PROTECTING NON-TARGET WILDLIFE FROM RODENTICIDES

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Background

- Department of Fish and Wildlife is responsible for protecting fish and wildlife in California.
- DFW Wildlife Investigations Laboratory is responsible for monitoring pesticide impacts on fish and wildlife in California.
- Receive animal carcasses from suspected pesticide poisonings all over the State.
- Department of Pesticide Regulation regulates pesticide use in California.
- Work with County Agricultural Commissioner's offices on pesticide-related wildlife incidents.

Pesticide Investigations: Some trends

- Fewer agricultural incidents.
- Fewer problematic ingredients.
- Smaller incidents.
- Fewer fish kills.

Typical pesticide case: 1990

- Agriculture: Rice, alfalfa, grapes
- Average of 539 animals per episode
- Most common pesticides: carbofuran (carbamate insecticide) and endosulfan (organochlorine insecticide)

Typical pesticide case:2010

- Urban/residential pesticide use
- Small number of animals (average of 17/episode)
- Most common pesticide: anticoagulant rodenticide

WE'VE COME ALONG WAY, BUT STILL HAVE A FEW ISSUES TO SOLVE.

No rodenticide is completely safe for wildlife (or kids or pets).

Acute rodenticides

- Kill quickly.
- Usually primary exposure is the problem.
- Often no antidote
- Strychnine, bromethalin, zinc phosphide, cholecalciferol.

Anticoagulant rodenticides

- Take several days to kill.
- Usually secondary exposure is a bigger problem.
- There are antidotes.
- First generation, second generation.

Non-target wildlife

Is it on the label?

Some Trends in Nontarget Losses

- Anticoagulant rodenticides were responsible for the highest number of incidents.
- Incidents caused by acute toxicants involved more animals per incident.
- Strychnine was the rodenticide most often involved in intentional poisoning incidents.
- Bromethalin cases are increasing.

Rodenticides used for Field Rodents

- Anticoagulants (First Generation)
- Bromethalin (Moles only)
- Strychnine (Gophers only)
- Zinc Phosphide
- Fumigants

Two different kinds of ARs.

1st Generation

- Multiple feedings
- Less persistent in tissues
- Commensal and outdoor use
- Chlorophacinone, diphacinone, warfarin

2nd Generation

- Intended for single feeding (more toxic)
- More persistent in tissue
- Registered only for commensal use
- Brodifacoum, bromadiolone, difethialone, difenacoum

Anticoagulant Rodenticides

- Cause death by impairing clotting – animal takes several days to die.
- In the early 1990's, DFW began receiving animals with signs of anticoagulant toxicosis. Symptoms include unexplained bleeding in the body cavities and subcutaneously and lack of clotting in blood.
- Mostly result of secondary exposure.

Species Impacted

- Golden Eagle
- Bald Eagle
- Great-horned Owl
- Barn Owl
- Red-tailed Hawk
- Red-shouldered Hawk
- Cooper’s Hawk
- American Kestrel
- Turkey Vulture
- Canada Goose
- Black bear
- Fisher

- Red Fox
- Gray Fox
- SJ Kit Fox
- Coyote
- Mountain Lion
- Bobcat
- Kangaroo Rat
- Raccoon
- Badger
- Wild Pig

How do we diagnose AR toxicosis?

- Signs of coagulopathy (abnormal bleeding) without signs of trauma.
- Concentration of AR in liver
- (Must have both – AR detections in liver without coagulopathy → no AR intoxication diagnosis)

Necropsies of Anticoagulant Cases

Interpretation can be difficult

- Often more than 1 kind of AR.
- Persistent in liver – don't know when exposure(s) occurred.
- Each AR has its own toxicological profile for different species.
- Gross necropsy doesn't tell the whole story.
- Other stressors (disease, trauma, starvation)
- (Must have both – AR detections in liver without coagulopathy → no AR intoxication diagnosis)

Monitoring Confirmed Widespread Exposure before Regulation Change

- 79% of San Joaquin Kit Foxes in Bakersfield had been exposed to ARs.
- Mountain Lions and Bobcats: 90% of bobcats, all of mt lions tested in Southern California (Riley, 2007).
- Raptors (Lima and Salmon, 2010): In San Diego 49/53 detections. In Central Valley 37/43 detections.
- Fishers (Mourad Gabriel, UCDavis): 79% had AR detections.

Conclusions from Mortality and Monitoring Data: 2014

- Widespread AR exposure to predators and scavengers
- Mortalities caused by exposure
- Sublethal Effects?
- Multiple exposure scenarios:

  Urban, Rural, Wilderness
- Illegal/Legal Use?

