DoD Natural Resources Program

Enabling the Mission, Defending the Resources

Transferring Translocation Science to Wildlife Conservation on DoD Installations

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Does pre-conditioning improve wildlife translocation?: a meta-analysis and case study

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ESTCP

Conservation Translocation: the intentional release or movement of captive-propogated or wild-caught animals, often with the aim of augmenting populations or re-establishing populations.

Mitigation (human-wildlife conflict)	Augmentation (boost pop. size)	Reintroduction (establish pop. in historic range)	Introduction
			

Wildlife translocation has a high failure rate

Variable	Trans-locations (*n*)	Success (%)
Threatened, endangered, or sensitive species	80	44
Native game	118	86
Release area habitat		
Excellent	63	84
Good	98	69
Fair or poor	32	38
Location of release		
Core of historic range	133	76
Periphery or outside	54	48
Wild-caught	163	75
Captive-reared	34	38
Adult food habit		
Carnivore	40	48
Herbivore	145	77
Omnivore	13	38
Early breeder, large clutch	102	75
Late breeder, small clutch	96	62
Potential competitors		
Congeneric	39	72
Similar	48	52
Neither	105	75

From Griffith et al. 1989

Causes of translocation failure:

- Long and erratic movements
- Predation
- Starvation
- Maladaptive habitat choices
- Low (if any) reproductive rates

Understanding causes of failure provides opportunities for improvement

Methodological changes are necessary to improve success of translocations

Can environmental enrichment, antipredator training, and soft-release improve success rates?

Roe et al. 2015. Herp Con Bio 10: 711 722

Environmental Enrichment

- Housing animals within complex enclosures that stimulate ecologically-relevant brain functions and behaviors.

DeGregorio, Moody, and Meyers, In Prep

Soft-release

- Confining animals in pens at release site before full release to allow acclimation to release area and conditions

Aridrecovery.org.au/prey-naivety

Anti-predator Training

- Introducing translocated animals to predator cues to encourage anti-predation behaviors post-release

Excellent reviews of pre-release conditioning but quantitative synthesis lacking

The Value of Enrichment to Reintroduction Success

Richard P. Reading,[1]* Brian Miller,[2] and David Shepherdson[3]

[1]*Denver Zoological Foundation, Denver, Colorado*
[2]*Wind River Ranch, Watrous, New Mexico*
[3]*Oregon Zoo, Portland, Oregon*

Journal of Applied Ecology

British Ecological Society

Journal of Applied Ecology 2015

doi: 10.1111/1365-2664.12498

REVIEW

Translocation tactics: a framework to support the IUCN Guidelines for wildlife translocations and improve the quality of applied methods

William G. Batson[1]*, Iain J. Gordon[1,2], Donald B. Fletcher[3] and Adrian D. Manning[1]

Meta-analysis Approach

- Holistic analysis of similar effects from multiple case studies
- For translocations, meta-analysis can be used to determine:
  - If behavioral conditioning broadly benefits animals
  - How various conditioning approaches affect success

- Criteria for study inclusion
  - Experimental (conditioned vs unconditioned)
  - Used antipredator training, environmental enrichment, or soft-release
  - Reported metrics of survival, movement, or site fidelity

