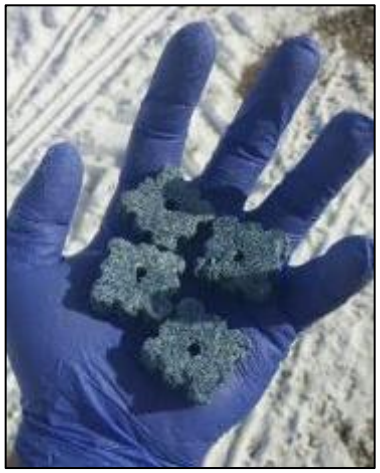
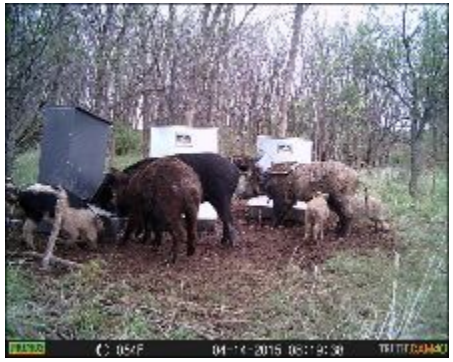
Where we've been and Where we're going with Warfarin for controlling wild pigs





Richard Poche

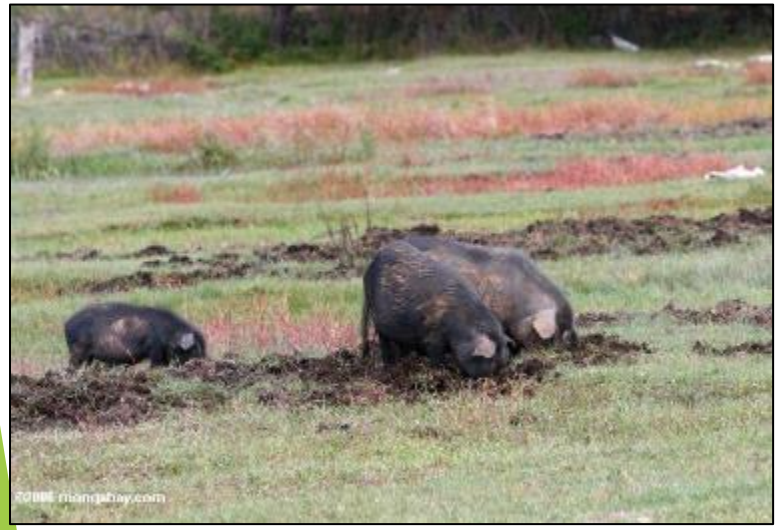
Genesis Labs

Wellington, Colorado

Background

- Peace Corps – Niger, Park W
- Schools UL, TAMU, UC Berkeley
- US Fish & Wildlife Service (DWRC)
- Genesis 1989

Landscape Modification



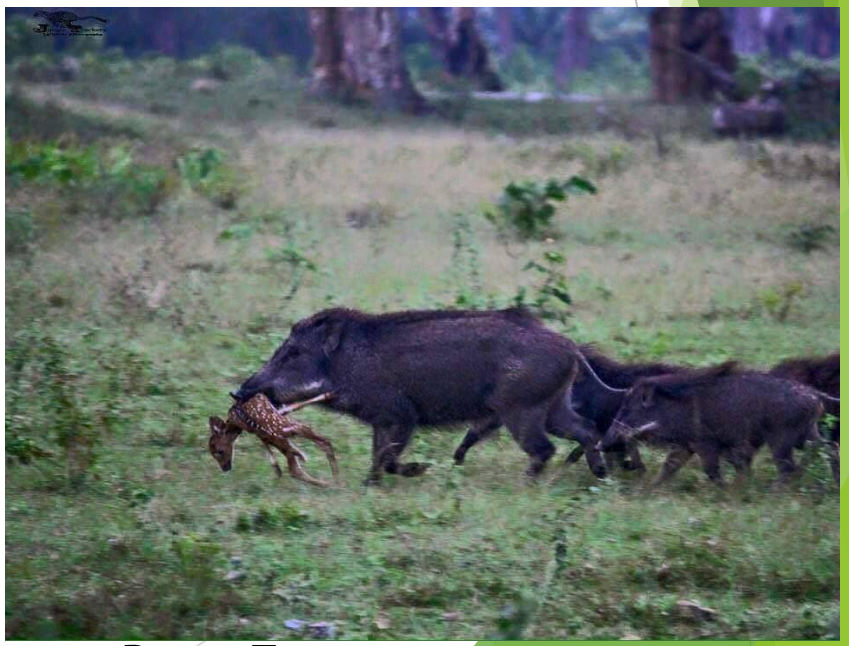
Predation

Livestock (sheep)

http://www.abc.net.au/

www.seaturtle.org

Sea Turtles



Deer Fawn

Area Comparison: Ft. Benning, Georgia vs Texas- Feral Hog Consumption of Herps Only

- 284 sq. mi.- Georgia study area (Fort Benning). 3.16 million reptiles & amphibians
- Texas area 268,580 sq. mi. = 2.99 billion reptiles & amphibians
- Impact on endangered species?

Feral Hog Bait Development Timeline

- 2000 Grant from Hawaii Community Foundation to work on a feral hog toxicant.
- 2008 USDA Grant awarded and pen studies conducted in Kingsville, Texas.
- 2008-16 Annual meetings with the EPA to review plans for developing a hog bait, along with slide shows describing hog problems and need for solution.
- 2013 Applied for an Experimental Use Permit with the US EPA.
- 2014 & 15 Permits issued by EPA and State of Texas to conduct field testing of baits.
- 2015-17 – Grants provided by Texas Dept. of Agriculture.
- January 3, 2017 EPA Issues Registration of Kaput Feral Hog Bait

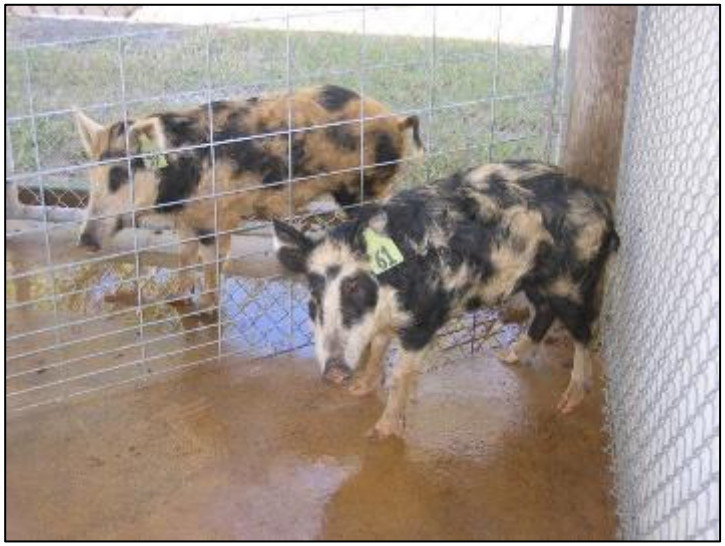
WHY WARFARIN?

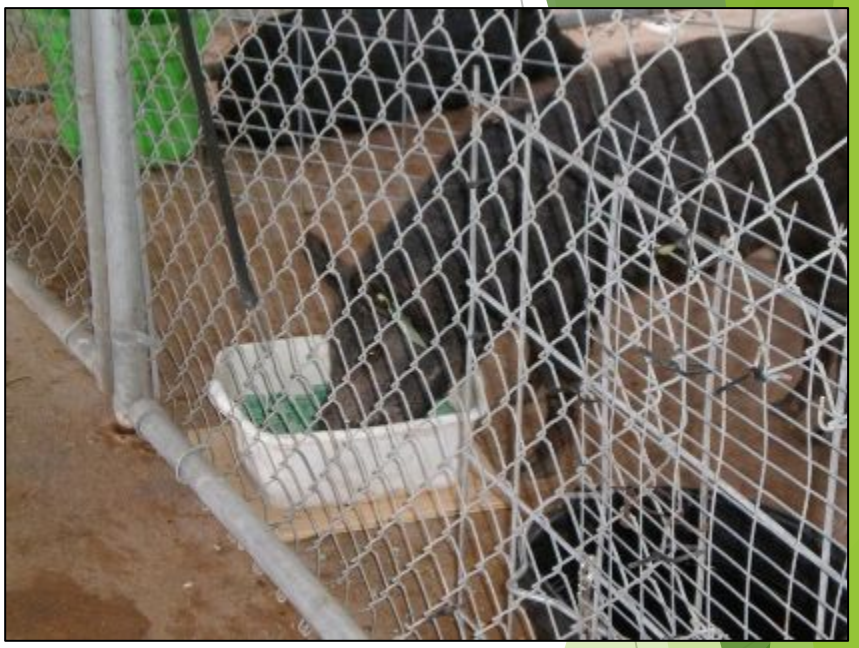
- Discovered during 1920's; WARF
- Approved as rodenticide in 1948
- Approved as a human drug in 1954
- One of 1st patients using Coumadin was President Dwight D. Eisenhower, later President Richard Nixon
- Antidote Vitamin K
- Half-life in blood 42 hours
- Does not bioaccumulate, unlike 2nd generation anticoagulants

