



And on That Farm, There Was a ...Rat? Rodent IPM for Your Farm

Ag Trades Show, January 11, 2023

Hillary Peterson, Ph.D.

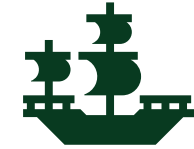
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Conservation and Forestry

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www.maine.gov/ipm



Rodents: Historical, Ecological, and Human Significance...



Global travelers
with humans

Used in research
for medicine and
genetics






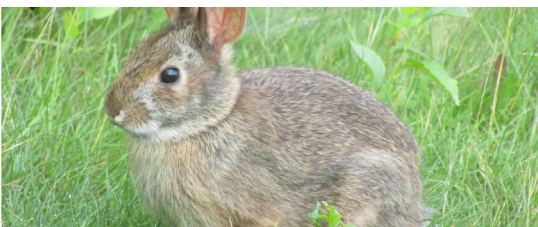

Beloved pets to
many

Important
members of many
ecosystems



**Pests of agriculture,
structures, and disease
vectors**

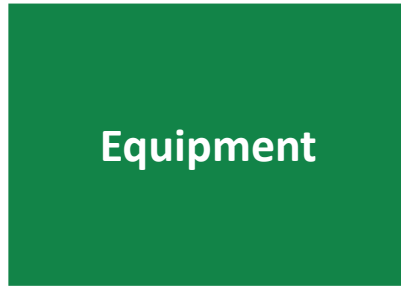
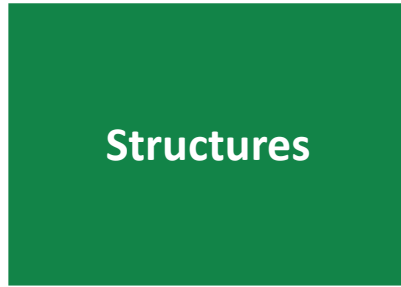
Species, Crops, & Situations of Concern

| | |
|------------------------|--|
| Mice |  |
| Norway Rats |  |
| Voles |  |
| New England Cottontail |  |
| Groundhogs |  |



Sources: [Purdue Orchard Factsheet](#); [UVM Factsheet](#); [Purdue Poultry Factsheet](#); [Mouse](#); [Rat](#); [Vole](#); [Rabbit](#); [Groundhog](#); [Structure Damage](#); [Wire Damage](#); [Cattle](#); [Poultry](#); [Potatoes](#); [Blueberry](#); [Apples](#); [Corn](#)

Species, Crops, & Situations of Concern



Rodents are Serious Problems in Agriculture

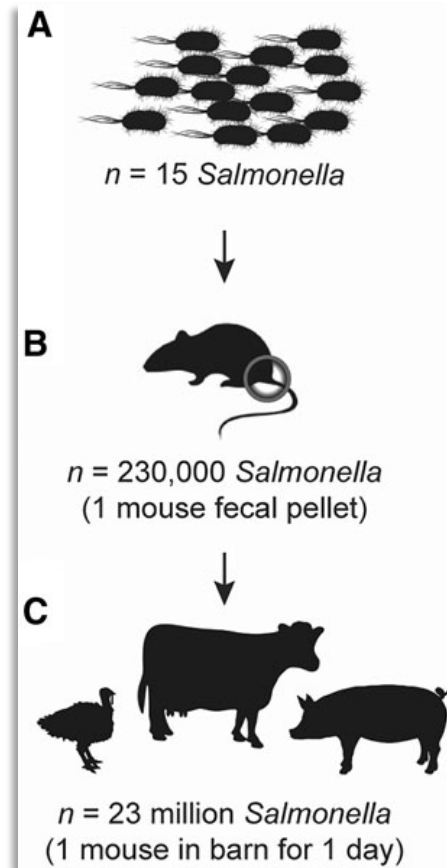


- 2018 – 23 illnesses
- 200 million eggs recalled due to salmonella
- Live and dead rodents in chicken houses and manure pits

Table 1. Some Common Diseases of Poultry That Rodents May Harbor or Disseminate*

| Disease | Agent | Rodents Implicated |
|---------------|----------|--------------------|
| Bordetellosis | bacteria | rats |
| Leptospirosis | bacteria | rats, mice |
| Erysipelas | bacteria | rats |
| Salmonellosis | bacteria | mice, rats |
| Fowl Pox | virus | rats |
| Fowl Cholera | virus | rats, mice |

* Because rodents are capable of both mechanical and physiological transmission of various bacteria, viruses, and nematodes, the potential exists for rodents to transmit several other pathogens in poultry systems.



Rodent Problems: Poultry Facilities and Barns

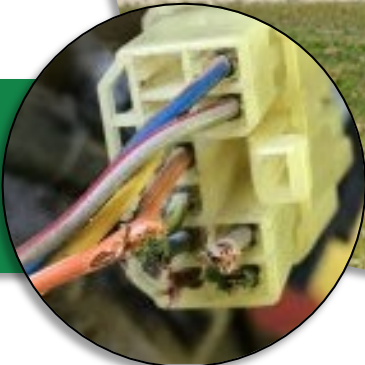
Can attract foxes,
raccoons, and other
chicken predators



Ideal rodent habitat – harborage,
food, water



Gnaw on structural,
mechanical, and
electrical utilities



Consumes AND contaminates
feed



Prefers feed to baits

Weakens concrete slabs and
walkways



Rodent Problems: Crop Damage



Voles, mice, and rabbits
girdle bark



Voles, mice, and rabbits
girdle bark



Voles burrow, feed on tubers, expose to sunlight
and freezing temps, predators dig & damage

Rodent Problems: Crop Damage

Voles can end up harvested with the crop!
Feed on tubers in storage for a potato feast...



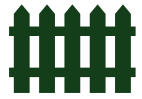
Voles burrow, feed on tubers, expose to sunlight
and freezing temps, predators dig & damage

What is integrated pest management?



Identification & Action Thresholds

- Proper identification of pest
- Understanding the system where the pest exists



Prevention, Cultural & Mechanical Control

- Prevent and control through physical means
- Set your location up for success



Monitoring & Recordkeeping

- Monitor in a tracked and systematic way
- Make it useful for the future!



Action Thresholds

- What is the population level?
- What methods are needed at this level?



Biological and Pesticide Control

- Dynamic and flexible as methods change

IPM is the standard and many institutions are involved



MAINE DEPARTMENT OF
**AGRICULTURE
CONSERVATION
& FORESTRY**



1865 THE UNIVERSITY OF
MAINE
Cooperative Extension

What is integrated pest management?

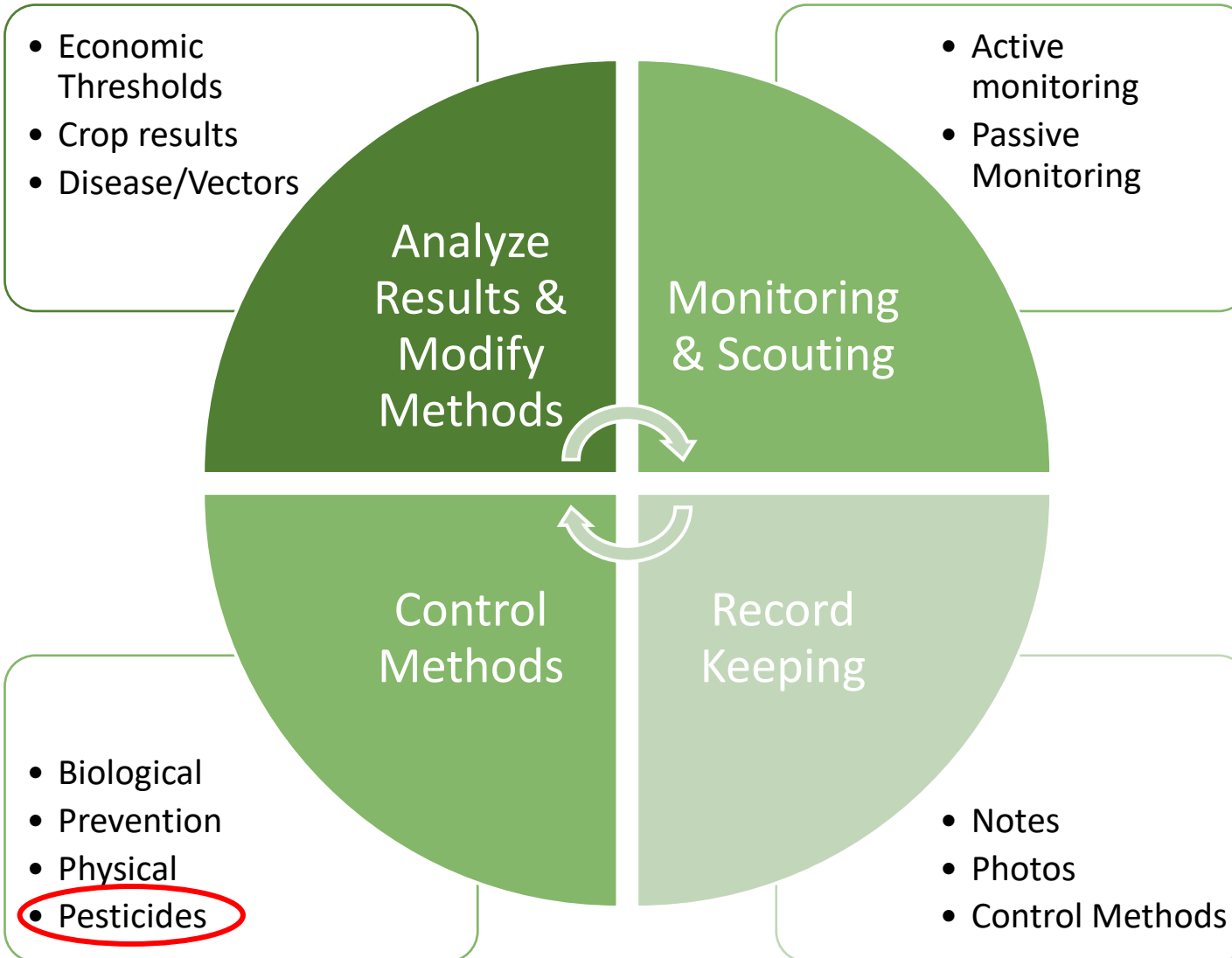
IPM Concept Highlights
Mindset Framework!