Analyzed total of 108 effects from 41 studies

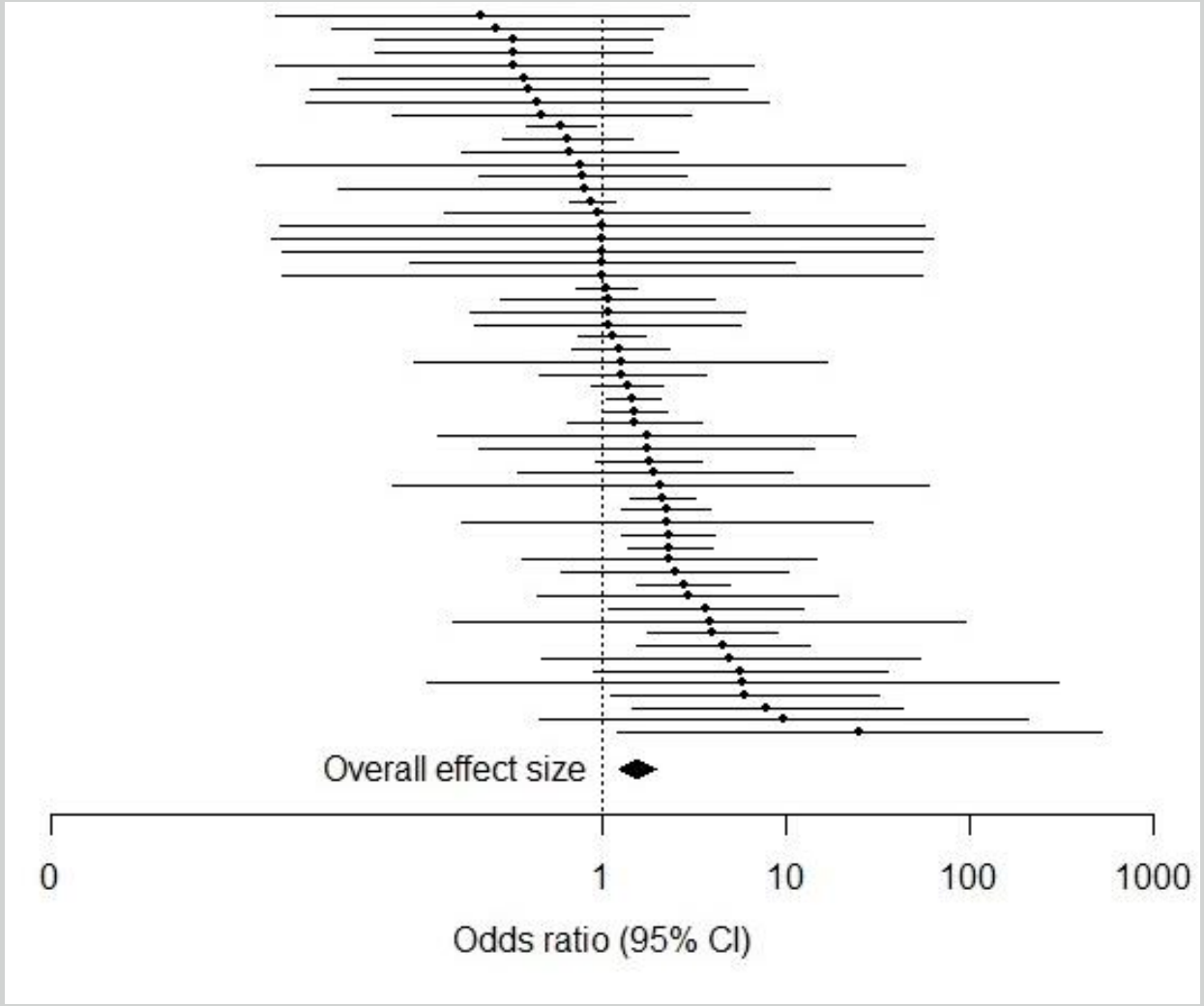
Fish, birds, mammals, and reptiles

Success metric	Effects	Unique studies
Survival	59	36
Movement	41	18
Site fidelity	8	6

Conditioning type	Effects
Soft release	73
Environmental enrichment	28
Antipredator training	7

Effects of Pre-release Conditioning on Survival

Pre-conditioning, of any type, lead to higher survival of translocated individuals



1.55 (95% CI: 1.23 to 1.95) times more likely to survive if pre-conditioned

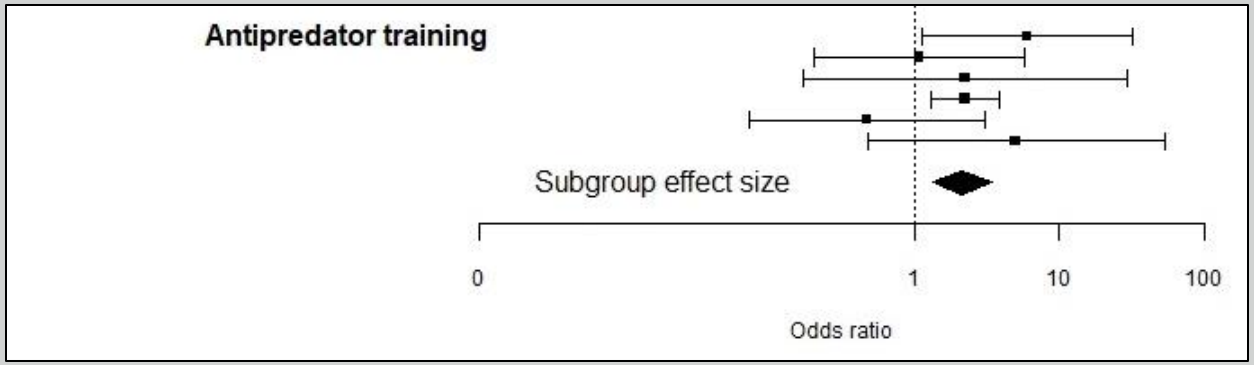
Juveniles released from captivity derived the greatest survival benefit from conditioning