Use of a Warfarin Bait to Control Feral Hogs

- Hogs are very susceptible
- Low concentration
- Human drug
- Non-Target species- low toxicity

Kingsville, Texas 2009





DPN vs Warfarin

Feral Hogs Exposure to Warfarin Baits Over Time (days) 2009

(%) Warfarin	1 day	2 day	3 day	5 day
0.025	2/4	4/4		
0.0125			3/4	4/4
0.005			1/4	4/4

Fat Soluble Dye, 2010

- Fat soluble dye- visible within 24 hours
- If hunter kills a feral hog, knows it has consumed bait

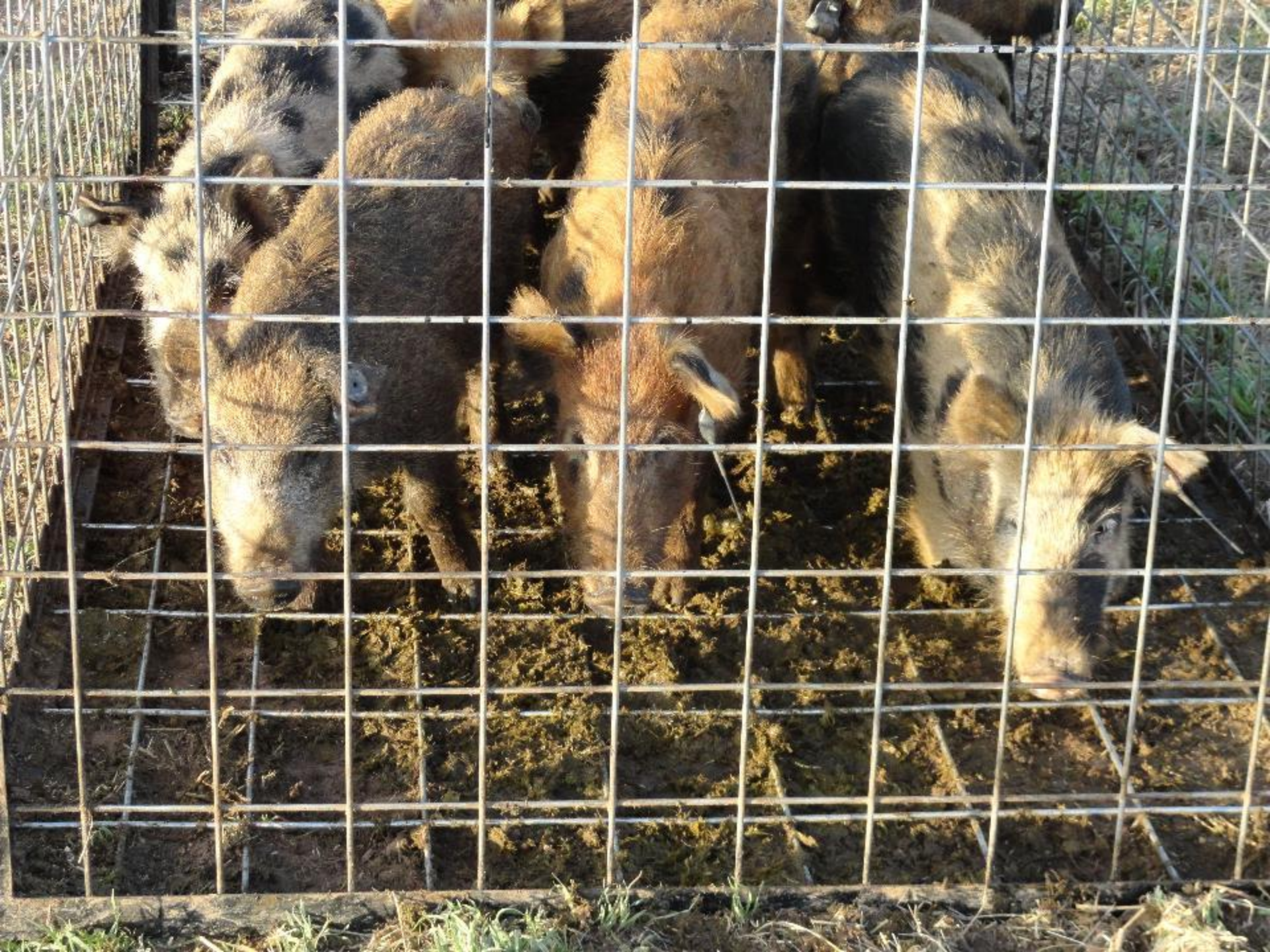
Pen Study: hogs fed 1kg bait/dayx5 days. "Day" refers to post-treatment time to mortality and mean tissue residue levels

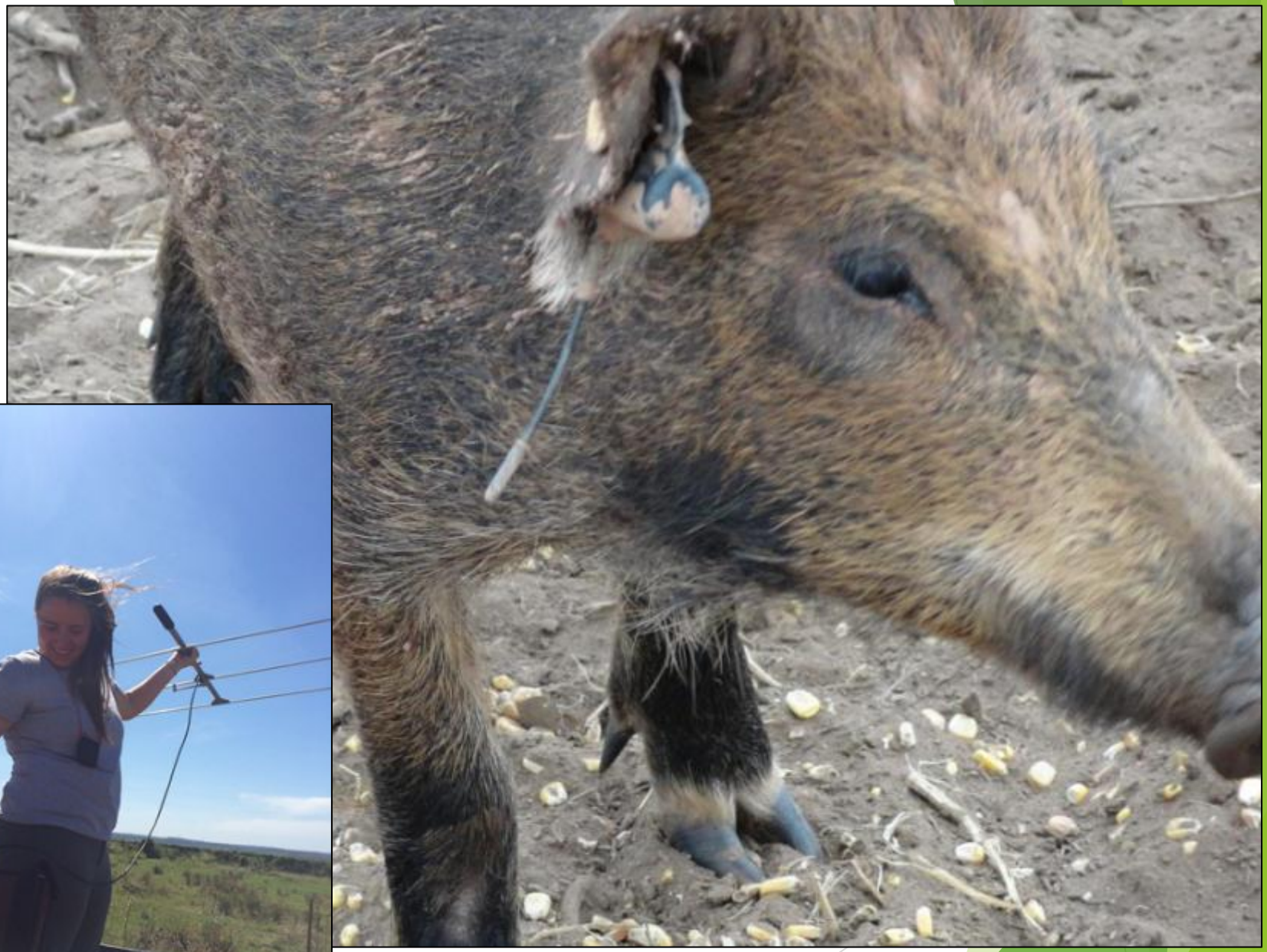
Day	No.	Muscle	Liver
0	7	1.63	4.51
1	9	0.49	1.72
2	1	0.63	3.24
3	1	0.18	1.64
4	1	0.07	1.47