Illegal Sources

(Gabriel 2012)

Regulation Change: 2014

- CDFW recommended that Department of Pesticide Regulation make SGARs Restricted Use Materials (need a license to buy or use).
- Also limited outdoor use to within 50 feet of manmade structure.
- DPR agreed – regulation change July 2014.
- USEPA also acted to remove the products from consumer venues.
- CDFW continued to monitor to determine if regulations have had the desired effect. Other monitoring studies as well.

Monitoring Since Regulation Change (2017)

- Preliminary results show continued high levels of exposure
- In the past 2 years: 20 intoxication cases (10 brodifacoum, 5 bromadiolone, 2 difethialone, 3 multiple ARs):
  - 4 great horned owls
  - 4 squirrels
  - 3 red-shouldered hawks
  - 3 skunks
  - 2 turkey vultures
  - 1 bear
  - 1 bobcat
  - 1 San Joaquin kit fox
  - 1 gray fox

CDFW Cases
July 2015 - 2017

Most predators tested exposed

- 87% (of tested) positive for brodifacoum
- 67% (of tested) positive for bromadiolone
- 46% (of tested) positive for difethialone

Multiple anticoagulants/individual tested

- 2.3 different anticoagulants/individual
- 1.8 SGARs
- 0.5 FGARs

A Piece of Success

- Marijuana grows (Estimated by Gabriel, Integral Ecology Research Center)

Rodenticide	2012-2014 (% of total)	2015 (% of total)	2016 (% of total)
Brodifacoum	70	40	5
Other SGAR	10	10	5
FGAR	10	30	40
Bromethalin	5	10	30
Phosphide/ Strychnine	5	10	20

FGARs vs. SGARs 2017

- SGARs still the major source of exposure.
  - Highest prevalence of detections
  - Responsible for the overwhelming majority of AR intoxication cases
- FGARs detections higher than pre-2014. Mostly diphacinone.

USEPA's Risk Model

Higher Risk

Lower Risk

Brodifacoum

Zinc Phosphide

Difethialone

Diphacinone

Bromadiolone

Chlorophacinone

Cholecalciferol

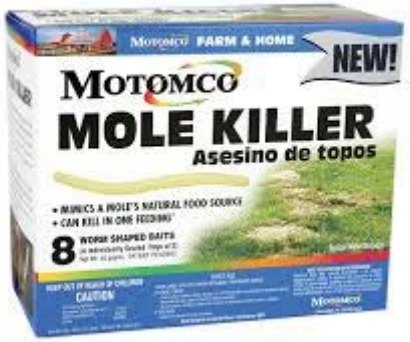
Warfarin

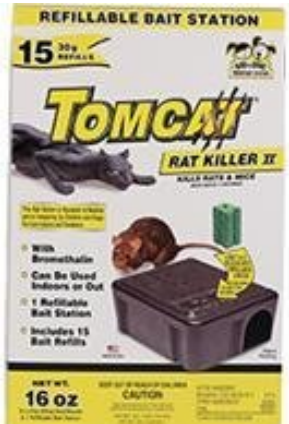
Bromethalin

USEPA. 2004. Erickson and Urban

Bromethalin

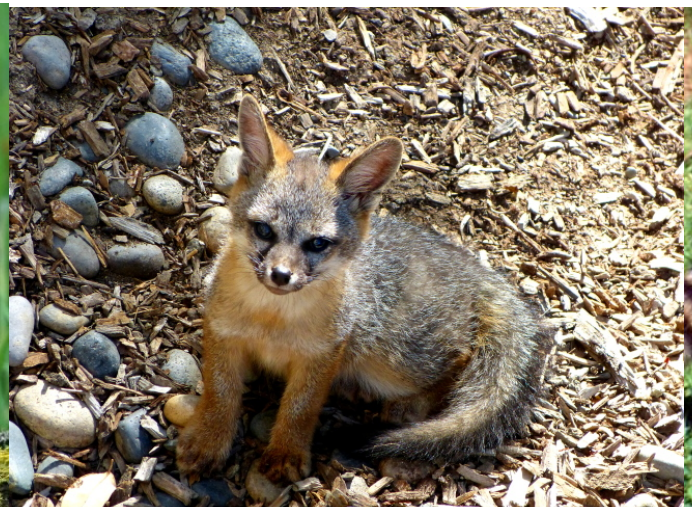
- Commensal rodents and moles
- Acute toxicant
- Secondary toxicity?
- Available in pellets, blocks, prefilled bait stations, place packs and worms





Bromethalin losses

- Close to 50 cases confirmed incidents.
  - Mostly skunks and raccoons
  - Also gray foxes and coyote
  - Mostly in Marin County (WildCare study)
- Direct exposure to bait
- Signs of intoxication:neurological signs, paralysis of rear limbs
- May appear to be trauma or neurologic disease