IPM Concepts

-  Identification
- Prevention & Cultural Control 
-  Monitoring & Record Keeping
- Action Thresholds 
-  Biological & Chemical Control

The IPM Cycle



IPM Concepts

-  Identification
-  Prevention & Cultural Control
-  Monitoring & Record Keeping
-  Action Thresholds
-  Biological & Chemical Control

Should not be first or default solution!

Need tools beyond rodenticides

VANCOUVER ISLAND | News

B.C.
minis

CT VIEWPOINTS

It's time for Connecticut to

ban

MASSACHUSETTS

Residents react to recent de

gre



by
Ap

NEWS

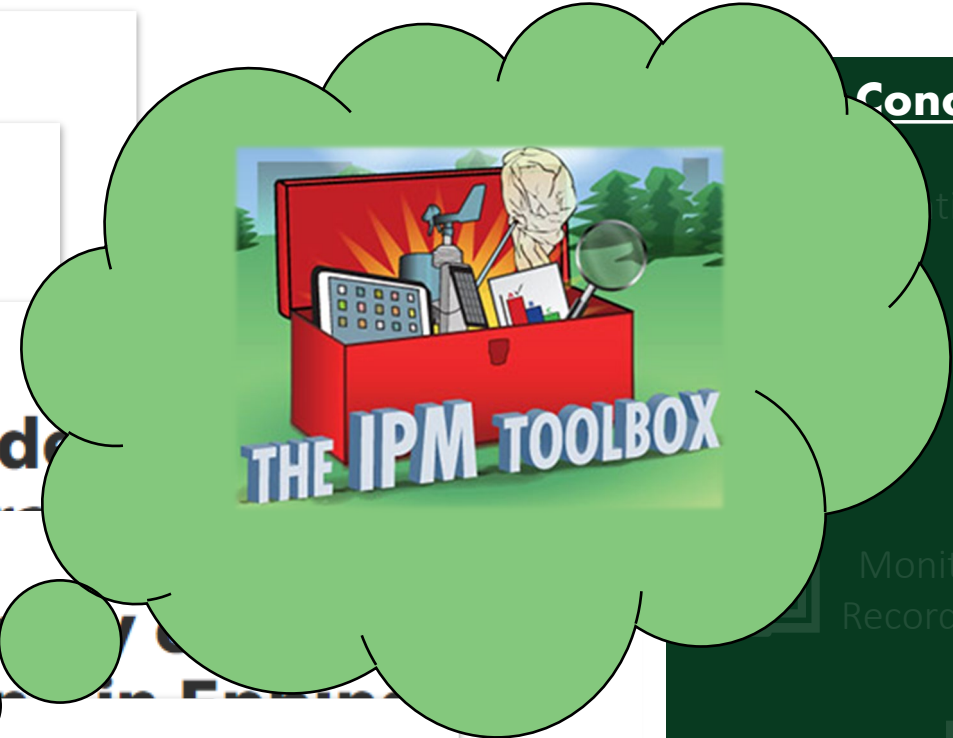


Rat poison is killing sn

Here's what On the

VANCOUVER ISLAND | News

'Impossible to control': Industry says
rodenticides needed to manage pest
infestations in B.C. amid calls for poison ban



Concepts

Identification



Monitoring &
Record Keeping

Action
Thresholds



Biological &
Chemical Control

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EPA's Proposed Mitigations for Rodenticides

On November 29th, 2022, the EPA released Proposed Interim Decisions (PIDs) for **11 rodenticides**, with label changes that, if implemented, will have a **major impact on the regulation and enforcement of all current rodenticide uses**.

February 13th, 2023, is the deadline to [submit written comments](#).



IPM Concepts



Identification

Prevention &
Cultural Control



Monitoring &
Record Keeping

Action
Thresholds



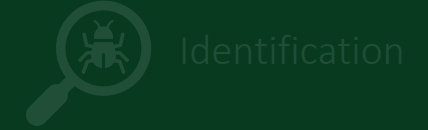
Biological &
Chemical Control

EPA's Proposed Mitigations for Rodenticides

- All rodenticides would be classified as Restricted Use Pesticides (RUPs), except for pre-filled single use disposable bait stations available to consumers
- Cancellation of reusable consumer bait stations (1lb or less) and refills
- Applicators of 'loose' formulations (pellets, meal baits, and treated grains) would be required to wear APF10 respirators (half-face elastomeric)



IPM Concepts



Identification



Prevention &
Cultural Control



Monitoring &
Record Keeping



Action
Thresholds



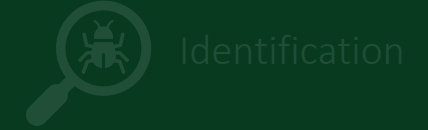
Biological &
Chemical Control

EPA's Proposed Mitigations for Rodenticides

- The PPE label requirement for gloves for all products would be changed to chemical-resistant gloves, generally with a thickness ≥ 14 mils (thicker than the current standard)
- Prohibition of currently allowed uses of First-Generation Anticoagulants (FGARs) in cropped areas including orchards, groves, vineyards, and alfalfa
- Prohibition of spot and broadcast applications to rangeland, pastureland, and fallow land



IPM Concepts



Identification



Prevention &
Cultural Control



Monitoring &
Record Keeping



Action
Thresholds



Biological &
Chemical Control

EPA's Proposed Mitigations for Rodenticides

- Prohibition of spot and broadcast applications of FGARs and zinc phosphide to turf, lawns, parks, golf courses, campsites, and other recreation areas
- Mandatory carcass searches for all zinc phosphide applications, and for all FGAR baits used in fields and other non-structural use sites
- Endangered Species requirements, including mandatory record-keeping of Bulletins obtained from EPA Bulletins Live! Two for each application of any product other than a consumer pre-filled bait station



IPM Concepts



Identification

Prevention &
Cultural Control



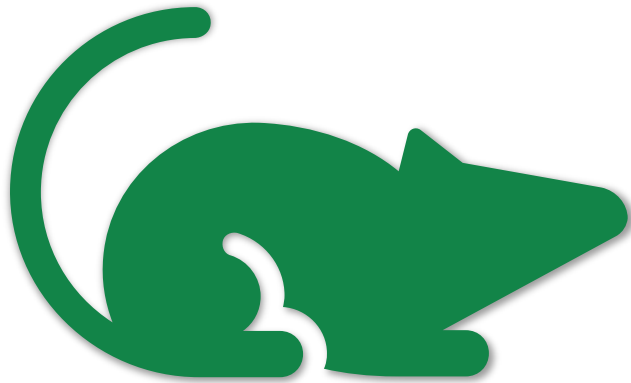
Monitoring &
Record Keeping

Action
Thresholds



Biological &
Chemical Control

Identification: Sources of Evidence



Features of the
organism



Droppings,
Tunnels, Gnawings
and Trails



Damage, Sick
Animals, Lost
Yield

IPM Concepts

- Identification 
- Prevention & Cultural Control 
- Monitoring & Record Keeping 
- Action Thresholds 
- Biological & Chemical Control 

Identification: Rats and Mice in Maine

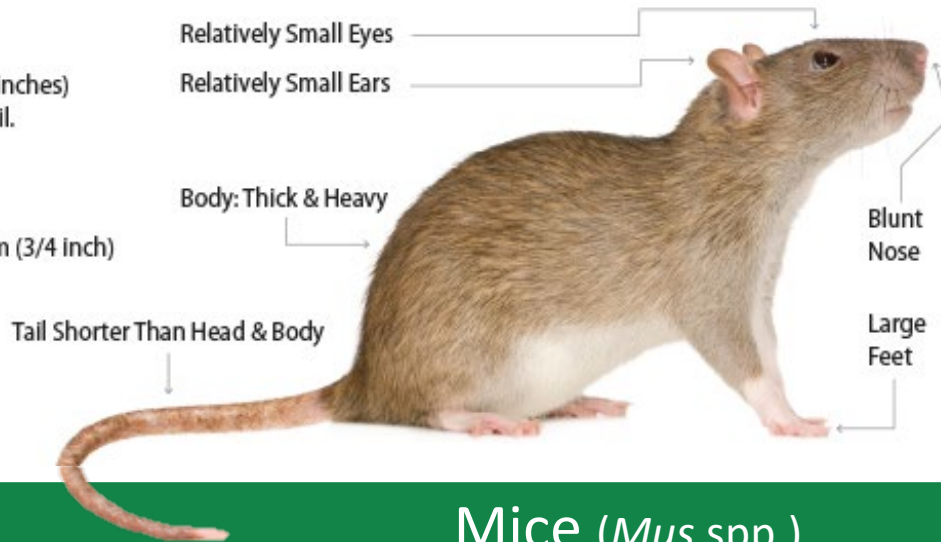
Norway Rat / Brown Rat (*Rattus norvegicus*)

Norway Rat

Size: 30-45 cm (12-18 inches)
from nose to end of tail.

DROPPINGS:

Long, Rounded Ends
Avg. Length: 15-20 mm (3/4 inch)



Types of Damage:

- Large gnaw marks (1/8th in.)

Location:

- Tunnels in soil disguised, 3-inch diameter

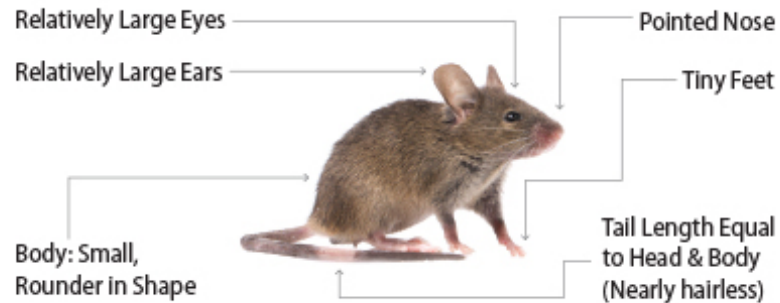
Mice (*Mus* spp.)