Juveniles were 1.94 (95% CI: 1.17 to 3.21) times more likely to survive if they had been conditioned

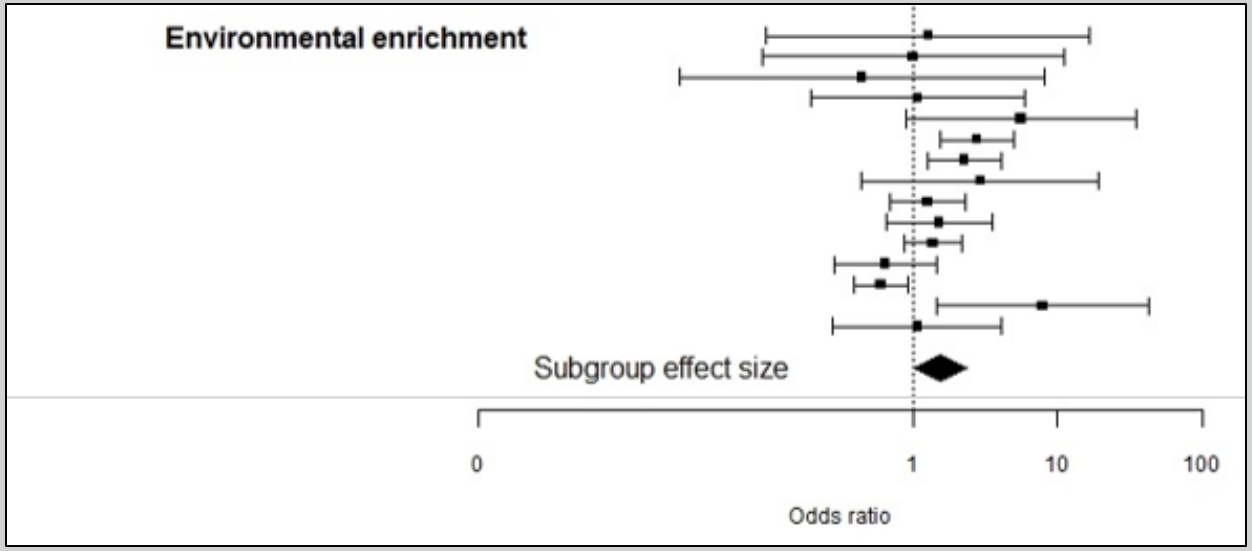
Predator avoidance training can increase survival Of Chinook Salmon (Maynard et al. 1998)

Pre-release experience is important for black-footed ferret survival Biggins et al. (1999)