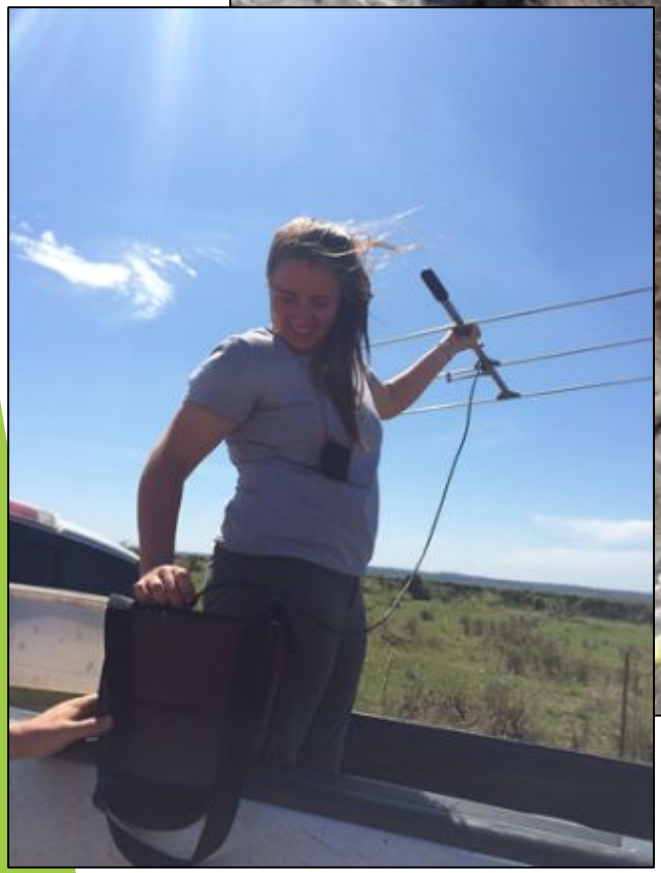
Bait contained 0.01% warfarin- 2015
Average consumption per hog 3.9 kg

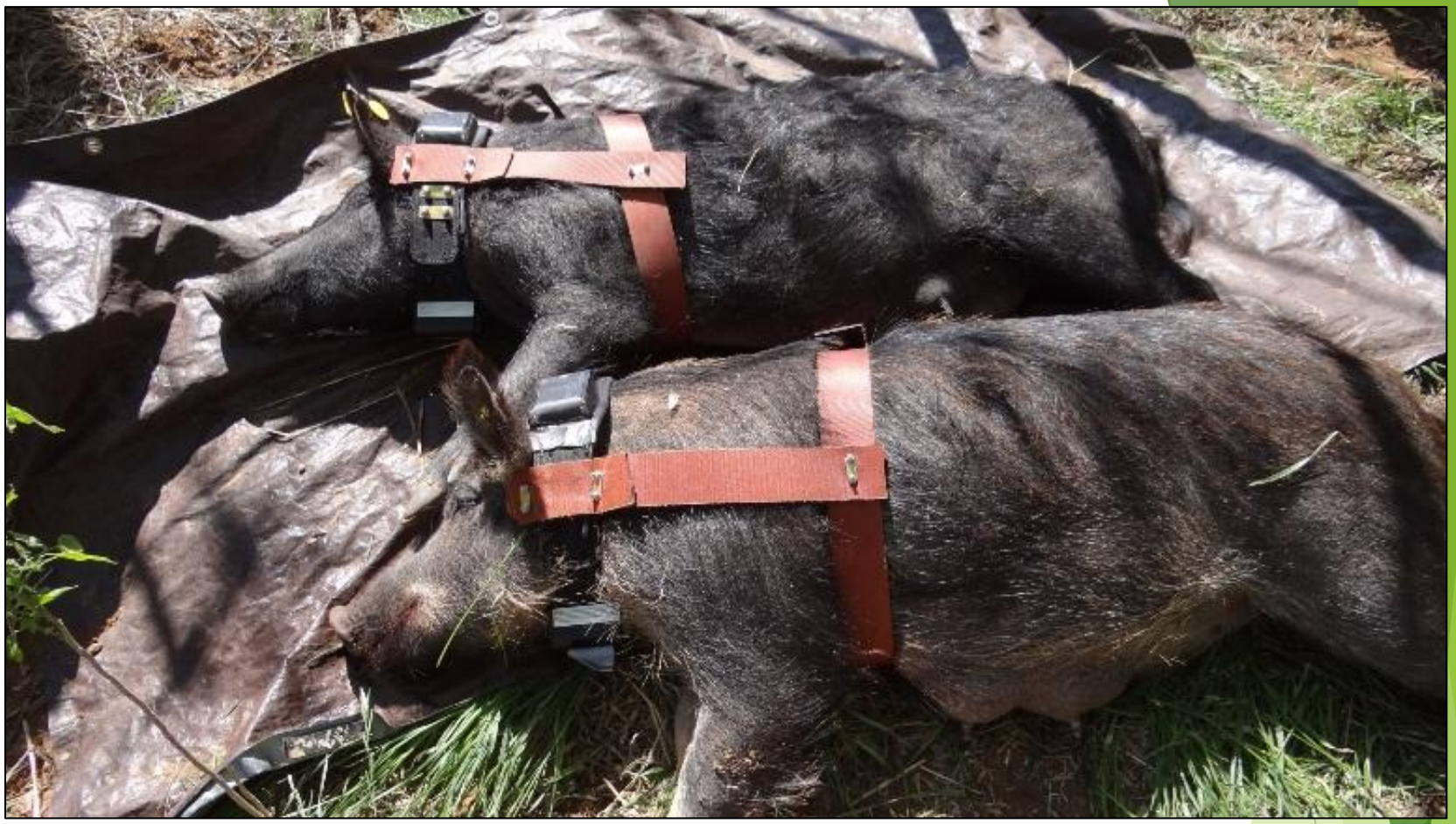
Field Efficacy of a Feral Hog Bait Containing 0.005% Warfarin