House Mouse

Size: 15-17 cm (6-7 inches)
from nose to end of tail.

DROPPINGS:

Small with Pointed Ends
Avg. Length: 4-7 mm (1/4 inch)



Types of Damage:

- Small gnaw marks
- Insulation, wiring, baseboards

Location:

- Squeeze easily behind walls

IPM Concepts



Identification

Prevention &
Cultural Control



Monitoring &
Record Keeping

Action
Thresholds



Biological &
Chemical Control

Identification: Mice in Maine that can be pests

House Mouse (*Mus musculus*)

5–7-inch length



~ch)



Tail almost naked, scaly

Large ears

Small black eyes

Overall gray coat

Types of Damage:

- Small gnaw marks

Location:

- Buildings, homes, barns

Deer Mouse (*Peromyscus maniculatus*)

7–9-inch length



Tail with short hair

Large black eyes

White underside

Types of Damage:

- Carries hantavirus

Location:

- Ground-floor walls of homes, barns

White-footed Mouse (*Peromyscus leucopus*)

7–9-inch length



Tail with short hair

Large black eyes

White underside

Types of Damage:

Location:

- Ground-floor walls of homes, barns

IPM Concepts



Identification

Prevention &
Cultural Control



Monitoring &
Record Keeping

Action
Thresholds



Biological &
Chemical Control

Photos: [House Mouse](#); [Deer Mouse](#)
ID Sources: [UC IPM](#); [CDC Pictorial Key](#)

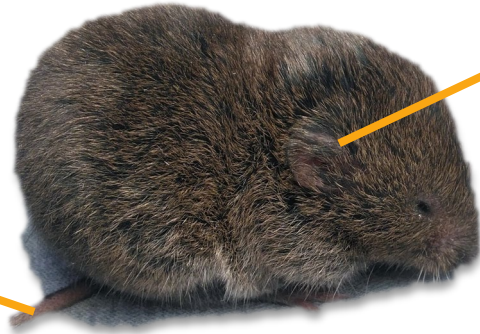
Identification: Voles

Pine Vole, Woodland Vole (*Microtus pinetorum*)



~4-5 inches
(tail ~1 inch)

tail equal length
as hind foot



Ears buried
in fur

sunken eyes

light brown fur

Types of Damage:

- Underground roots in orchards (causes rows of suckers and dwarf leaves)
- Eats bark and girdles trees

Location:

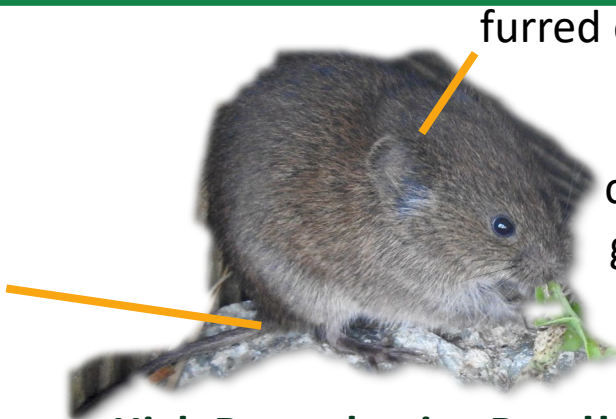
- Lives underground
- Tunnel entrance 1-1.5 inches, no mound of soil

Meadow Vole (*Microtus pennsylvanicus*)



7 inches
(tail ~1-2.5 inches)

tail at least 2x
length hind foot



furred ears

prominent eyes

chestnut brown,
gray underparts

coarse fur

Types of Damage:

- Eats bark and girdles trees

Location:

- Active aboveground
- Lives in networks of runways in grass and debris

High Reproductive Rate!!!

IPM Concepts



Identification

Prevention &
Cultural Control



Monitoring &
Record Keeping



Action
Thresholds



Biological &
Chemical Control

Photos: Pine Vole ([iNaturalist, idietrch](#), CC BY-NC 4.0), Meadow Vole ([iNaturalist, Wbarker26](#), CC BY-NC 4.0) Source: [UNH Extension](#)

Identification: Vole Look-Alikes

Hairytail Mole



Diet: Earthworms, slugs, grubs, insects, **NOT PLANTS!**

Location:

- Orchards and blueberries

Northern Short Tailed Shew

pointed snout

fine gray fur

no visible ears



5 toes on the front feet

Diet: Insects, worms, small salamanders and small rodents, **NOT PLANTS!**

Location:

- Orchards and blueberries

IPM Concepts



Identification

Prevention &
Cultural Control



Monitoring &
Record Keeping

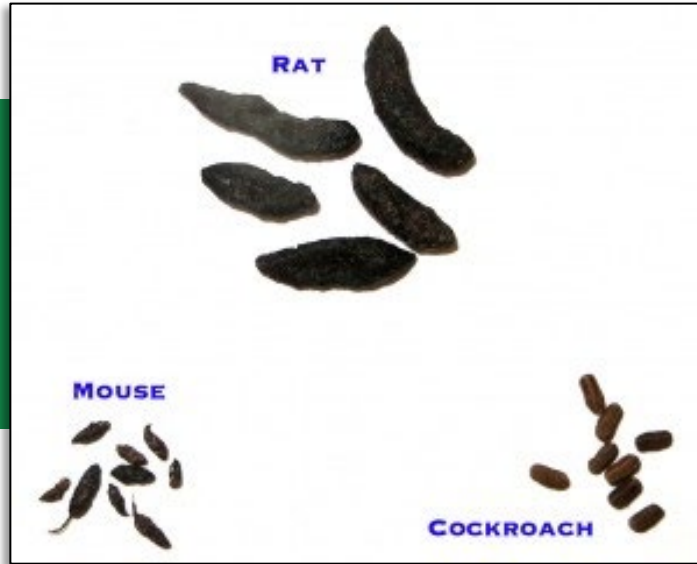
Action
Thresholds



Biological &
Chemical Control

Identification: Poop – you might be surprised!

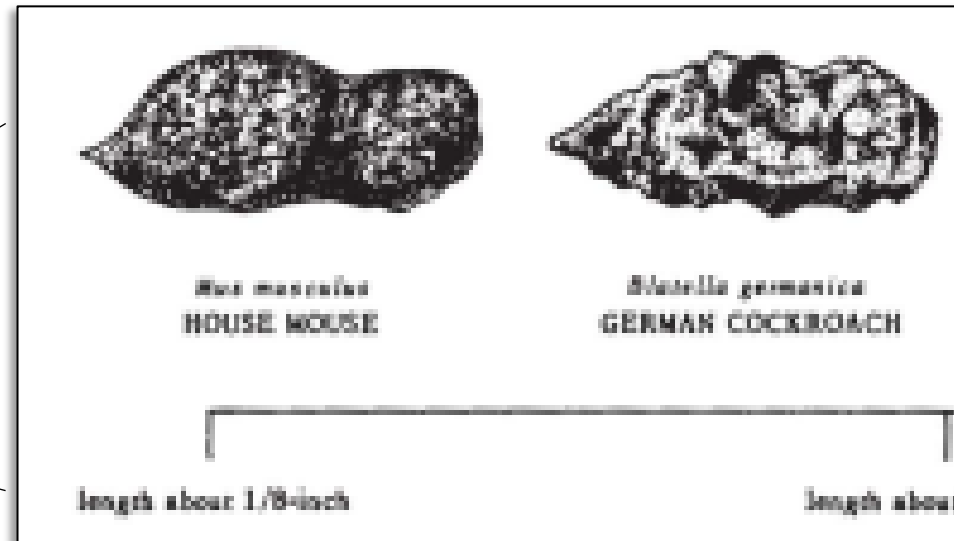
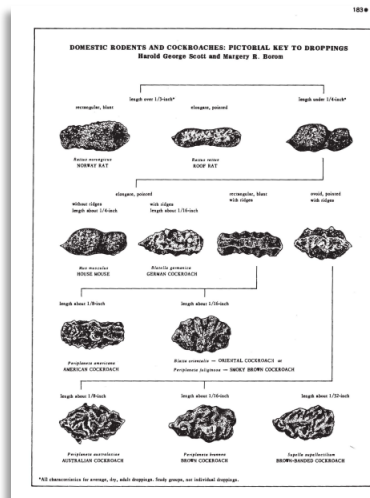
It is possible to confuse mouse and cockroach droppings!



Cockroach droppings have ridges.



There's a key for that!