Controlling Primary vs. Secondary Exposure

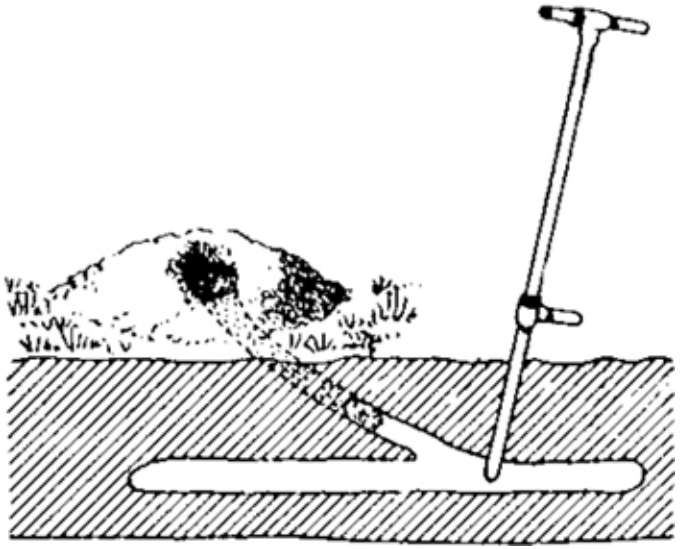
Which is easier to control?

OR

Recommend use only in a bait station.

Strychnine

- Restricted and general use.
- Only legally applied underground for gopher control.



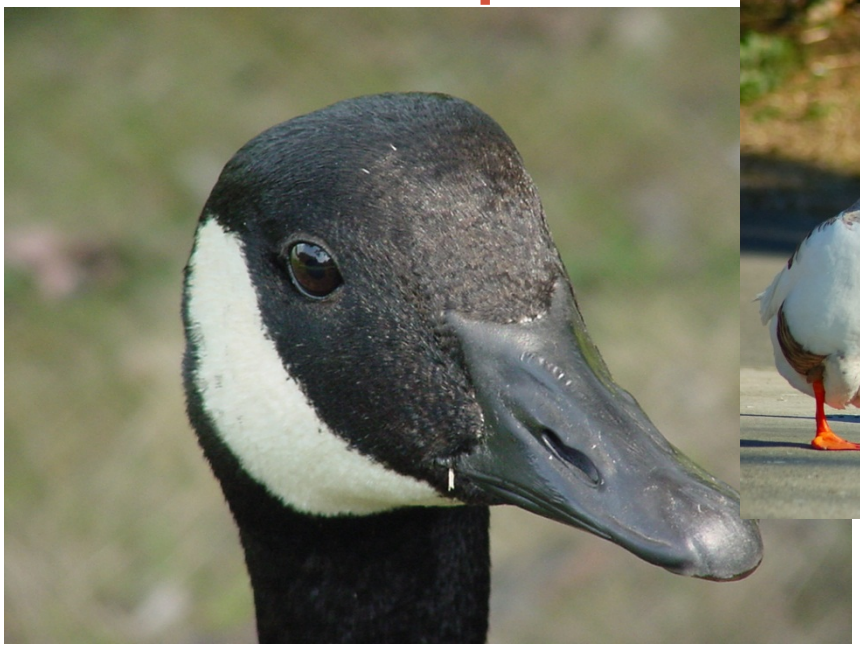
Strychnine

- Mostly primary exposure.
- Most commonly used pesticide for intentional poisoning.
- Flock of birds or “problem” wildlife.
- Animal show neural signs (tremors, convulsions) while alive, or stiff-legged when dead.
- 2011-2015: ~60 losses in several different incidents.
- Few incidents over the last few years (use decreased by 65% over 5 years)
- Use practices that have caused recent losses have not been determined.
- San Joaquin kit fox: Federally Endangered Species.

Which one was strychnine?

Photo credit: Jaime Rudd

Zinc Phosphide



- Restricted and General Use.
- Intentional poisonings
- Accidental
- Pre-baiting is key
- High risk of primary exposure.

Fumigants

- Aluminum phosphide, gas cartridges, etc.
- No known losses, but…?
- Proper burrow identification essential for protection of non-targets.


What's in that burrow?

Integrated Pest Management

- Acceptable pest levels
- Preventative cultural practices
- Monitoring
- Mechanical controls
- Biological controls
- Responsible use

Summary

- All vertebrate toxicants have the potential to cause non-target mortality.
- Acute toxicants and fumigants – primary exposure.
- Anticoagulants – primary and secondary exposure.

Thanks for Listening!

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