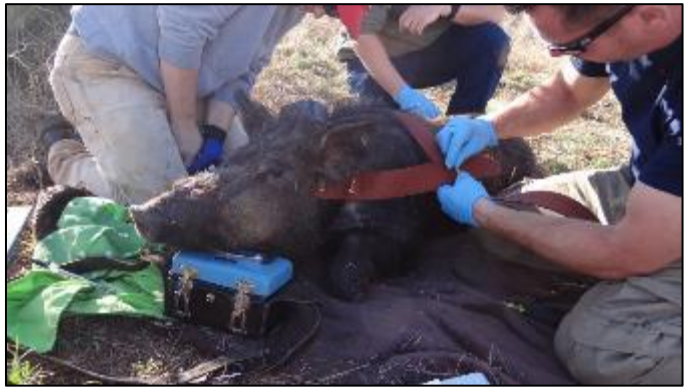
North Texas 2015-17

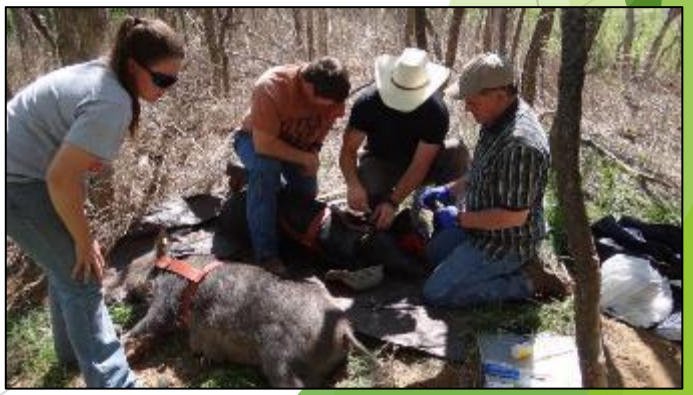


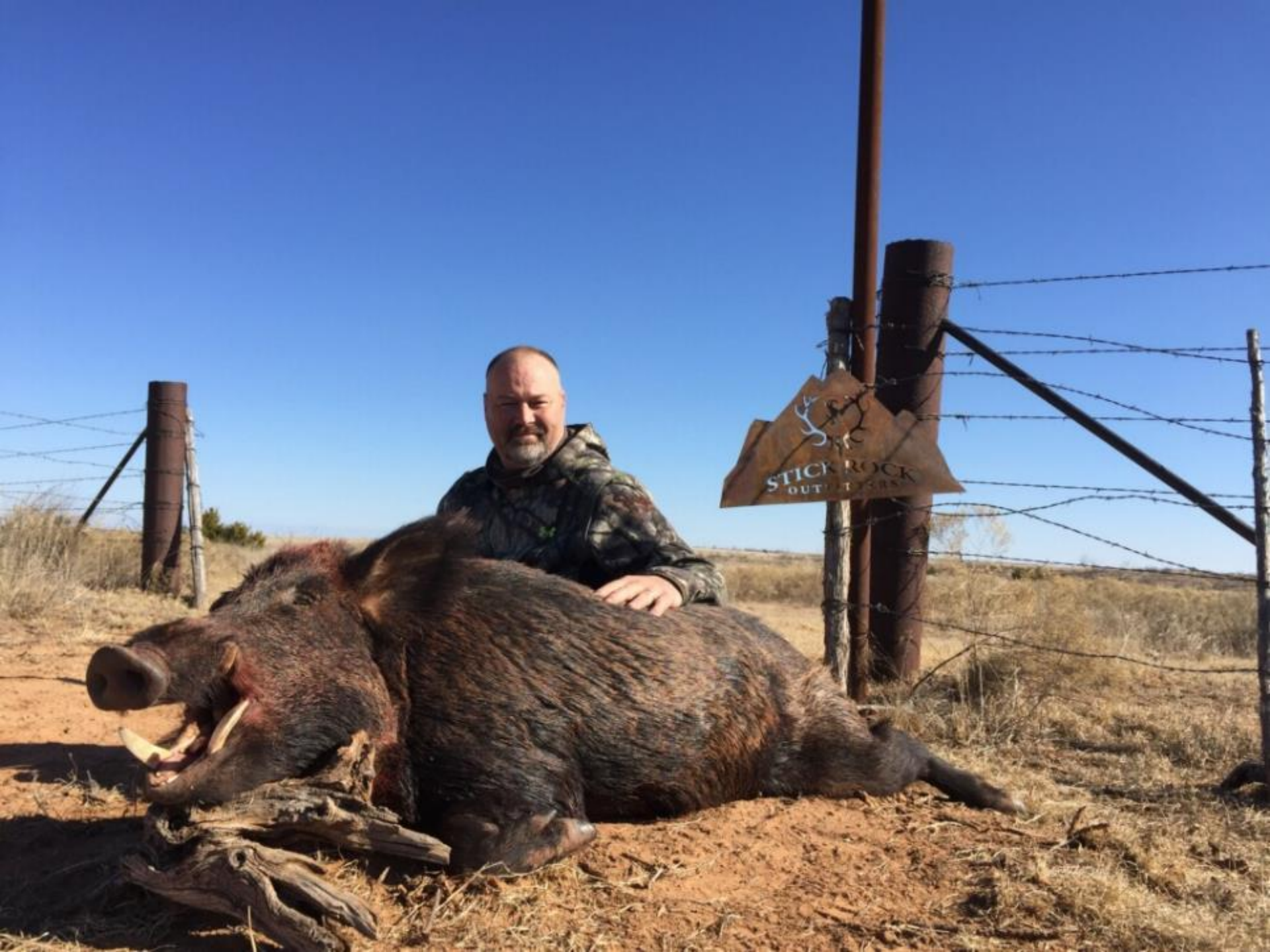


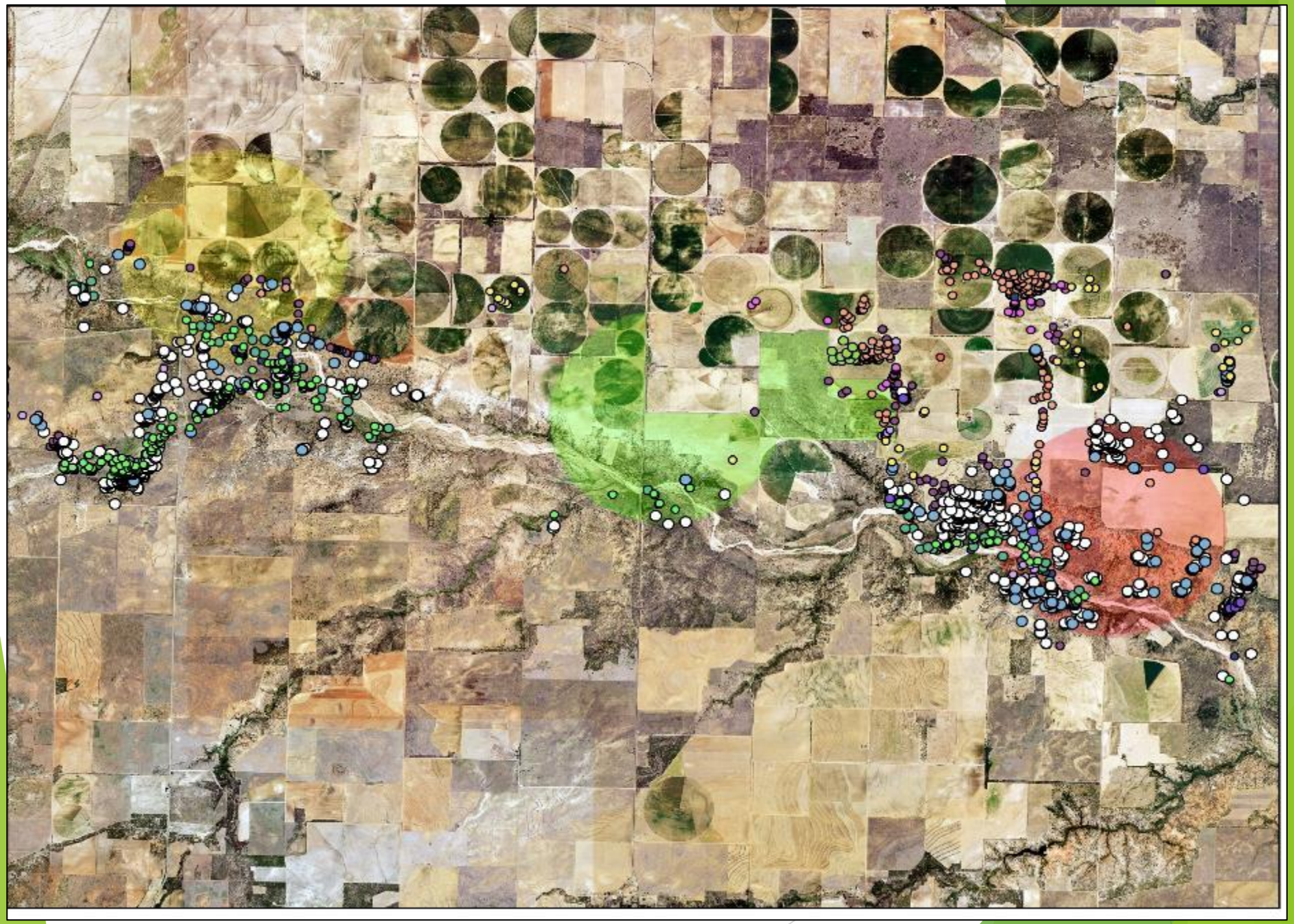









STICK ROCK



Feral Hog Efficacy with 0.005% Warfarin Bait

Mortality Data Based On:	Efficacy
Radio-telemetry	100 %
Trail Cameras at Feeder Station (Pre and Post- Treatment)	98.7 %
Bait Consumption (kg/week)	97.8 %