IPM Concepts

- Identification
- Prevention & Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

INTERNET SEARCHES – a tool you need to know how to use



- The first few links are likely to be ads
- Careful trusting information written by those will profit from it (pest control companies, big box stores)
- Just because a website claims to be “natural” or “earth friendly”, information needs to be backed by research (references and citations)

IPM Concepts



Identification

Prevention & Cultural Control



Monitoring & Record Keeping

Action Thresholds



Biological & Chemical Control

INTERNET SEARCHES – a tool you need to know how to use



- Generally, better resources can be found under **.edu** and **.gov**
- Writing the question in a different way can help (instead of “kill rats”, search for “rat prevention” or “rodent IPM”)

IPM Concepts



Identification

Prevention & Cultural Control



Monitoring & Record Keeping

Action Thresholds



Biological & Chemical Control

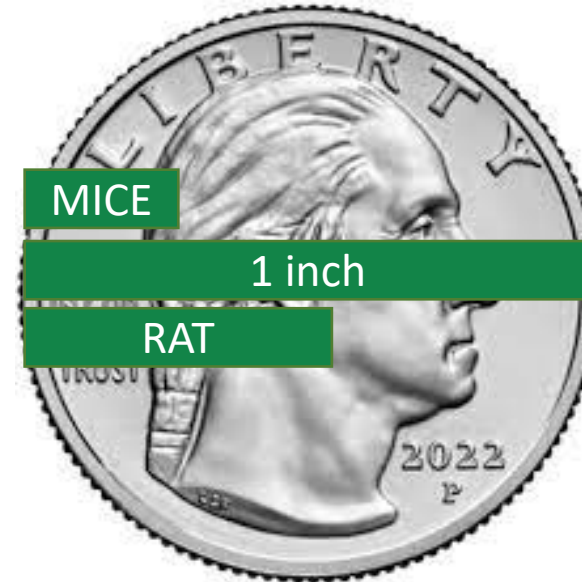
Prevention & Cultural Control: Rodent Behavior

- Most rodents have a “home range” – 80% time spent in one location
- Rats are **powerhouses**
 - Intelligent and wary
 - Can tread water for three days straight
 - Can jump vertically 3 feet and survive a 50-foot drop
- Rodents will go through if they cannot go around
 - Can gnaw lead sheathing, cinder-block, aluminum siding, glass



Rats are intelligent

Rodents can *squeeze*:



MICE

1 inch

RAT

ELIMINATE entry points

IPM Concepts



Identification

Prevention & Cultural Control



Monitoring & Record Keeping

Action Thresholds



Biological & Chemical Control

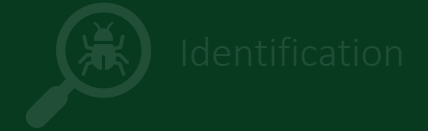
Prevention & Cultural Control: Sanitation

Remove:

- **Nesting materials** – clutter inside and outside
- **Water sources** – open garbage, spilled bird seed, leaky faucets, bird baths
- **Food sources** – sealed jars, tins, heavy plastic
- **Travel pathways** – trim trees and vegetation 3ft from walls/roofs
- **In orchards** – mowing closely exposes to predators



IPM Concepts



Identification

Prevention & Cultural Control 

 Monitoring & Record Keeping

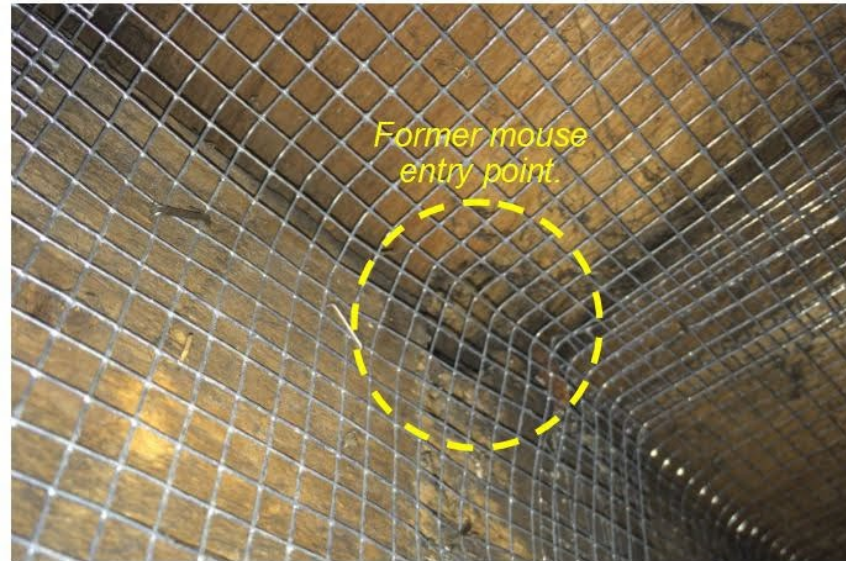
Action Thresholds 

 Biological & Chemical Control

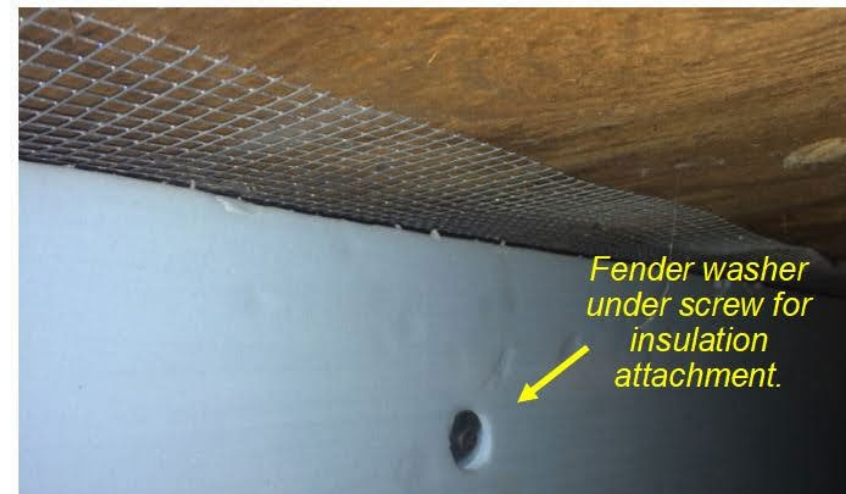
Prevention & Cultural Control: Rodent-Proofing



- In a barn, **ALL openings** must be closed tightly
- Check pipes, exhaust fans, and drains
- Materials for rodent-proofing: Concrete, Galvanized Sheet Metal, Brick, Hardware Cloth
- Outside: eliminate hiding places and food sources

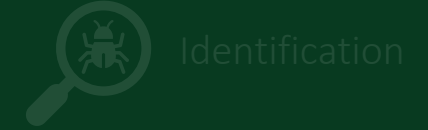


Hardware cloth between the joist and the floor.



Finished installation, underfloor without finish surface.

IPM Concepts



Identification



Prevention & Cultural Control



Monitoring & Record Keeping



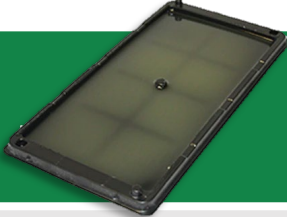


Action Thresholds



Biological & Chemical Control

Prevention & Cultural Control: Trap-Types

|  <h2>Snap & Alligator</h2> |  <h2>Multiple-Capture</h2> |  <h2>Glue Boards</h2> |
|--|--|---|
| <p>Pros: Simple, inexpensive, effective</p> | <p>Pros: Catch several rodents, do not require bait</p> | <p>Pros: No snapping mechanism, inexpensive</p> |
| <p>Cons: Ineffective alone in a large infestation; gruesome</p> | <p>Cons: More expensive, live rodents to dispose of, monitor frequently</p> | <p>Cons: Inhumane, off target capture, lose effectiveness if dirty</p> |
| <p>Styles:</p> <ul style="list-style-type: none">• Wooden snap trap• Plastic snap trap• Plastic enclosed snap trap• Plastic alligator trap | <p>Styles:</p> <ul style="list-style-type: none">• Curiosity traps• Winding or trap door• Electronic instant kill | <p>Styles</p> <ul style="list-style-type: none">• Different sizes• Baited or unbaited• Covered or open |

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Prevention & Cultural Control: Tips for Effective Trapping

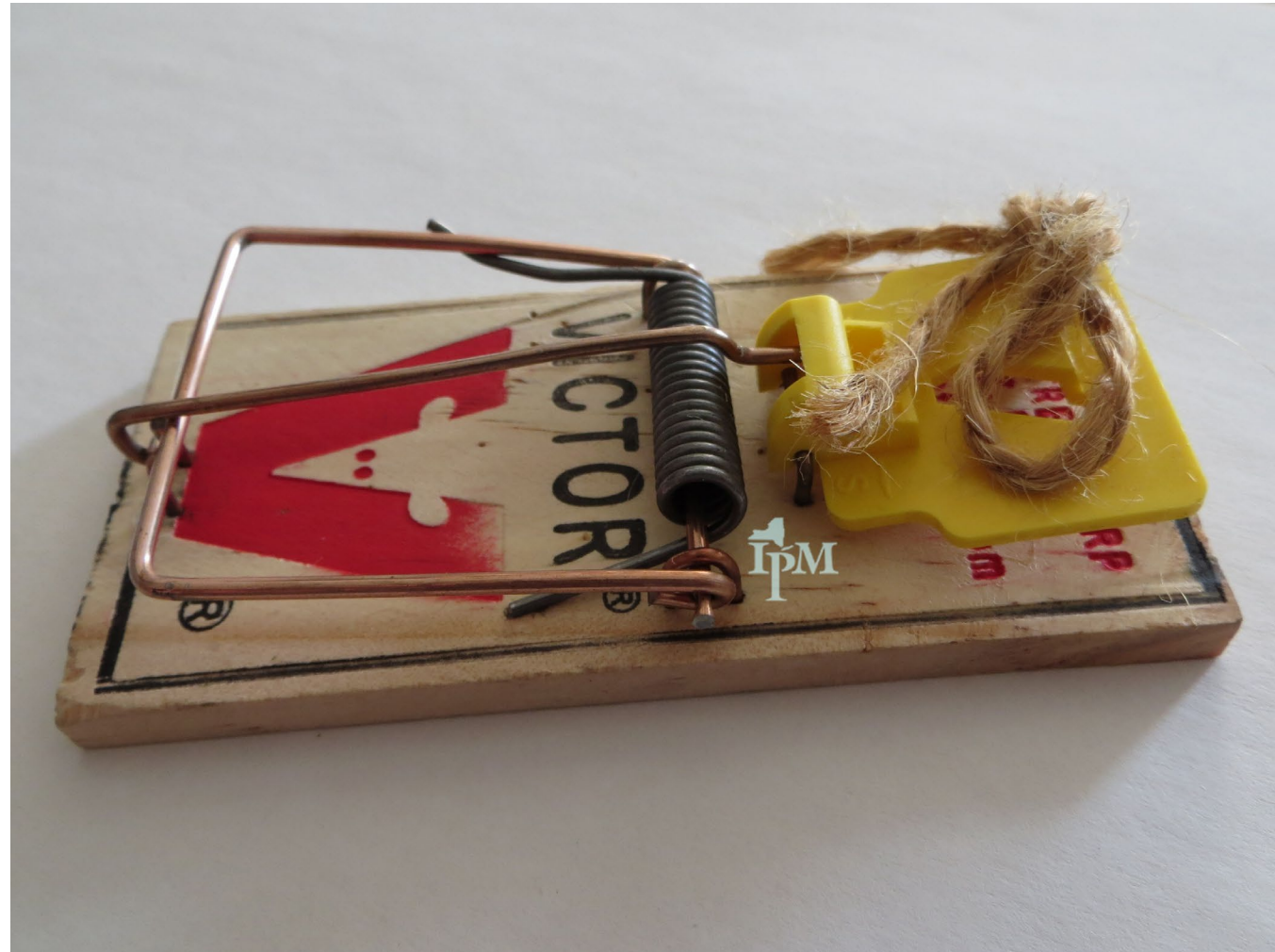
Set traps:

- Close to walls
- Behind objects
- Dark corners
- Warm spots (near motor, etc.)

