removal of lead from GI tract
  - i.e. endoscopy, gastric lavage, surgery, and/or fiber rich foods (e.g. Metamucil) to encourage GI motility

Effects of Lead in our Environment:

- Millions of birds die annually worldwide from lead. In the US alone, 1.5-3 million waterfowl (this # is *not* counting our raptors, mammals, songbirds, etc.)

- Even **low levels** of lead can delay bone healing, impact reproduction, and overall immune health in our wildlife

- Human health issues can occur from lead exposure - may occur by ingesting hunted animals with high lead levels (squirrels, ducks, geese), consuming backyard poultry or eggs from contaminated areas, gardening in soil with high levels etc. - *many human health implications, especially in children!*



How do we prevent toxicities in our wildlife?

Research, Educate + Advocate for Safer Alternatives


Decreasing Lead in
our Environment:

To protect our wildlife, switch to lead alternatives for hunting and fishing.

Fishing Alternatives

- Purchase fishing tackle made of tin, tungsten, steel, epoxy, etc. *instead* of lead

- Support the small businesses selling *only* non-lead fishing tackle - *see on Loon Preservation Committee*

Additionally:

- Double check knots to decrease the likelihood that tackle will break off

- Collect any damaged fishing tackle for proper disposal away from waterways

Regulations:

Recent regulations passed in *other* states (none in RI yet):

- **Maine:** Phasing out the sale and use of small-sized painted lead jigs
- **Massachusetts + New Hampshire:** Banned lead sinkers, weights, and jigs weighing less than 1 ounce
- **Vermont:** Banned all lead sinkers

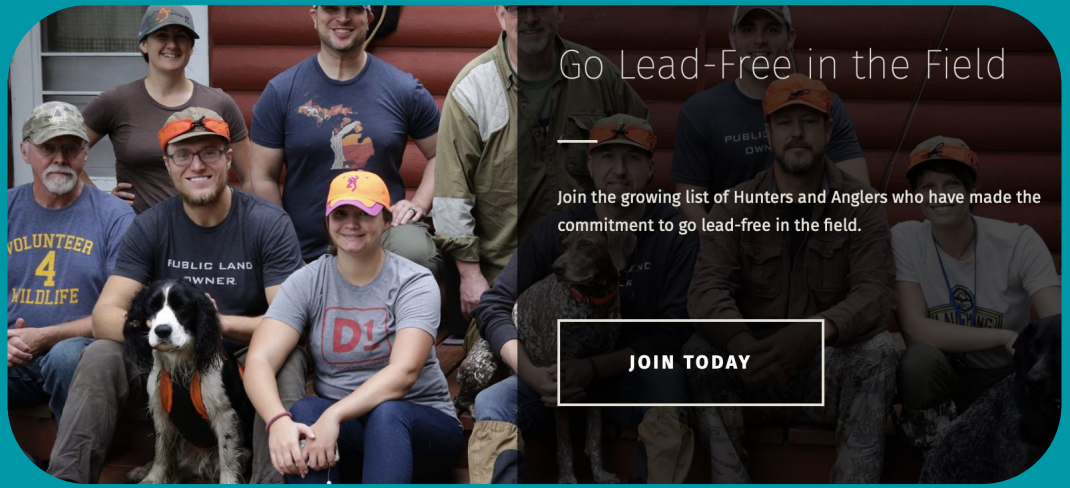
Hunting Alternatives

Alternatives Include: Steel, Bismuth, Tungsten, Solid Copper, Copper Alloys

There is no identical substitute for lead shot, but the alternatives work just as effectively if you follow these simple rules:

- *Steel – increase shot size by at least two sizes and consider reducing your choke*
- *Bismuth – increase shot size by at least one size*
- *Tungsten – use as lead*

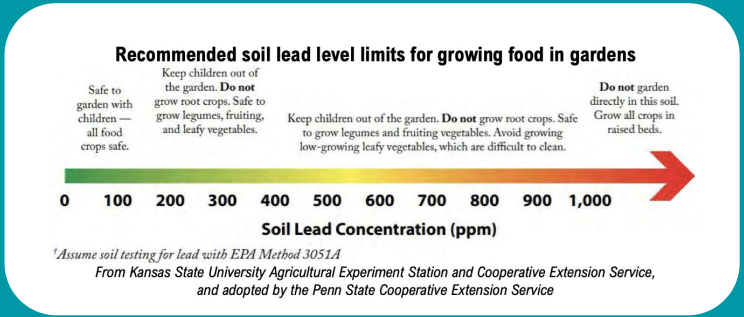
- **Lethality:** Field trials demonstrated no difference in number of birds killed per shot or wounded per shot between lead and steel bullets.



Soil Testing

- Especially important if buildings on property were built before 1978 (lead paint), plan on raising chickens, planting a garden, and/or have young children playing outside. Send to a certified lab yourself or hire a professional lead inspector.

- **If levels are high, consider soil remediation through a professional service.** This may consist of several methods to reduce lead levels including removing and replacing top soil, using heat or chemicals to immobilize or remove lead, or biological methods using specific plants to remove the lead.