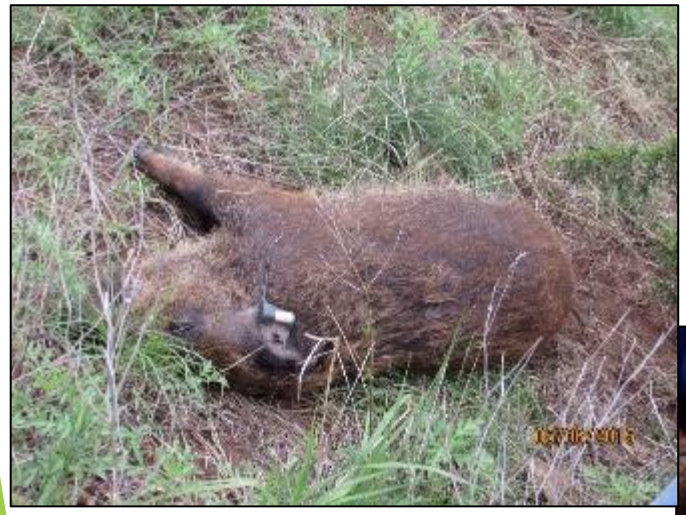
- Warfarin Residues in Liver: Mean 3.7 mg/kg (Human daily dose for Coumadin: 2-10 mg/day)

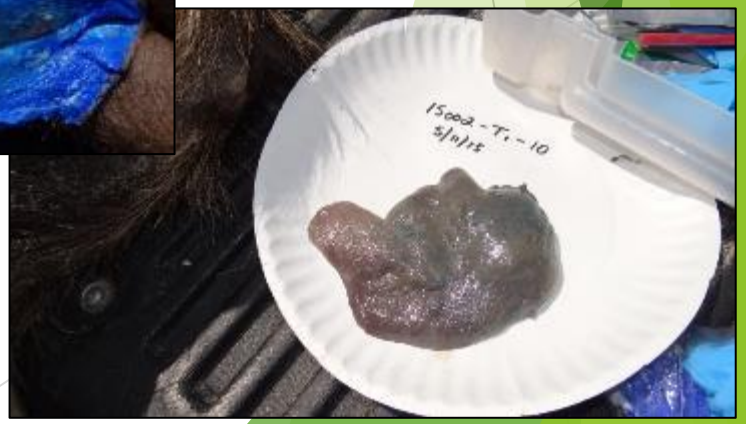
EPA Requested Data Collection

- Area treated: 8^2 kilometers
- Amount of bait used: 0.005% warfarin, 330 lbs (0.02 lb. or 7.5 g warfarin)
- Total Bait Spillage: 1 lb. or 22.7 mg warfarin
- Hog Carcass Fate: Coyotes, Turkey Vultures, Crows, Feral Hogs
- Non-target Hazard Searches: 97 searches with no kills other than hogs
- Tissue residues in hog livers averaged 3.7 mg/kg

Carcass Collections and Necropsies

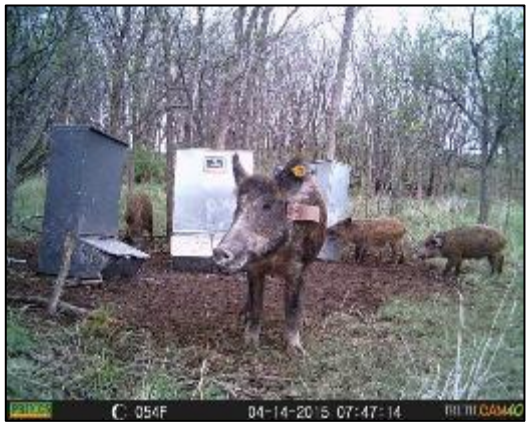
- Use of VHF and GPS units
- Hazard Searches
- Necropsies (signs of bait consumption)
- Liver Collection

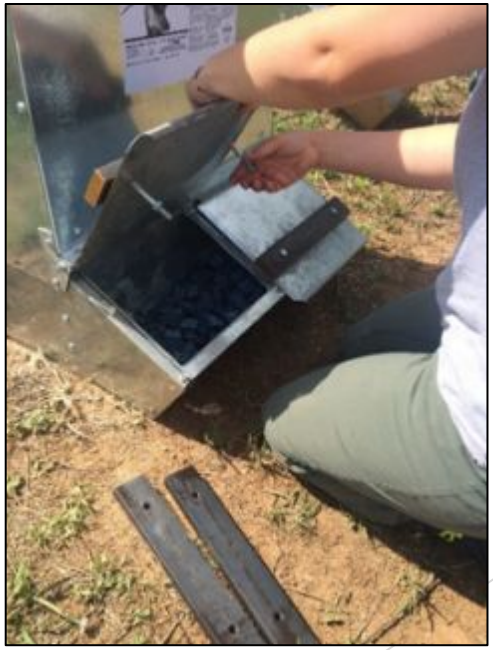


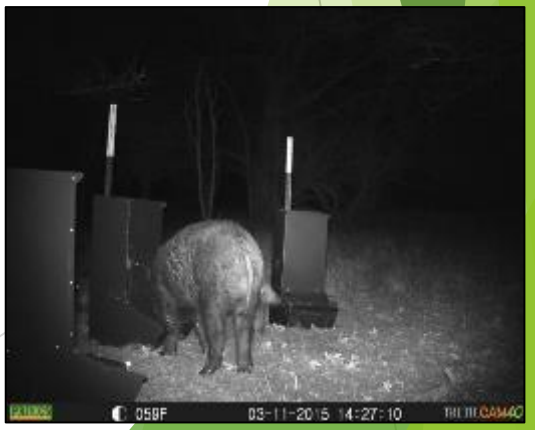


Hog Feeders

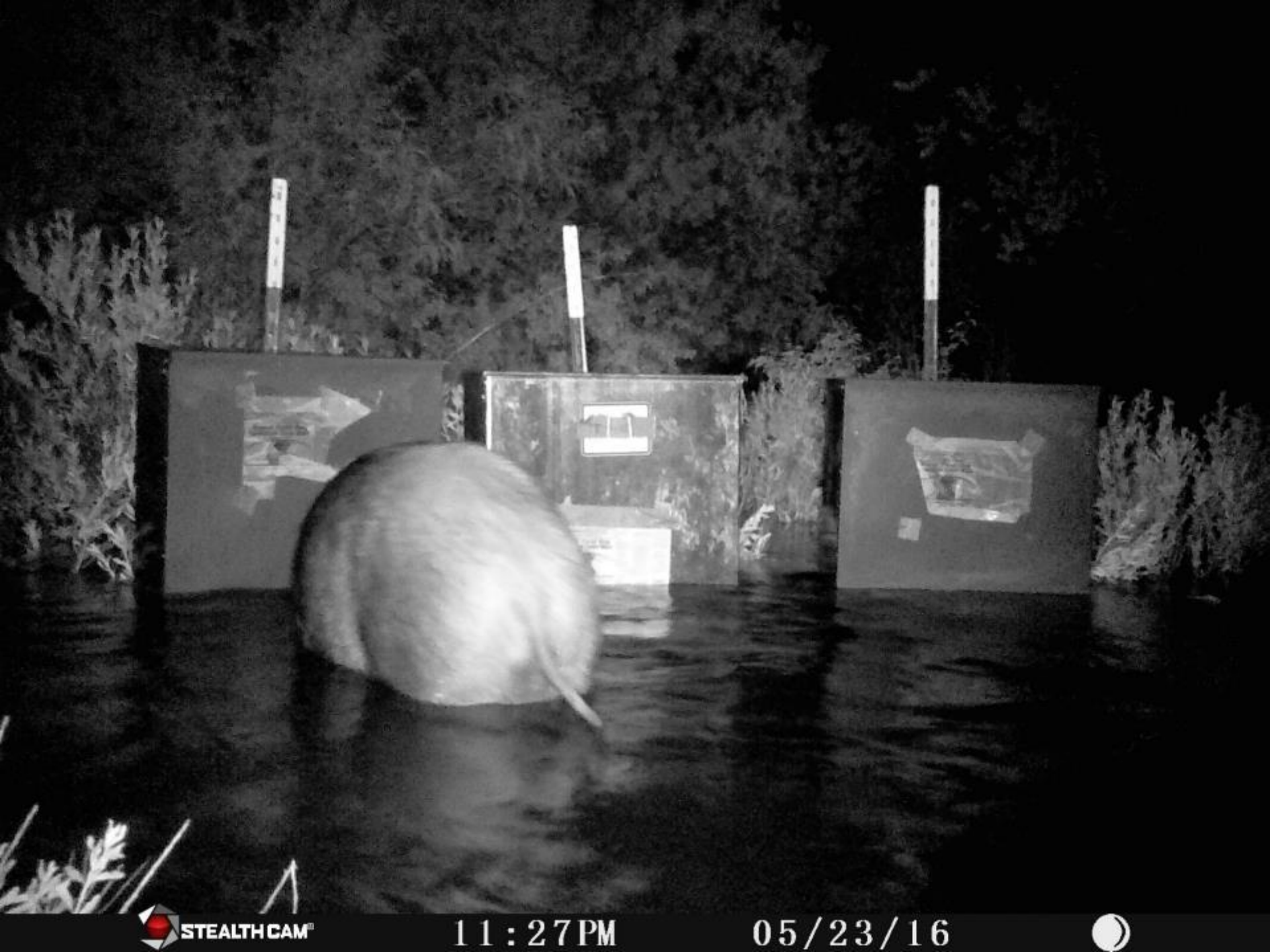
- Controlled exposure of bait
- Maximize containment of bait
- Use feeders only with heavy lids that minimize non-target access to bait
- Applicable feeders currently in design process