Bait traps with:

- Nesting materials (secured with floss)
- The food they are eating
- DO NOT over bait!

[Excellent video by Dr. Matt Frye](#)



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Prevention & Cultural Control: Tips for Effective Trapping

For rats:

- Leave traps baited (“pre-bait”) but unset until bait taken at least once
- Space 10-15 feet apart
- SMART rats may need traps hidden (cover with sawdust, pet rodent bedding, etc.)

For mice:

- Space snap traps 6-8ft apart



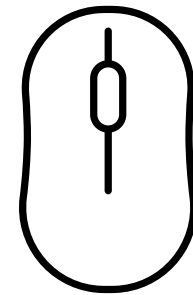
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Prevention & Cultural Control: Cleaning Up

HOW TO: CLEAN UP MOUSE URINE AND DROPPINGS



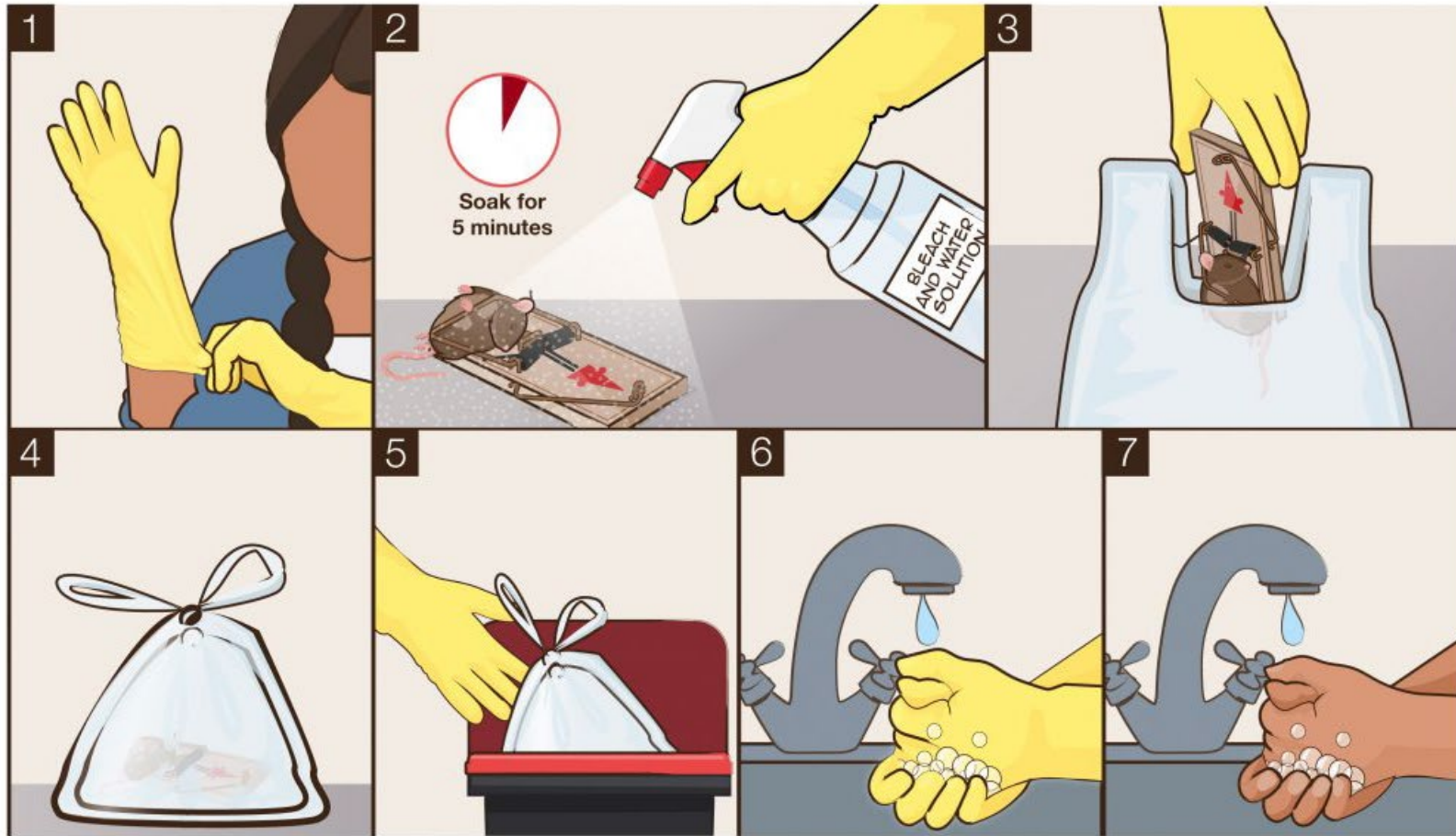
[Further details here!](#)



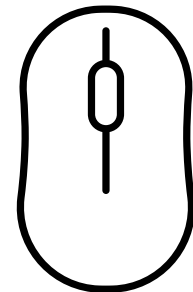
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Prevention & Cultural Control: Cleaning Up

HOW TO: CLEAN UP A DEAD MOUSE IN A SNAP TRAP OR NEST



[Further details here!](#)



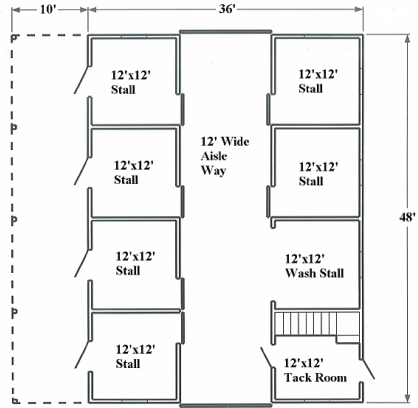
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Monitoring & Record Keeping

Scouting and Monitoring Tools



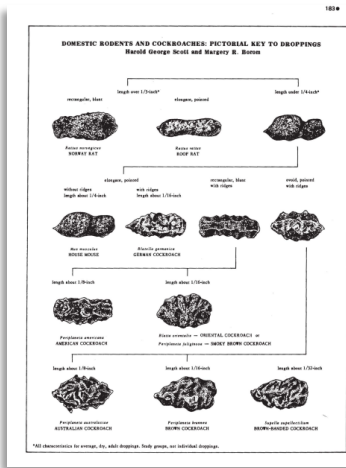
Logbook or System



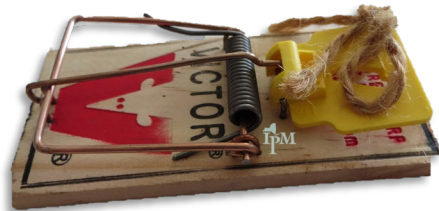
Map / Sketched Floor Plan



Flashlight



Identification Guides for Rodents & Evidence



Traps & Attractive Bait (Food, Nesting Materials)

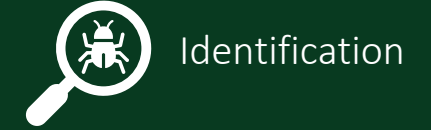


Smartphone, Camera, Trail Cam!!!



Get creative with what you have!

IPM Concepts



Monitoring & Record Keeping

Active/Visual/Scouting Monitoring *Systematic Sampling = Useful Results*

- Inspect for:
 - Droppings
 - Tracks
 - Burrows
 - Pathways
 - Fresh gnawing's
 - Dead rodents
- Indoors – active just after dusk and shortly before dawn. Daytime sightings mean an established infestation
- Look along walls and stationary objects as rodents prefer to move along them



IPM Concepts

- Identification 
- Prevention & Cultural Control 
- Monitoring & Record Keeping 
- Action Thresholds 
- Biological & Chemical Control 

Monitoring & Record Keeping

**Set up weekly and repeatable systems:
Creating your logbook is a great place to start!**

| Date | Time | Initials | Location | Observation Type | Description | <i>Many options...</i> |
|------|------|----------|----------|------------------|-------------|------------------------|
| | | | | | | |
| | | | | | | |

- Visual scouting – a big box to write in evidence *or* many columns with pest species
- Passive monitoring – traps with unique identifiers, and columns with rodent species
- Control methods – keep track of maintenance, rodenticide use, dead mice collected