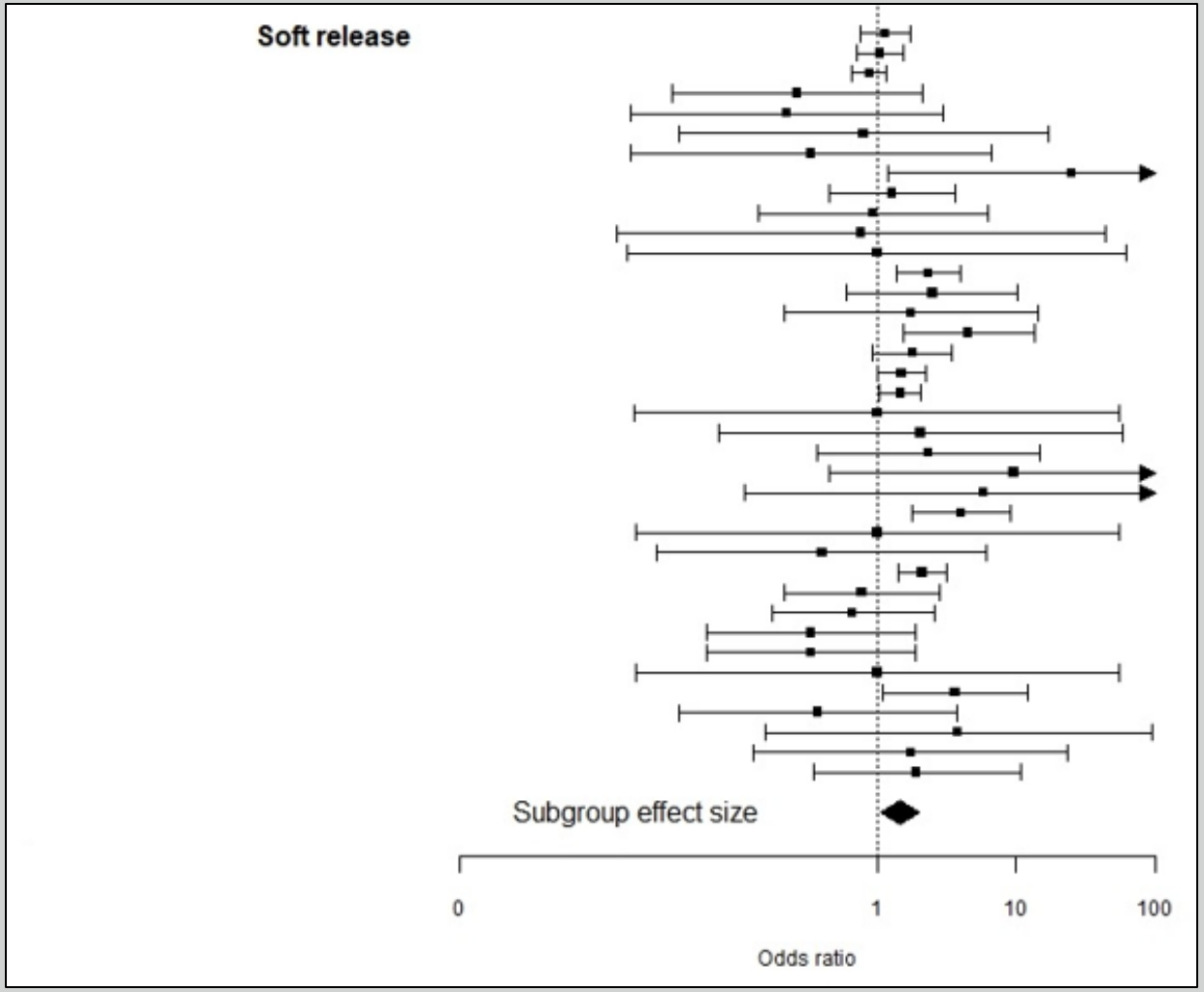
Each conditioning approach improved survival



Antipredator Training: OR 2.14 (95% CI: 1.34 to 3.40)



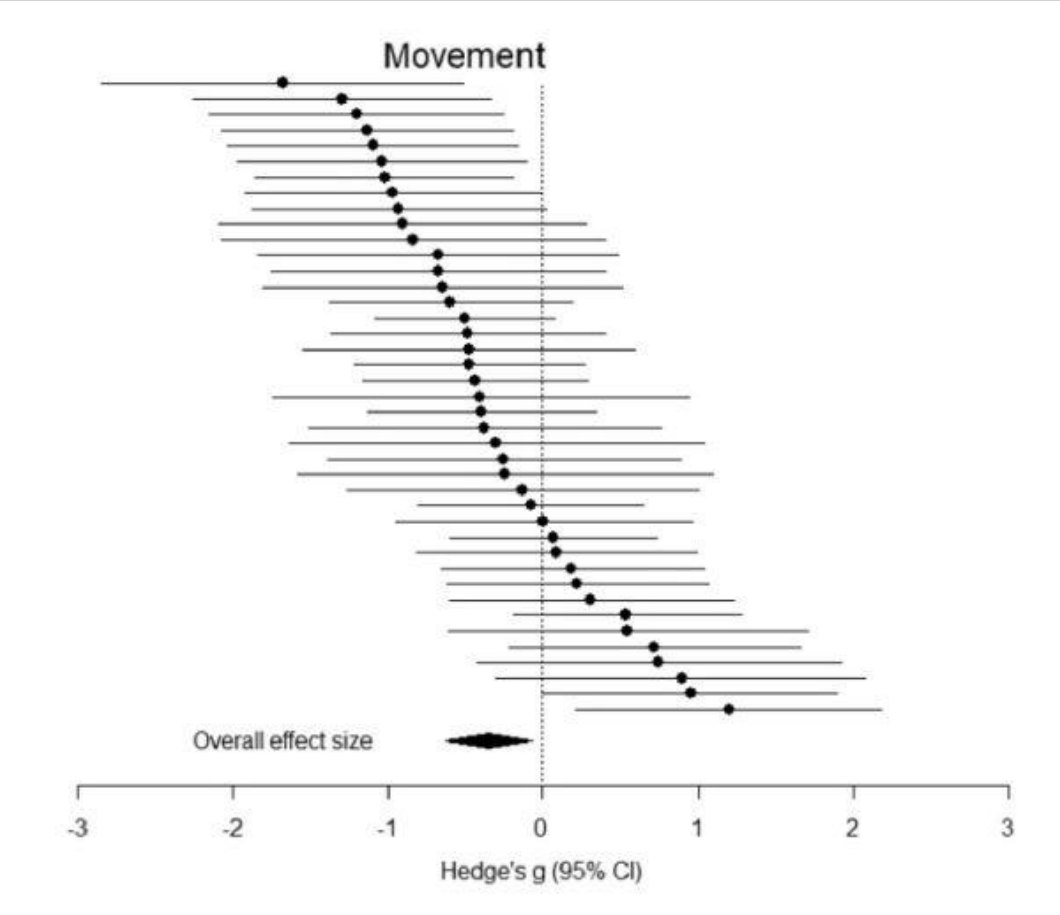
Environmental Enrichment: OR 1.55 (95% CI: 1.01 to 2.39)