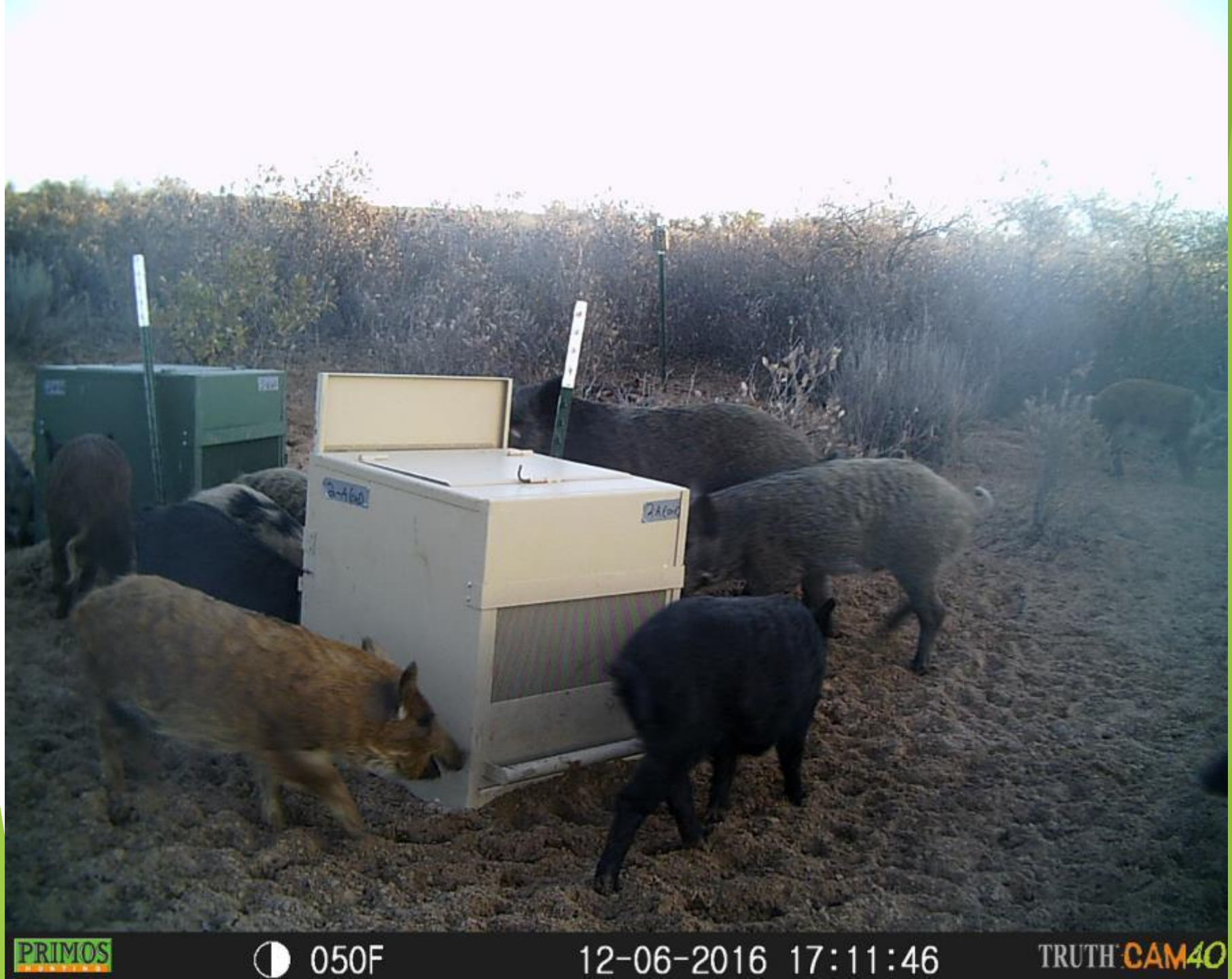



3 feeders per cluster x 10 clusters/plot
TZ-03
STEALTH CAM
08:18 AM
05/15/16


STEALTH CAM
11:27PM
05/23/16

New Feeder Developed in 2015-17

- Heavy 16 gauge sheet metal
  - Door 14 gauge weighs 17.2 lbs., total 127 lbs.; heaver unit 146 lbs.; 1-sided feeder 78 lbs.
- Vertical doors at opposite ends
- Keeps non-target wildlife out
- Doors opened for 3-6 weeks for feed conditioning
- After, doors lowered and bait added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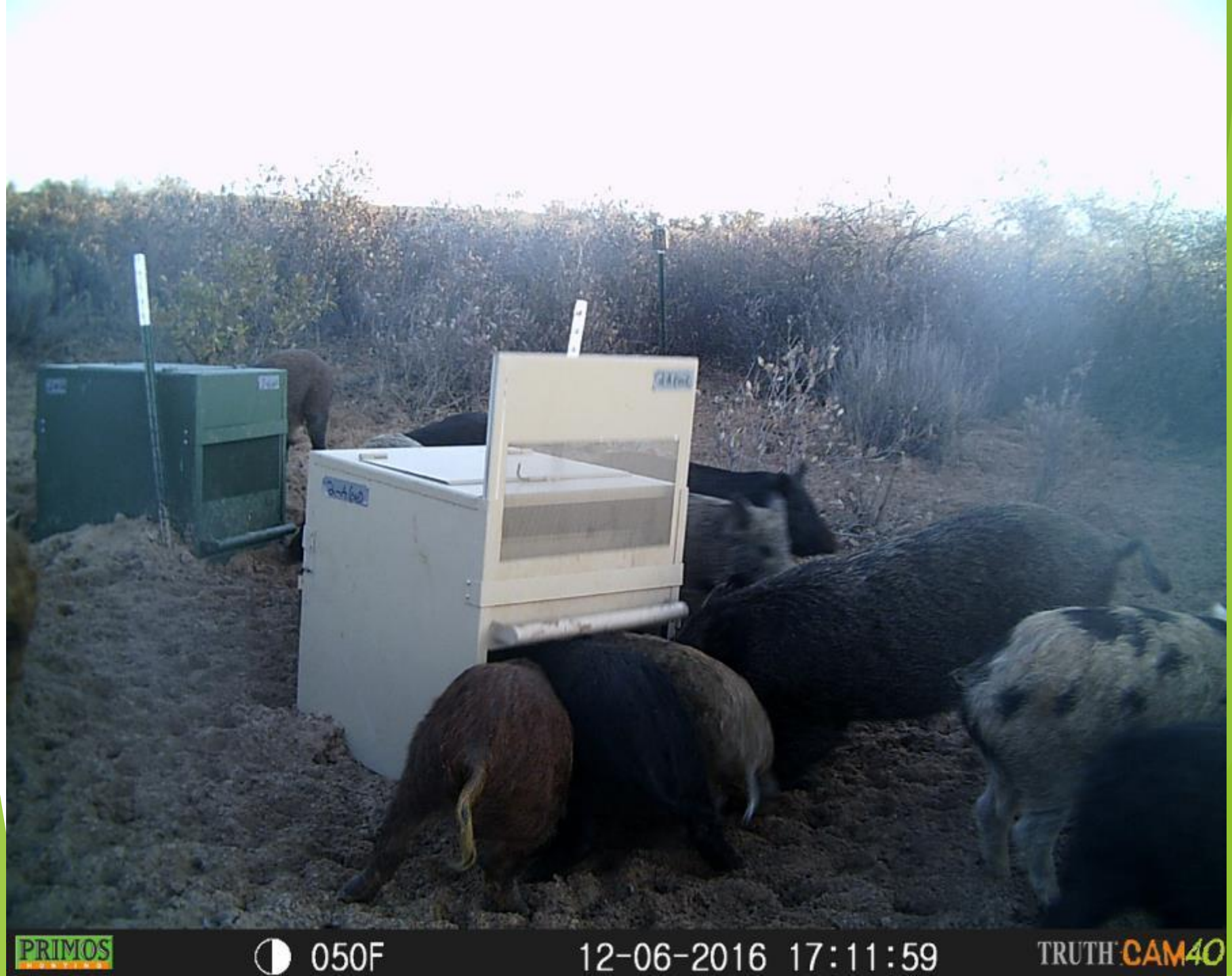
TRUTH CAM40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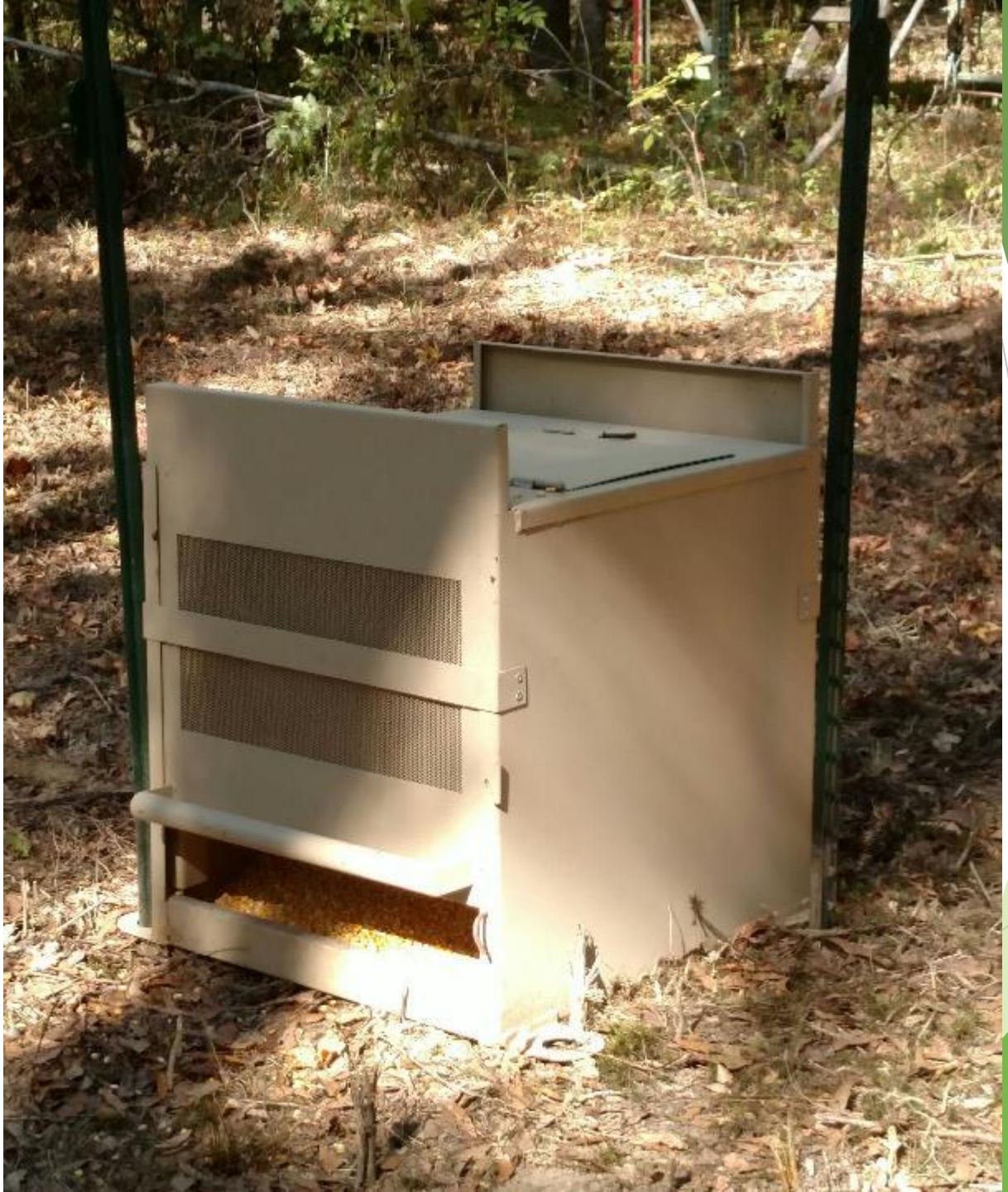


Black Bear Study, Alabama

Dose Makes the Poison

- Australia study contained 0.09% warfarin, 18 times more than Kaput.
- Warfarin Rat & Mouse Baits contain 0.025% warfarin in the US
- Kaput Feral Hog Bait Contains 0.005% warfarin, or 1/5th the concentration of US rat bait products
- All chemicals are inherently toxic
- Goal is to arrive at a reduced risk level to ensure efficacy while reducing danger to wildlife and other non-target animals

Pesticide Signal Words as Defined by the USEPA

- Danger-Poison- highly toxic, Category 1
  - LD_{50} < 50 mg/kg
- Warning – Moderate Toxicity, Category II
  - LD_{50} >50-500 mg/kg
- Caution – Low Toxicity, Category III
  - LD_{50} > 500-5,000 mg/kg
- Caution – Very low toxicity, Category IV
  - LD_{50} > 5,000 mg/kg

- Aspirin 300 mg/kg
- Caffeine 192 mg/kg