Rodent Control *without* Rodenticides:

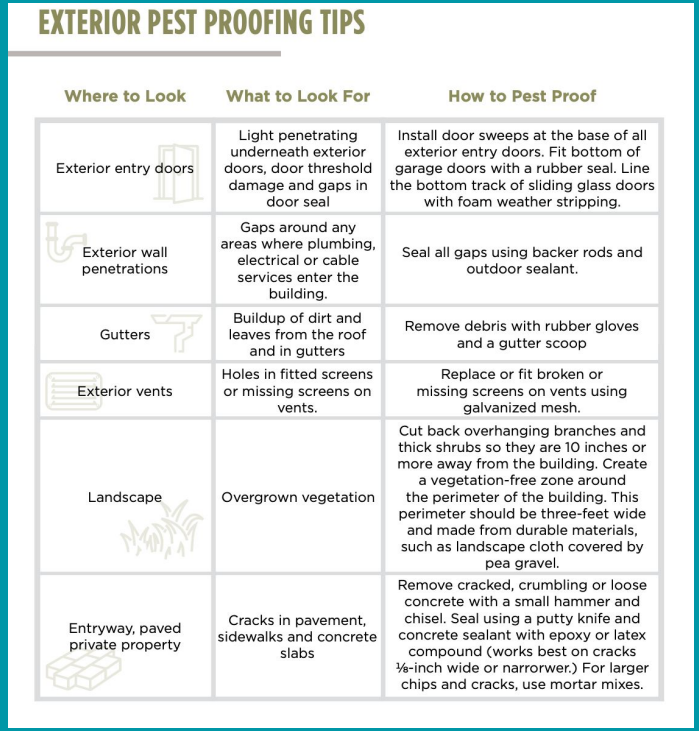
Integrative Pest Management (IPM)

Rodenticides *poorly* control rodent populations. Integrative pest management utilizes multiple strategies to make your environment less favorable for rodents.

1. Exclude: Rodents look to set up homes where favorable space is available (warm and safe)

- Remove yard debris, dense ivy and ground covering
- Seal any cracks, holes or openings larger than a quarter (especially around pipes) on the exterior of your house with concrete, metal, Stuf-fit Copper Mesh Wool, etc. to prevent rodents from entering your home or shed.

Rodent Ready! - City of Providence



EXTERIOR PEST PROOFING TIPS

Where to Look	What to Look For	How to Pest Proof
Exterior entry doors	Light penetrating underneath exterior doors, door threshold damage and gaps in door seal	Install door sweeps at the base of all exterior entry doors. Fit bottom of garage doors with a rubber seal. Line the bottom track of sliding glass doors with foam weather stripping.
Exterior wall penetrations	Gaps around any areas where plumbing, electrical or cable services enter the building.	Seal all gaps using backer rods and outdoor sealant.
Gutters	Buildup of dirt and leaves from the roof and in gutters	Remove debris with rubber gloves and a gutter scoop
Exterior vents	Holes in fitted screens or missing screens on vents.	Replace or fit broken or missing screens on vents using galvanized mesh.
Landscape	Overgrown vegetation	Cut back overhanging branches and thick shrubs so they are 10 inches or more away from the building. Create a vegetation-free zone around the perimeter of the building. This perimeter should be three-feet wide and made from durable materials, such as landscape cloth covered by pea gravel.
Entryway, paved private property	Cracks in pavement, sidewalks and concrete slabs	Remove cracked, crumbling or loose concrete with a small hammer and chisel. Seal using a putty knife and concrete sealant with epoxy or latex compound (works best on cracks ⅛-inch wide or narrorwer.) For larger chips and cracks, use mortar mixes.

Integrative Pest Management (IPM)

2. Eliminate easy food sources: Rodents look to set up homes where food is readily available

- Eliminate easy food sources, such as pet or farm animal feed, by using rodent proof containers
- Remove bird feeders if attracting rodents or place tray under them to collect fallen seed and clean it nightly.
- Pick up any fallen fruit from fruit trees
- Secure garbage cans and be sure trash/dumpster is routinely emptied fully

Integrative Pest Management (IPM)

3. Target remaining rodents effectively *without* the use of poison

- Rodent Birth Control: ContraPest is a non-lethal option that causes infertility in both male and female rats, greatly reducing rodent populations humanely.
- Catch and release traps for those inside your home. Check daily. This only works if the exterior of the building is properly sealed to prevent further intruders.
- If you *have* to: Snap, CO2 or electric traps that do not pass poison into the environment
- Make your yard predator friendly - e.g. introduce owl nest boxes!

Second Generation Anticoagulant Rodenticides

ASRI.org

In 2024, Audubon also worked with legislators to introduce a bill that, for the first time in Rhode Island, would ban Second Generation Anticoagulant Rodenticides, or SGARs. A pesticide used to promote rodent deaths, the measured secondary impact on raptors and other predators is starkly disturbing. SGARs accumulate in the system of predators like Great Horned Owls and Bald Eagles and impact their liver functioning. If a raptor is poisoned, they can lose certain flying capabilities, have tremors, bleed out from minor injuries, or die directly from SGARs poisoning. To show how widespread SGARs are in the Avian population, Tufts University's wildlife clinic conducted a study on rodenticide exposure in raptors. In one startling statistic, **100% of Red-tailed Hawks** who were tested by researchers had been exposed to rodenticides.

Barred Owl by Peter Green

Our advocacy efforts did not go unnoticed. We made tremendous strides in educating the legislature on the harms of SGARs and the need to ban their use in Rhode Island. You can read Audubon Director of Avian Research Charles Clarkson's letter on the dangers of SGARs here. Currently, the state of California has a moratorium on these pesticides; we will continue to advocate for Rhode Island to become the next.

Audubon Society of Rhode Island

Click here to sign the petition to support banning SGARs in Rhode Island!

Other ways to help wildlife in RI

If you find injured or orphaned Wildlife please contact the Wildlife Clinic of Rhode Island at (401) 294-6363

If you are interested in volunteering or programing, please reach out to info@riwildliferehab.org to be connected with our Volunteer Coordinator:

- Animal Care Volunteers
- At-home wildlife rehabilitators
- Transport Network
- Other skills? Contact us!

Our organization relies on private donations, please consider supporting us for 401 Gives on April 1st!

Follow us on Facebook and Instagram at:

@riwildliferehab

Wildlife Rehabilitators Association of RI


Questions?