Soft Release: OR 1.47 (95% CI: 1.07 to 2.02)

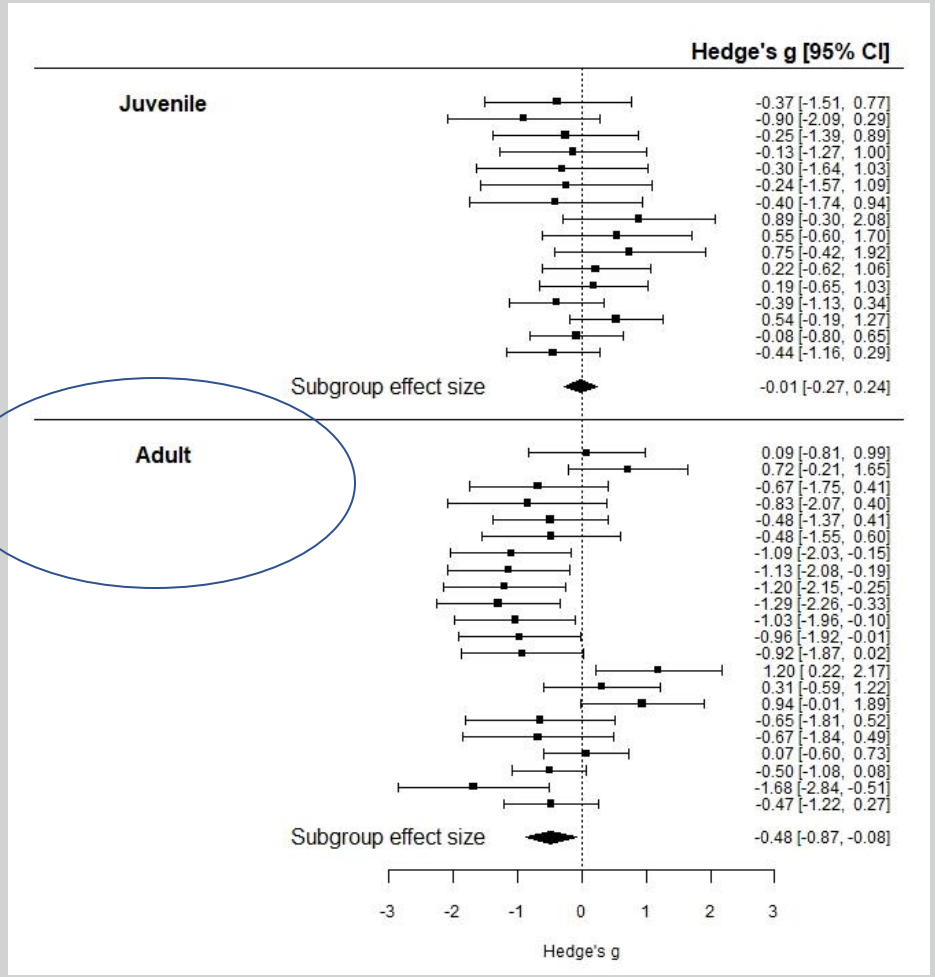
Effects on post-release movement

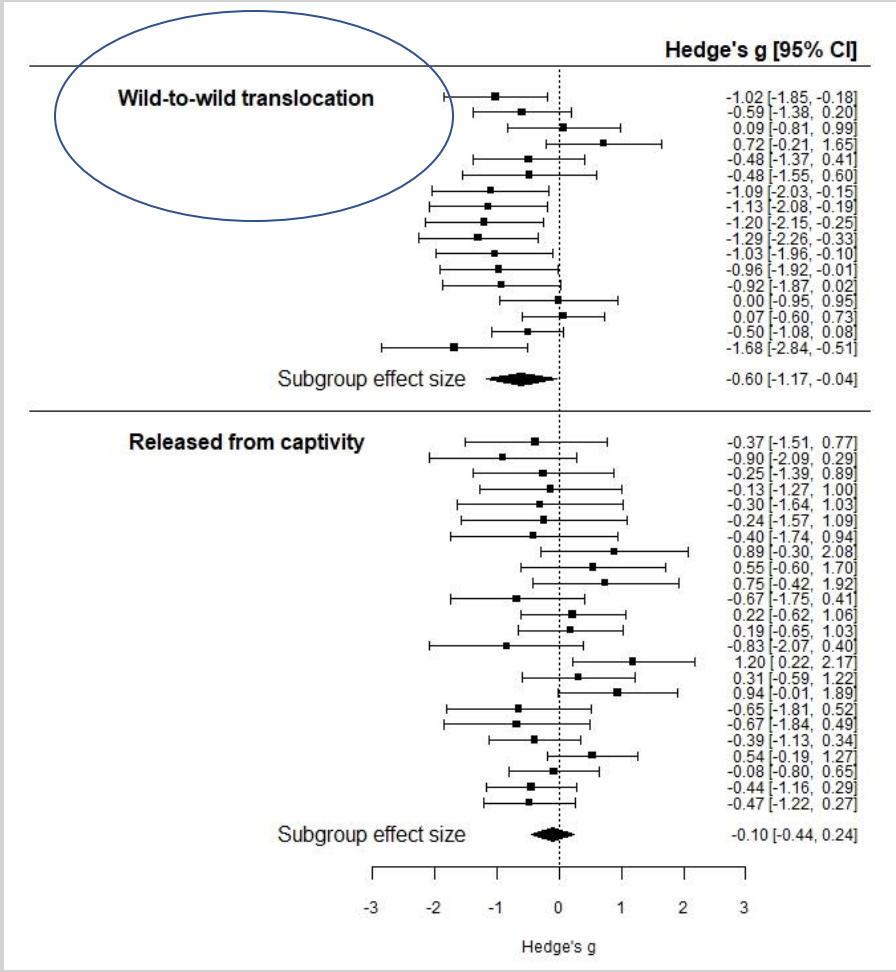
In general, animals that were pre-conditioned moved slightly less post-release than non-conditioned animals (Hedge's g=–0.34, 95% CI: –0.63, –0.06)



As expected, – primarily driven by soft-release

Benefits dependent on conditioning type and animal source/age





Wild-wild translocations of adults most likely to see reduced movement post-release with conditioning

Also – limited opportunity to apply environmental enrichment or antipredator training