- Nicotine 50 mg/kg
- Vitamin D3, 37 mg/kg
- Kaput Feral Hog Bait > 60,000 mg/kg

Accepted Facts

- 40,000 deaths caused by aspirin and painkillers each year (American Journal of Medicine)
- 92 human fatalities each day from car accidents (33,580)
- 88,000 people die each year from alcohol abuse
- In 2015, a total of 13,286 people were killed by firearms
- 2.9 million companion animals euthanized each year
- 1,230,000 deer are killed by automobiles each year

Coumadin (warfarin) a Human Drug

- **Warfarin dosing information**
- **Usual Adult Dose of Warfarin for Congestive Heart Failure:**
- Initial: 2 to 5 mg orally or intravenously once a day for 1 to 2 days, then adjust dose according to results of the International Normalized Ratio (INR) or prothrombin time (PT).

  Maintenance: the usual maintenance dose ranges from 2 to 10 mg orally or intravenously once a day.

Toxicity of Hog Bait to Animals (A.P. Meehan 1984)

- Hogs (40 kg)- Acute exposure 3 mg/kg = 2.4 kg (5.3 lbs) bait
  - Chronic (7 days) 0.4 mg/kg/day = 11.4 oz./day -some kill
- Turkey: 7 kg bird, 95mg/kg x 19 days = 13.3 kg (29.3 lbs) bait/day
- Bobwhite quail- LC50 625 ppm (12.5 kg (27.5 lbs) bait/day) (EPA-practically non-toxic)
- Dog- acute 100/mg/kg = 2 kg bait x 20 kg dog = 40 kg (88 lbs) bait
  - 3 mg/kg x 5 days = 1.2 kg (2.6 lbs) bait/day x 5 = 6 kg (13 lbs) bait
- Cattle- 200 mg/kg x 5 days - 400 kg steer required 1,600 kg (3,520 lbs) feral hog bait per day for 5 days.