IPM Concepts



Identification

Prevention &
Cultural Control



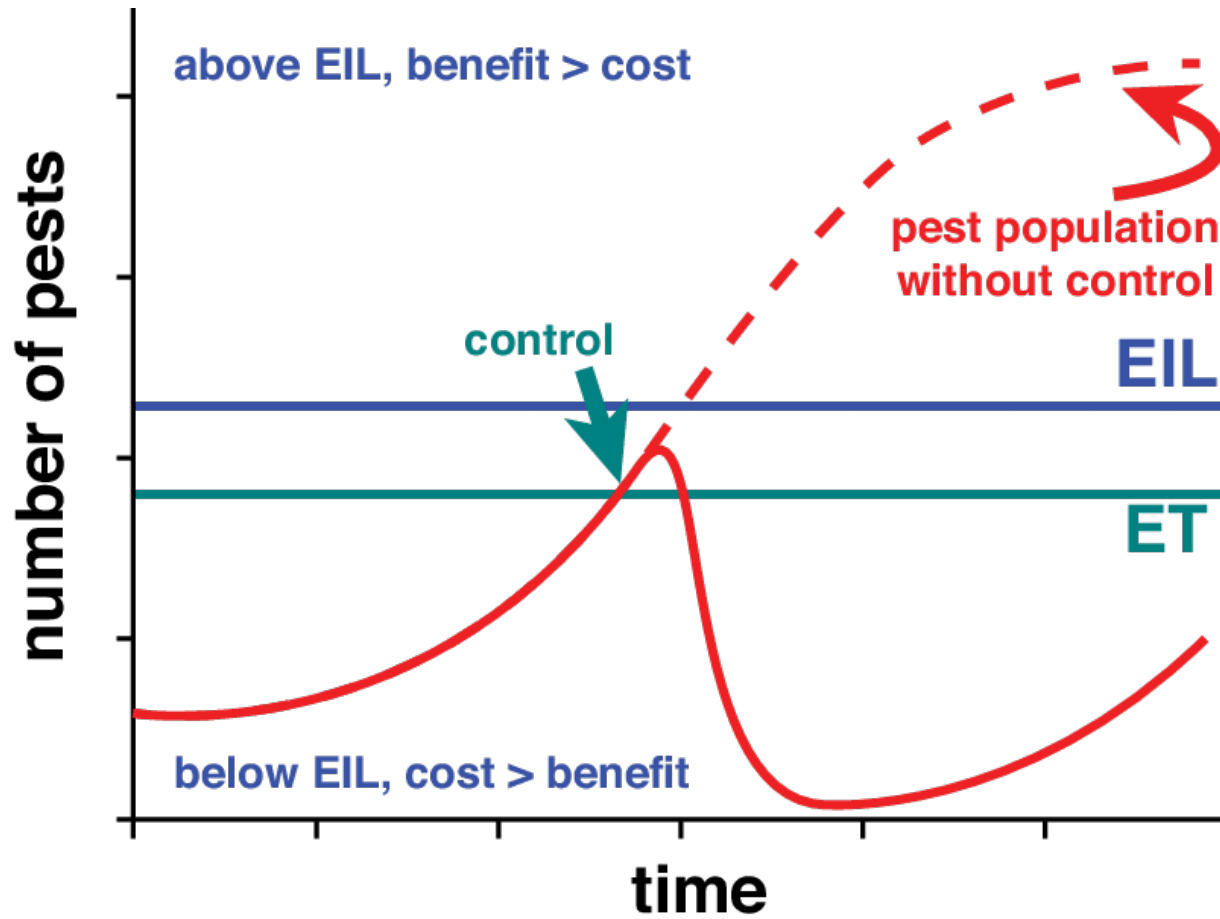
Monitoring &
Record Keeping

Action
Thresholds



Biological &
Chemical Control

Action Thresholds



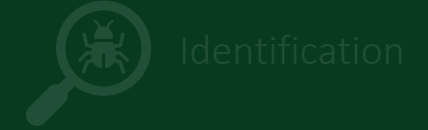
Economic Injury Level

Crop loss is more expensive than controlling the pest

Economic Threshold

Pest abundance or damage level that will exceed EIL if not treated

IPM Concepts



Identification



Prevention & Cultural Control



Monitoring & Record Keeping



Action Thresholds



Biological & Chemical Control

Action Thresholds: Rodent Example



- In a barn, a **minor** problem can be:
 - Possibly solved with traps
 - If bait is needed, only placed into rodent burrows
- A **major** problem could mean:
 - More baits placed strategically through a facility

IPM Concepts



Identification

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Cultural Control



Monitoring &
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Action
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Biological &
Chemical Control

Biological Control: Encourage Raptors



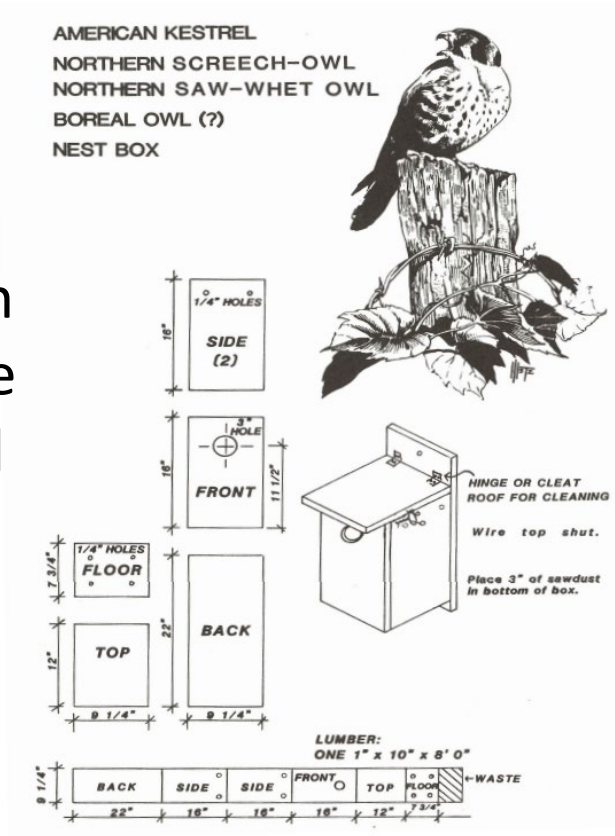
Care **MUST** be taken to not attract raptors to poisoned rodents. This method is incompatible with poison bait use. Be mindful of placement if insecticides will be sprayed nearby.



- **Attract Raptors** (hawks, owls, eagles) with nest boxes and perches
- **Monitoring & Maintenance** – keep nest boxes in good condition during **winter repairs** and ensure other birds are not using them. Wear gloves and a dust mask to avoid infection.



[UNH Extension Factsheet with Nesting Box and Perch Designs](#)






IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control





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Biological & Chemical Control: Rodenticide 101

| First-Generation Anticoagulants  | Second-Generation Anticoagulants  | Non-anticoagulants  |
|---|--|--|
| <p>Pros: No bait shyness</p> | <p>Pros: Kills in single feeding; no bait shyness</p> | <p>Pros: Some kill in single dose, effective for resistant rodents</p> |
| <p>Cons: Kills in multiple feedings, resistance has developed</p> | <p>Cons: Greater risk of killing prey</p> | <p>Cons: Still a risk of killing prey</p> |
| <p>Mode of Action: Stops blood clotting</p> | <p>Mode of Action: Stops blood clotting</p> | <p>Mode of Action: Various</p> |
| <p>Used For: Controlling serious outbreak</p> | <p>Used For: Controlling serious outbreak</p> | <p>Used For: Resistant rodents</p> |





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Biological & Chemical Control: Rodenticide Formulations

|  <h2>Pellets</h2> |  <h2>Wax Blocks</h2> |  <h2>Feed</h2> |  <h2>Packets</h2> |
|--|--|---|---|
| <p>Pros: Less expensive</p> | <p>Pros: Can get damp, convenient</p> | <p>Pros: May outcompete other food sources</p> | <p>Pros: Convenient</p> |
| <p>Cons: Loose pellets easy for children and pets to find</p> | <p>Cons: Wax may be less palatable</p> | <p>Cons: Spoil quickly</p> | <p>Cons: More expensive</p> |
| <p>Used For:</p> <ul style="list-style-type: none">• Many bait placements• Container baiting methods | <p>Used For:</p> <ul style="list-style-type: none">• Direct baiting of burrows and walls• Damp locations | <p>Used For:</p> <ul style="list-style-type: none">• Places with highly-palatable competing food sources | <p>Used For:</p> <ul style="list-style-type: none">• Direct baiting of burrows and walls |

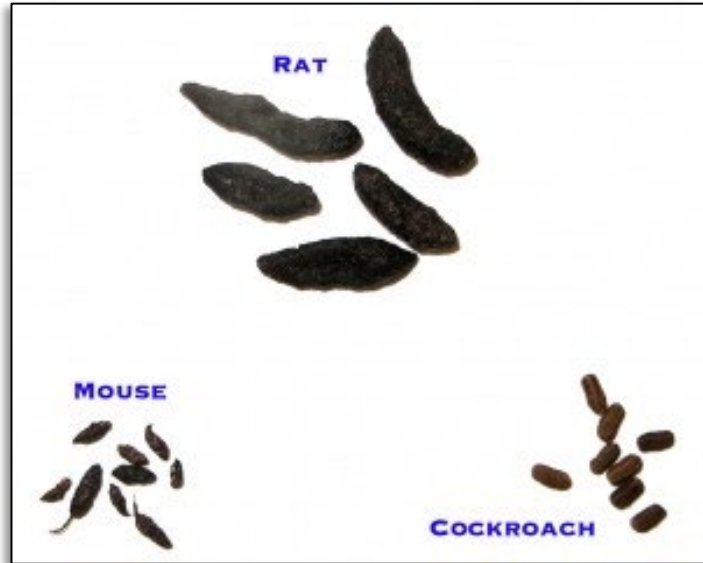
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Biological & Chemical Control: Bait Containers

| Tamper-proof plastic  | Tamper-proof metal  | Cardboard  | Plastic & PVC Homemade  |
|---|--|--|---|
| Pros: Durable, locking | Pros: Durable | Pros: Inexpensive | Pros: Inexpensive |
| Cons: Expensive | Cons: Expensive | Cons: Not durable, NOT SECURE | Cons: Exact uses, NOT SECURE |
| Used For: <ul style="list-style-type: none">Indoor/outdoor | Used For: <ul style="list-style-type: none">Indoor/outdoor | Used For: <ul style="list-style-type: none">Indoor | Used For: <ul style="list-style-type: none">Indoor |

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Identification: Poop – look in the bait station