Tinker Air Force Base

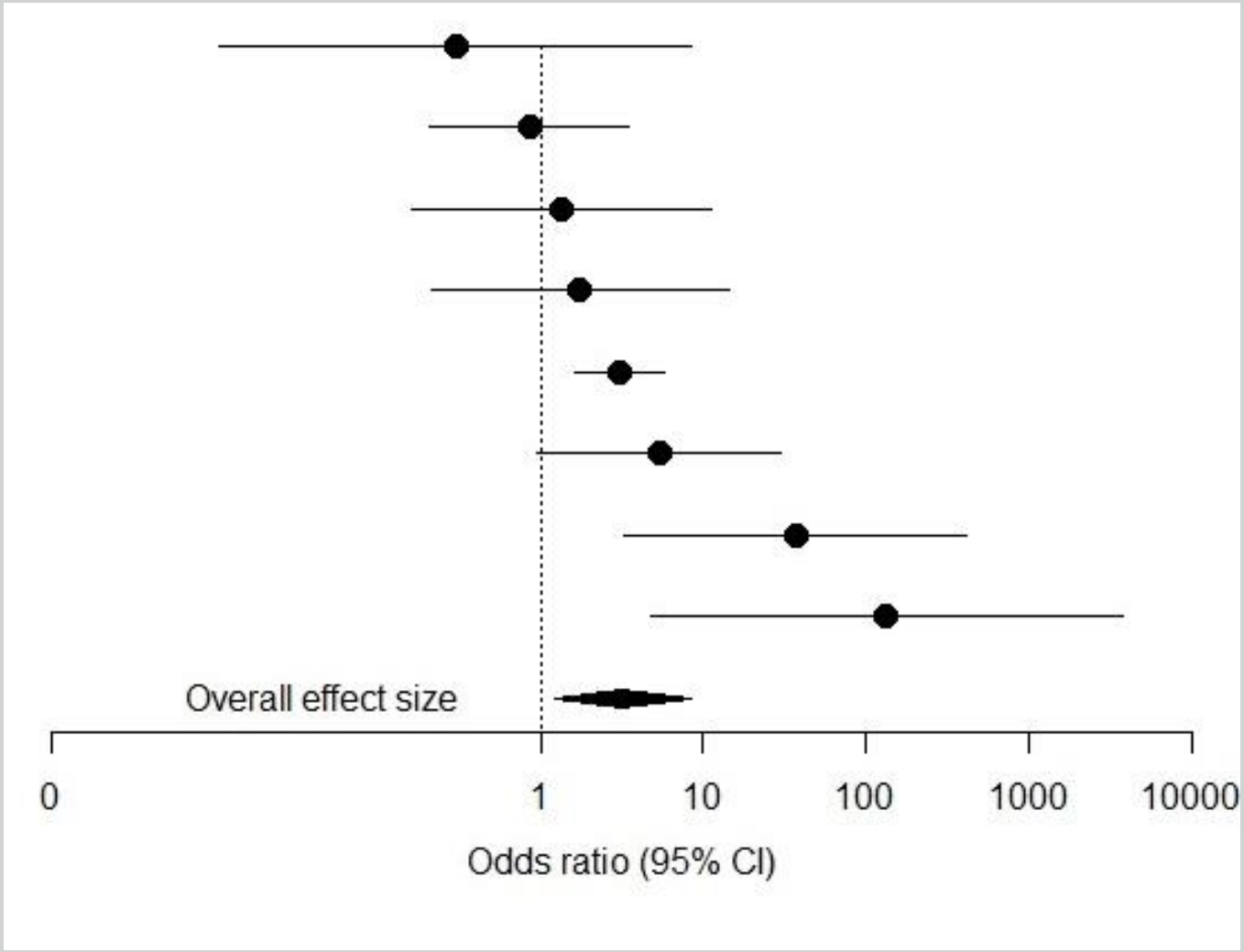
Aiken Gopher Tortoise Preserve

Soft released animals had reduced movement compared to hard released animals (Hedge's g=−0.51, 95% CI: -0.84 to −0.19): Most beneficial for wild-wild translocated animals (Hedge's g=−0.60, 95% CI: −1.17 to −0.04)

No significant effects from antipredator training (n = 1) or environmental enrichment on movement

Effects on Site Fidelity

Soft release was an effective approach for improving site fidelity



Soft released animals were 3.20 (95% CI: 1.23 to 8.34) times more likely to show site fidelity than hard released animals

Conclusions of Meta-analysis

- Pre-release conditioning generally improves results of wildlife translocation efforts
- Survival (the most important result in translocation) can be improved by predator training, environmental enrichment, or soft-release
  - Effects vary by taxa. Most consistent for fish most inconsistent for birds
  - Antipredator training had relatively large effects but few studies
- Soft-release effective for reducing post-release movement of adults and wild-wild translocated animals
  - Increases site fidelity
- Although generally positive, effect sizes were not usually large
  - Must balance resources vs benefits

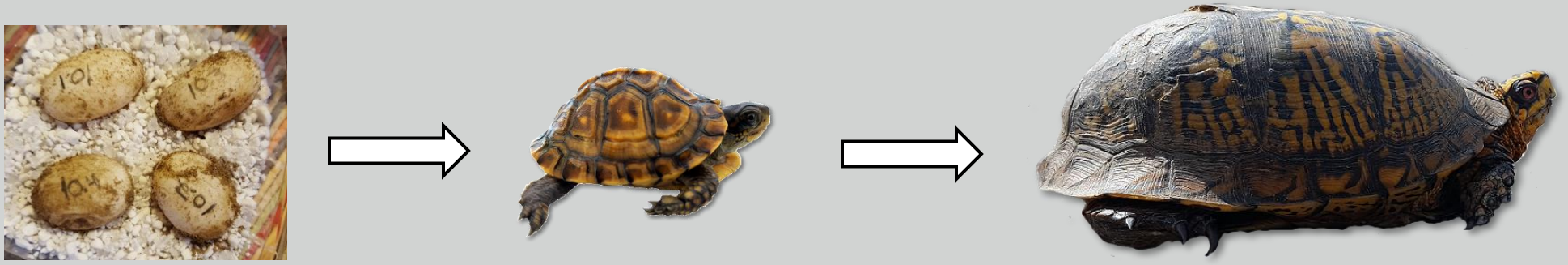

“Everybody likes box turtles.”
-Archie Carr, 1994

Environmental Enrichment of Eastern Box Turtles as a Case Study

Experimentally assess environmental enrichment and time in captivity effects on translocation of captive-reared box turtles