Primary Toxicity Data on Warfarin (0.025%) to wildlife – Nutria Bait Development 1998

- Mallard (5x) 14 days. No effects
- Bobwhite quail (5x) 14 days. No effects
- LD_{50} bobwhite >10,000 mg/kg (ai)
- LD_{50} mallard ducks >10,000 mg/kg

Warfarin concentration 5 times Feral Hog Bait

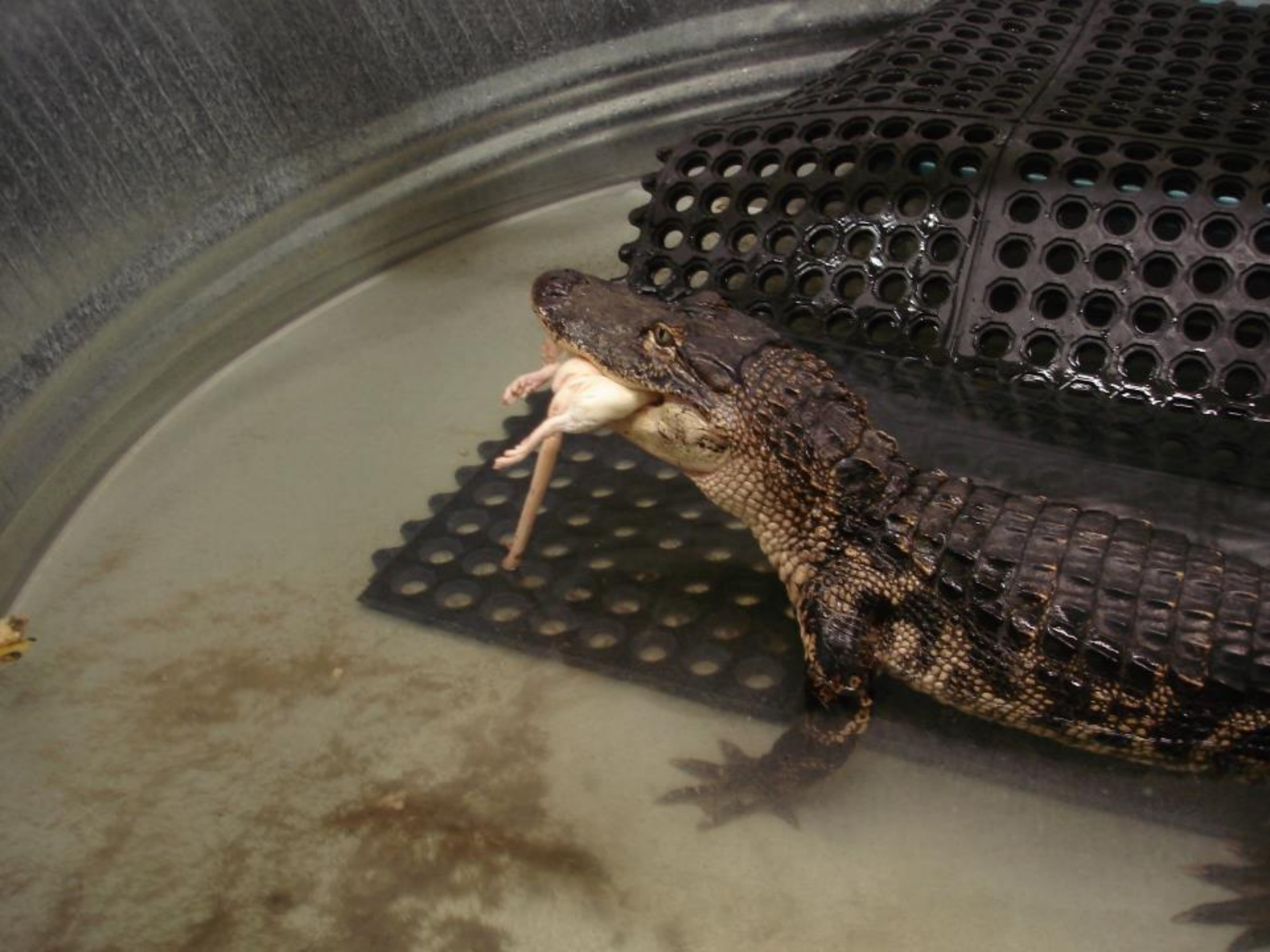
Secondary Toxicity Data Submitted to EPA (0.05% warfarin)

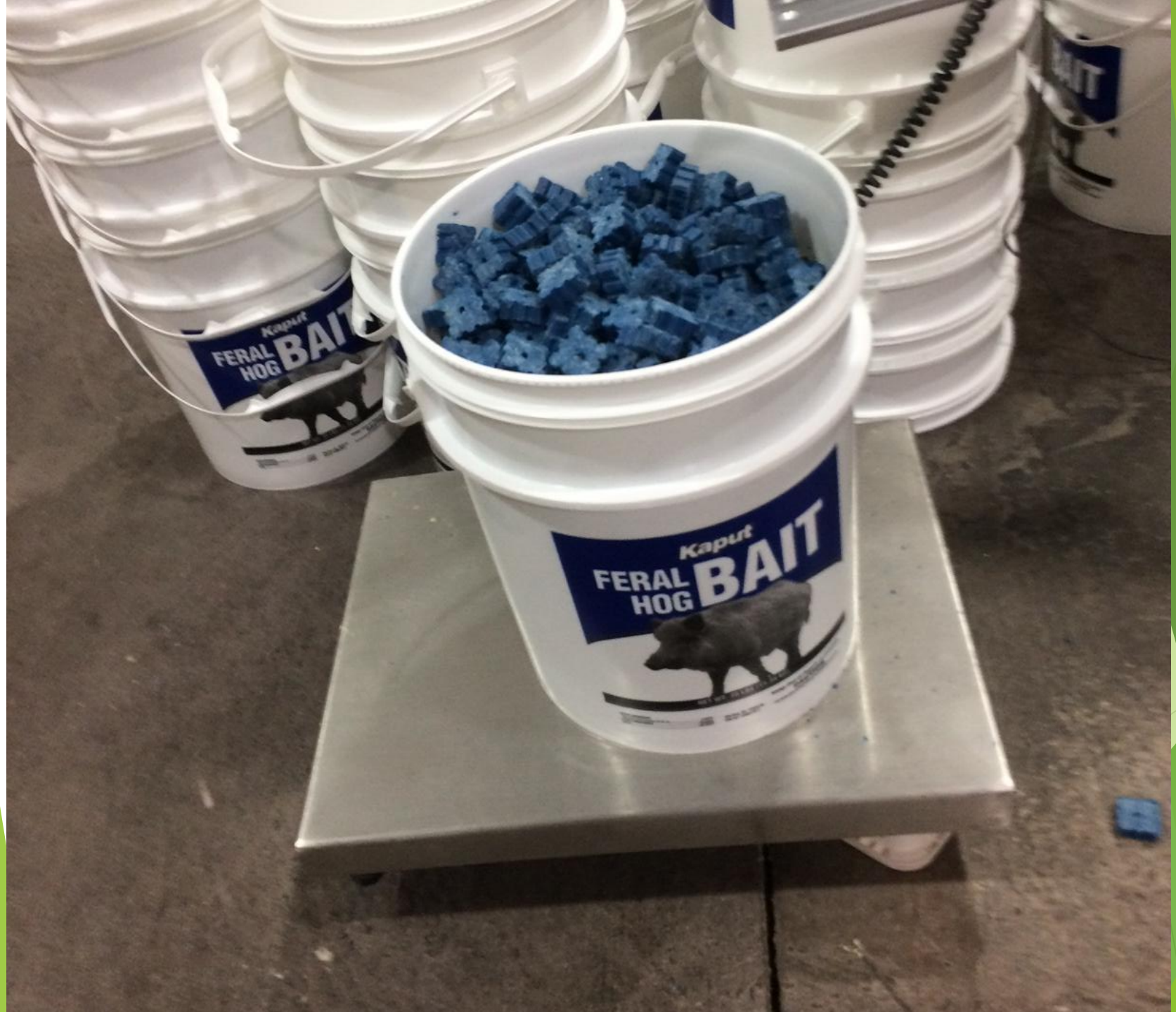
- Warfarin (10x)-killed rats fed to magpies. No effects.
- Warfarin (10x)-killed prairie dogs fed to European ferrets. No effects.
- Warfarin (10x)-killed rats fed to Alligators. No effects.
- Warfarin (10x) fed to mallards, 14 days. No effects.
- Warfarin (10x) fed to bobwhite quail, 14-days. No effects.

Warfarin concentration 10 times Feral Hog Bait

Ongoing Studies

- Field efficacy using a cracked-corn formula
- Dye persistence
  - Dye intensity daily after consumption
  - Time until coloration appears
- Habitat usage via GPS collared hogs




Kaput
FERAL HOG BAIT

ACKNOWLEDGEMENTS

- Hawaii Community Foundation (2000) Grant
- USDA, SBIR Grant (2008)
- Texas Department of Agriculture (2015-17)

Questions