IPM Concepts



Identification

Prevention &
Cultural Control



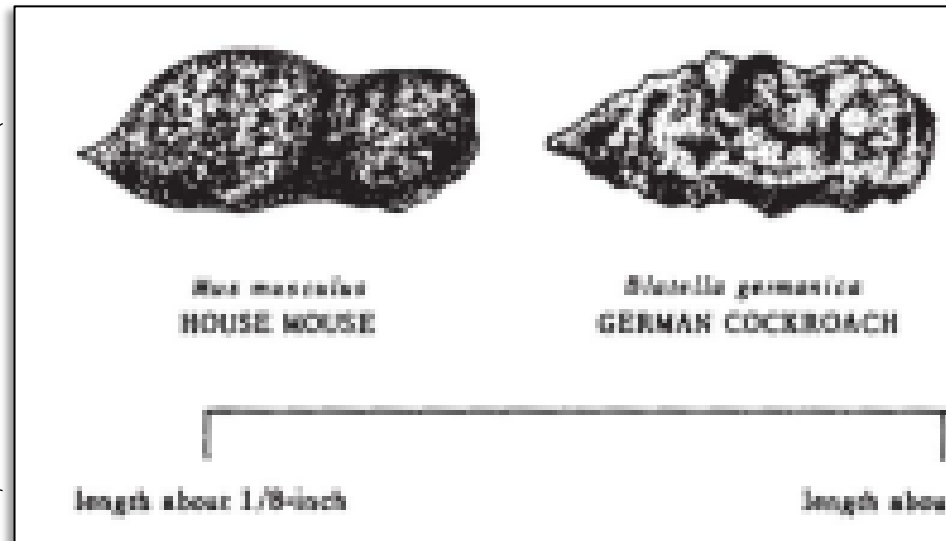
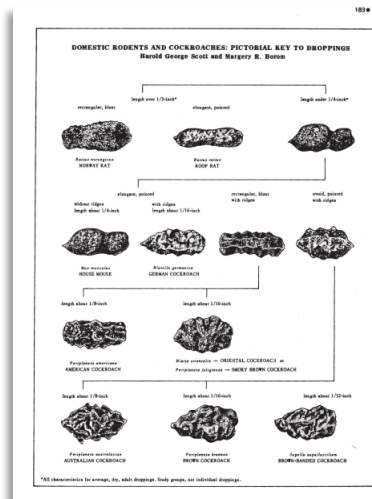
Monitoring &
Record Keeping

Action
Thresholds



Biological &
Chemical Control

There's a key for that!



Rodenticide Acute Toxicity

Table 1. ACUTE TOXICITY CLASSIFICATION - RODENTICIDES

| | Oral | Inhalation | Dermal | Primary Eye Irritation | Primary Skin Irritation |
|------------------------------|--------------------------|-------------------|-------------------|------------------------|-------------------------|
| Warfarin ^{3,6} | Moderate - High toxicity | Not significant | Not significant | No data | No data |
| Chlorphacinone ⁴ | High toxicity | High toxicity | High toxicity | Non-irritating | Non-irritating |
| Diphacinone ⁴ | High toxicity | High toxicity | High toxicity | Moderate irritation | Slight irritation |
| Bromadiolone ⁴ | High toxicity | High toxicity | High toxicity | Low irritation | Minimally irritating |
| Difethialone ³ | High toxicity | High toxicity | High toxicity | Mild irritant | Non-irritating |
| Brodifacoum ⁴ | High toxicity | High toxicity | High toxicity | Minor irritation | Mild irritant |
| Bromethalin ⁴ | High toxicity | High toxicity | Moderate toxicity | Slight irritation | Non-irritating |
| Cholecalciferol ³ | High toxicity | Very low toxicity | Low toxicity | No data | No data |
| Zinc phosphide ⁵ | High toxicity | High toxicity | Low toxicity | Slight irritation | Non-irritating |
| Strychnine ⁷ | High toxicity | High toxicity | Low toxicity | Highly irritating | Non-irritating |

Classification categories were modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Labeling. <http://www.epa.gov/oppfead1/labeling/lrm/chap-07.pdf>

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Rodenticide Acute Toxicity

Table 2. Summary of common rodenticides

| Rodenticide | Type | Chemical class | Days of feeding needed |
|-----------------|-------------------|-----------------|------------------------|
| Warfarin | Anticoagulant | Hydroxycoumarin | multiple |
| Chlorphacinone | Anticoagulant | Indandione | multiple |
| Diphacinone | Anticoagulant | Indandione | multiple |
| Bromadiolone | Anticoagulant | Hydroxycoumarin | single |
| Difethialone | Anticoagulant | Hydroxycoumarin | single |
| Brodifacoum | Anticoagulant | Hydroxycoumarin | single |
| Bromethalin | Non-anticoagulant | other | single |
| Cholecalciferol | Non-anticoagulant | Vitamin D3 | multiple or single |
| Zinc phosphide | Non-anticoagulant | other | single |
| Strychnine | Non-anticoagulant | other | single |

Single dose
anticoagulants
are more toxic

Also known as
“second
generation”

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Rodents are Mammals



MEADOW VOLE



EASTERN CHIPMUNK

Rodenticides may have the same type of effect when eaten by any mammal



WHITE-FOOTED MOUSE



EASTERN GRAY SQUIRREL

MAMMALS OF MAINE



IPM Concepts



Identification

Prevention & Cultural Control



Monitoring & Record Keeping

Action Thresholds



Biological & Chemical Control

Rodenticides can kill birds

Rodenticides
can also
directly and
indirectly kill
birds



Poster: [Kate Dolamore Art](#). Used with permission.

IPM Concepts

- Identification 
- Prevention & Cultural Control 
- Monitoring & Record Keeping 
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Rodenticides can kill birds

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Rodenticides kill wildlife

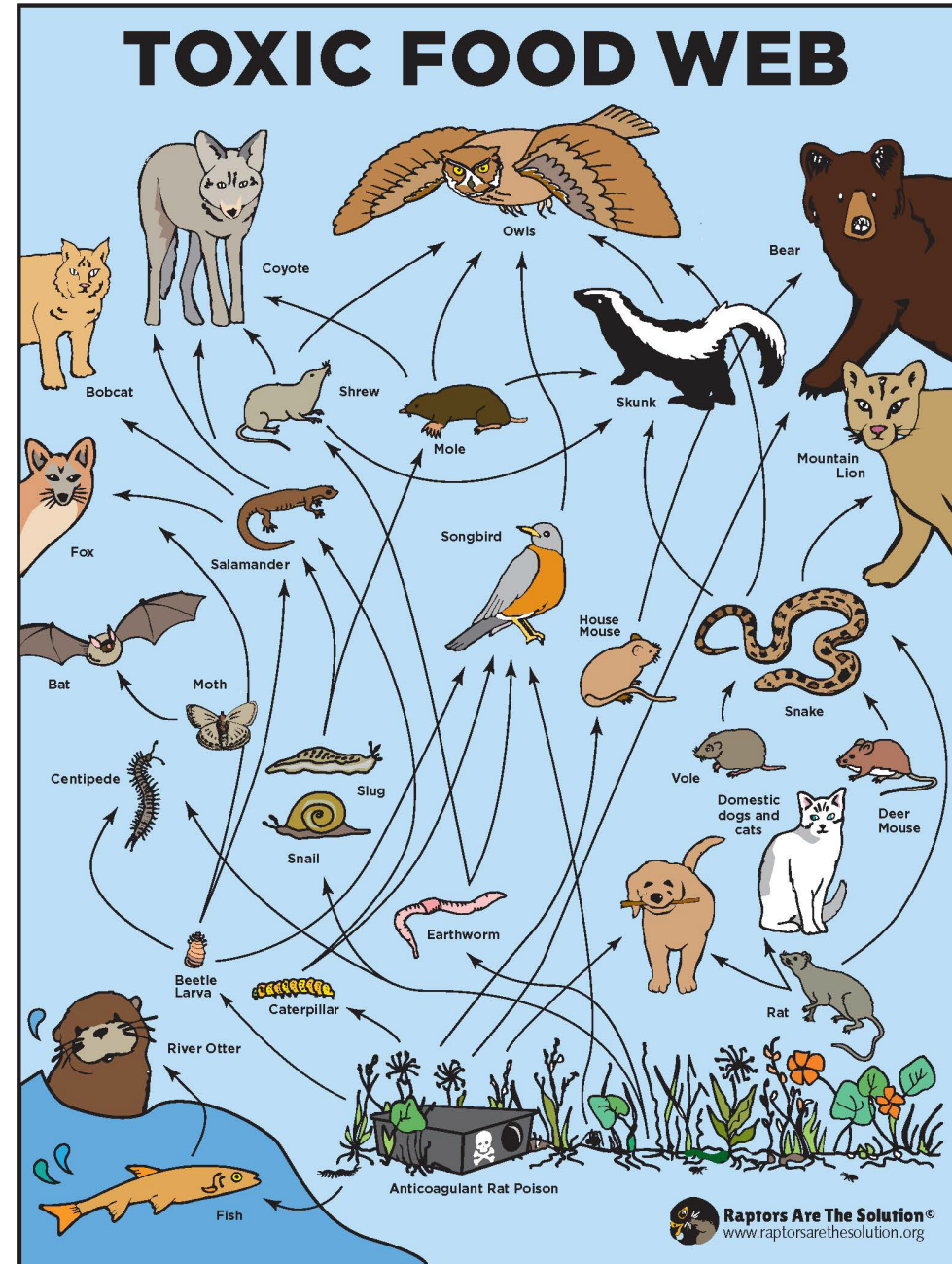
Exposure pathways of anticoagulant rodenticides to nontarget wildlife

John E. Elliott • Sofi Hindmarch •
Courtney A. Albert • Jason Emery •
Pierre Mineau • France Maisonneuve

Rodenticides detected in liver samples of Norway rats at both baited and non-baited farms.

Also detected in a vole, song sparrow, carrion beetles.

A house sparrow was seen entering bait stations and feeding on bait.



