A review of tools for snake control, and their applicability to *Boa constrictor* on Aruba

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Snakes as invasive species - Case studies

Brown Treesnake (*Boiga irregularis*), Guam

Habu (*Trimeresurus flavoviridis*), Ryukyu Islands

Burmese Python (*Python molurus*), Florida

Boa Constrictor (*Boa constrictor*), Aruba, Cozumel, Florida
Snakes as invasive species

Impacts

A. Human health
Snakes as invasive species

Impacts

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B. Infrastructure
Snakes as invasive species

Impacts

A. Human health
B. Infrastructure
C. Ecological
Known python diet in Everglades National Park, Florida

- **Mammals**
  - Rats (various spp.)
  - Rabbits
  - Squirrels
  - Cats (including bobcats)
  - Raccoons
  - Opossum
  - Round-tailed muskrat
  - White-tailed deer

- **Birds**
  - Pied-billed Grebe
  - Wood Stork
  - Limpkin
  - White Ibis
  - Coot
  - House Wren
  - Frigatebird
  - Domestic Goose

- **Reptiles**
  - American Alligator
Invasion facilitated on islands by:

- Naïve prey
- Few competitors
Invasive snakes on islands often exhibit:

- High density
- Large body size
- High reproductive rate
Basic components of snake control programs

- Ecological research
- Assessment of control tool efficacy
- Trained staff
- Predictable funding
- Public outreach & education
Review of control tools
1. Active searching by humans
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Detection probability
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Detection probability

Brown Treesnakes: Detection is ca. 7% of population for teams of two searchers during a nocturnal visual survey
1. Active searching by humans

Detection probability

Requires massive effort to quantify, may be difficult for Aruban boas.

Results of radiotelemetric studies may offer alternative insights.
2. Traps

A. Intercept traps – direct moving snake into trap with one-way entrance

B. Attractant traps – use sensory cues from prey or conspecifics
2. Traps

A. **Intercept traps** – direct moving snake into trap with one-way entrance

B. **Attractant traps** – use sensory cues from prey or conspecifics

*Traps are the primary tool for capturing snakes in most snake control programs*
Traps: Complicating factors

- Success may vary with snake characteristics
Size-selectivity in Brown Treesnake traps

Percentage of sample

mm SVL (midpoint)

0% 20% 40% 60% 80% 100%

350 450 550 650 750 850 950 1050 1150 1250

Trap & Vis

Visual only
Traps: Complicating factors

- Success may vary with snake characteristics

- Pheromones as attractants
  - May only attract adult males
  - No success in synthesizing pheromones
  - No known applications in reptile control
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• Capture of non-target species
  - Risk to Aruba Island rattlesnake?
  - By-catch can be reduced by careful trap design and placement
3A. Chemical control

Application of toxicants (poisons)
3A. Chemical control

Acetaminophen in use as a toxicant for Brown Treesnakes on Guam
3A. Chemical control

Complicating factors are similar to those for traps

- May not target all segments of population
- Potentially significant harm to non-targets
3B. Chemical control

Reproductive inhibition
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Reproductive inhibition

• >10 yrs research with Brown Treesnakes
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Reproductive inhibition

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Reproductive inhibition

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- Hormone disrupter effective for at least 1 yr
- Requires injection of snake – lethal control preferable?
- Not in operational use
4. Biological control

Release of predators, pathogens, parasites
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**Predators**: Few snake-specific predators, history of unwanted side effects
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**Predators**: Few snake-specific predators, history of unwanted side effects
**Pathogens**: Limited applications in vertebrates (myxomatosis and rabbit haemorrhagic disease), no known applications in reptiles
**Parasites**: No evidence of high mortality or species-specificity, no known applications in reptiles
5. Detector dogs

Two main applications for invasive snakes

• Detecting snakes in cargo

• Detecting free-ranging snakes in the field
5. Detector dogs

- Detecting snakes in cargo
5. Detector dogs – for free-ranging snakes
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Complicating factors:

• Requires significant training effort
5. Detector dogs – for free-ranging snakes

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5. Detector dogs – for free-ranging snakes

Complicating factors:
• Requires significant training effort
• Costs can be high
• Dogs must be carefully selected
• Assessing efficacy can be difficult
6. Exclusion

Construction of barriers to movement of snakes
6. Exclusion
Control of *Boa constrictor* on Aruba
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There are no silver bullets or magic cures

Successful control requires application of multiple tools, following a realistic control plan
Control of *Boa constrictor* on Aruba

Preliminary suggestions:
Control of *Boa constrictor* on Aruba

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- Continue basic ecological research
- Develop traps that exclude rattlesnakes
- Investigate utility of detector dogs
- Work towards public support for program
- Draw from similar control efforts elsewhere
Other considerations

1. Public outreach and education
Other considerations

2. Exporting your problem
Other considerations

2. Exporting your problem

Risk to Bonaire & Curaçao?
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