The carrion beetle was from an unbaited farm.



Rodenticide Secondary Poisoning

Table 3. Secondary poisoning risks to birds and mammals²

| Rodenticide | Secondary risk to birds | Secondary risk to mammals |
|-----------------------------|------------------------------|------------------------------|
| Warfarin | slight risk | low risk |
| Chlorophacinone | slight risk | high risk |
| Diphacinone | moderate risk | high risk |
| Bromadiolone | moderate risk | high risk |
| Difethialone | high risk | high risk |
| Brodifacoum | high risk | high risk |
| Bromethalin | possible (insufficient data) | low risk |
| Cholecalciferol | low risk | low risk |
| Zinc phosphide | low risk | slight risk |
| Strychnine ^{17,24} | possible (insufficient data) | possible (insufficient data) |

Secondary poisoning or relay toxicosis is caused by eating poisoned prey

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Rodenticides kill wildlife

CALIFORNIA

Death of pregnant mountain lion underscores two human-caused
danger

NEWS

Poisons killed beloved owls in Tampa Bay. Can their defenders save others?

Rodenticide poisoning widespread among NY's red-tailed
hawks

Barry The Owl Was Poisoned Before Central Park

Rat poison mystery: Pumas and coyotes are dying

Grad student is studying how wild carnivores are being killed by rodenticides



IPM Concepts



Identification

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Monitoring &
Record Keeping

Action
Thresholds



Biological &
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Rodenticide: Ways to Ensure Efficacy



- In facilities such as poultry operations, large amounts of other food opportunities will make baits less attractive
- Contaminated baits (dirt, manure, insects) are unattractive to rodents
- Follow the label

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. **Pesticide Storage:** Store only in original container in a cool, dry place inaccessible to children and pets. Keep containers closed and away from other chemicals.

Pesticide Disposal: Dispose of wastes resulting from the use of this product at an approved waste disposal facility or call your local solid waste agency for alternative disposal instructions. Never place unused product down any indoor or outdoor drain.

Container Handling: Nonrefillable container. Do not reuse or refill this container. When completely empty, offer for recycling if available, or dispose of empty container in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

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Rodenticide: Ways to Ensure Efficacy



- In facilities such as poultry operations, large amounts of other food opportunities will make baits less attractive
- Contaminated baits (dirt, manure, insects) are unattractive to rodents
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APPLICATION DIRECTIONS

Norway and Roof Rats:

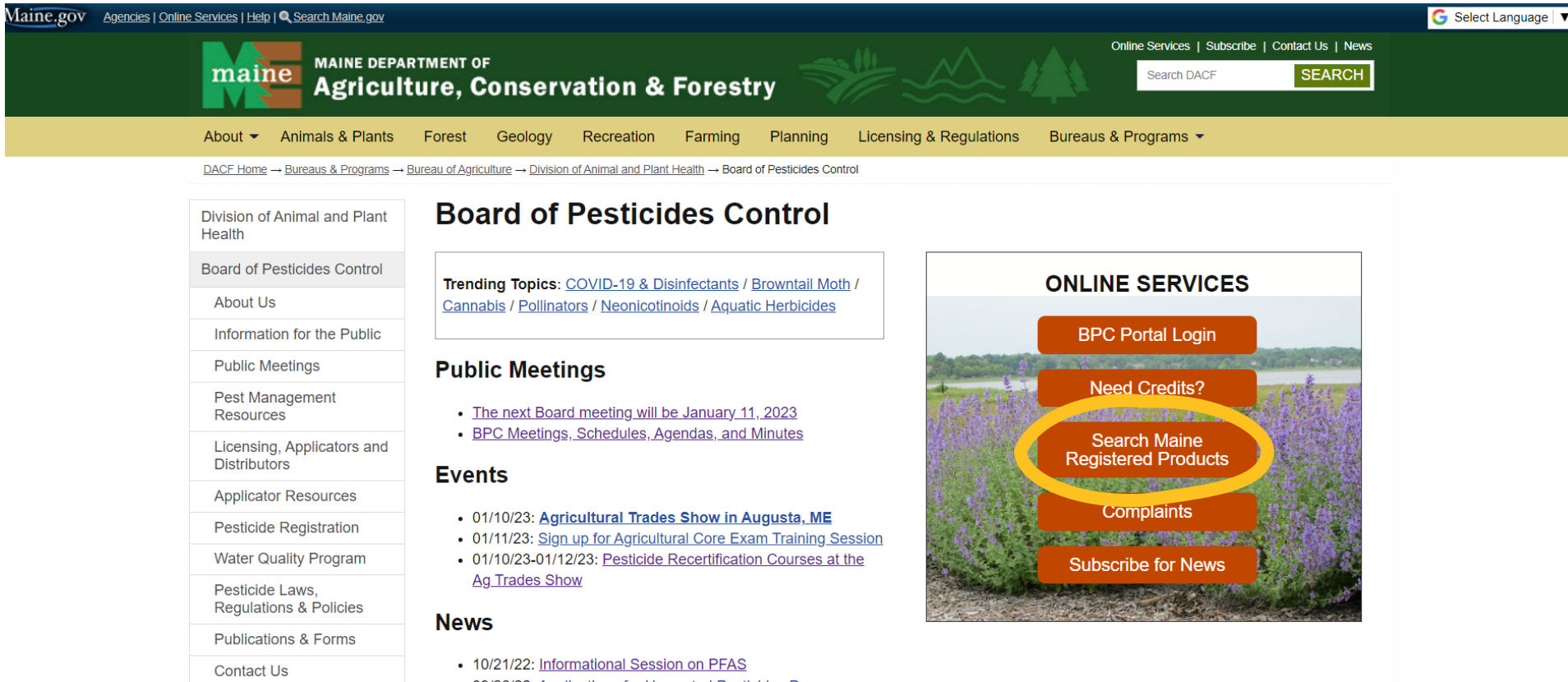
Apply 4 – 16 oz. of bait (usually at intervals of 15-30 ft.) per placement. Maintain an uninterrupted supply of fresh bait for 10 days or until signs of rat activity cease.

House Mice:

Apply $\frac{1}{4}$ - $\frac{1}{2}$ oz. of bait per placement. Space placements at intervals of 8-12 ft. Larger placements (up to 2 oz.) may be needed at points of very high mouse activity. Maintain an uninterrupted supply of fresh bait for 15 days or until signs of mouse activity cease.

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Biological & Chemical Control



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Board of Pesticides Control

Division of Animal and Plant Health

Board of Pesticides Control

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- Licensing, Applicators and Distributors
- Applicator Resources
- Pesticide Registration
- Water Quality Program
- Pesticide Laws, Regulations & Policies
- Publications & Forms
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Trending Topics: [COVID-19 & Disinfectants](#) / [Browntail Moth](#) / [Cannabis](#) / [Pollinators](#) / [Neonicotinoids](#) / [Aquatic Herbicides](#)

Public Meetings

- The next Board meeting will be January 11, 2023
- [BPC Meetings, Schedules, Agendas, and Minutes](#)

Events

- 01/10/23: [Agricultural Trades Show in Augusta, ME](#)
- 01/11/23: [Sign up for Agricultural Core Exam Training Session](#)
- 01/10/23-01/12/23: [Pesticide Recertification Courses at the Ag Trades Show](#)

News

- 10/21/22: [Informational Session on PFAS](#)
- 09/26/22: [Applications for Unwanted Pesticides Disposal](#)

ONLINE SERVICES

- BPC Portal Login
- Need Credits?
- Search Maine Registered Products**
- Complaints
- Subscribe for News



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<http://thinkfirstspraylast.org/>

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Photos: Jing (pixabay.com; creative commons)

NPIRS National Pesticide Information Retrieval System

[About Us](#) [Searches](#) [Resources](#) [Forms](#) [Contact](#) [Training](#)

SAVE THE DATE: NPIRS and ALSTAR Spring 2023 Conference in Washington, D.C. April 11-13, 2023. Room blocks available now through March 14, 2023 at the Kimpton: Hotel Monaco D.C.. More details coming soon!

SEARCH MAINE STATE PESTICIDE PRODUCTS

Search for pesticide products currently registered in Maine using *one* of the following methods.

EPA Registration Number: - -
Search by the multi-part EPA registration number. You can copy/paste the complete EPA Registration Number into any of the boxes above.

State Product Name:
Search by the full or partial name of a product registered in a state.

State Company Name:
Search by the full or partial name of a company registering products in a state.

Active Ingredient:
Search by the PC code, Chemical Abstract Services Number (CAS) or the full or partial chemical name.

NPIRS

NATIONAL PESTICIDE INFORMATION
RETRIEVAL SYSTEM

IPM Concepts



Identification

Prevention &
Cultural Control



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Photos: Jing (pixabay.com; creative commons)

Reducing rodenticide risk

How Water Poured on Rodenticide Caused 4 Deaths in a Texas Home

This form of pesticide can be deadly when inhaled.

Puducherry Girl Mistakes Rat Poison Kept by Window as Chocolate Cake, Dies after Consuming It

Posted by Jinesha
DOGS

NYC Puppy's Suspected Rat Poison Death Prompts Tragic Warning

This Article is From Mar 15, 2022

Experts say 80 percent of
quickly dog owners see

By Melissa Colorado • Published
at 7:33 am

Infant Dies After Accidentally Consuming Rat Poison In Kerala

Hospital sources said the child, while playing inside the house a few days ago, had come in contact with a container which had contained rat poison.

Kerala News | Press Trust of India | Updated: March 15, 2022 10:28 pm IST

IPM Concepts



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Biological &
Chemical Control

Reducing rodenticide risk to children, pets, livestock, & wildlife

Prevent exposures...

- Do not store within reach of children or pets
- Tamper resistant bait stations
- Follow the label instructions
- Dogs will dig up buried bait
- Search for, collect, and dispose of poisoned rodents
- Milk crates over traps reduce off-target kills and little fingers!



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Questions?



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Conservation and Forestry

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www.maine.gov/ipm