Head-starting as a conservation solution

- Rear animals in captivity past stages of naturally high mortality, then release into nature



Work that inspired our turtle head-starting approach

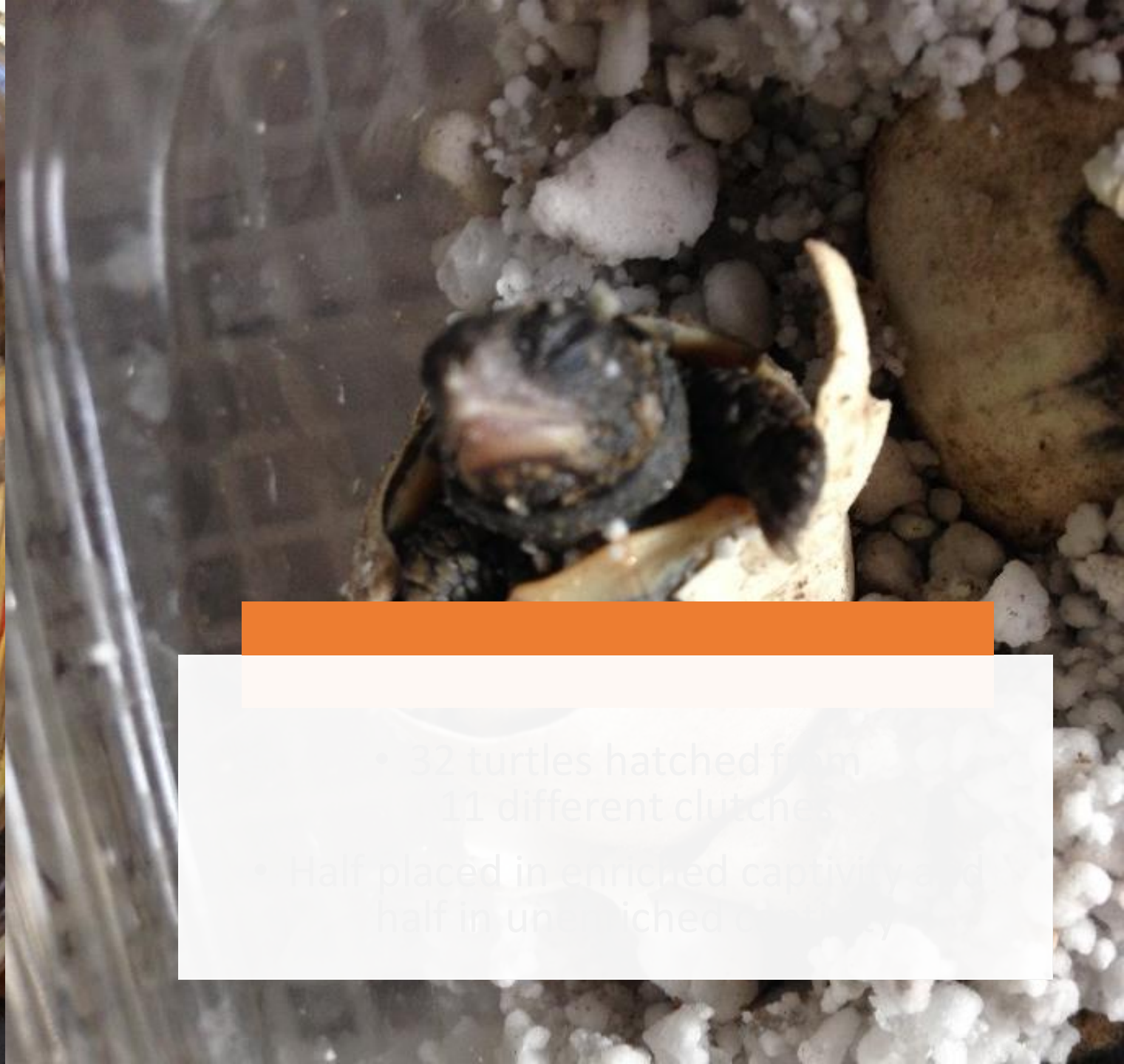
- What if captive-born reptiles are enriched right after birth?
- Will they behave more naturally and survive better upon release?
- There are likely costs to being raised in artificial environment, can enrichment offset these costs?

Objectives

- Head-starting emphasizes fast growth in simplistic enclosures
  - Might this come at a cost to preparing animals to behave adaptively?
- Do contrasting rearing conditions and varying head-starting durations affect:
  - Pre and post release growth
  - Pre and post-release behavior
  - Post release survival

Fort Custer Training Center

Study Animal Acquisition

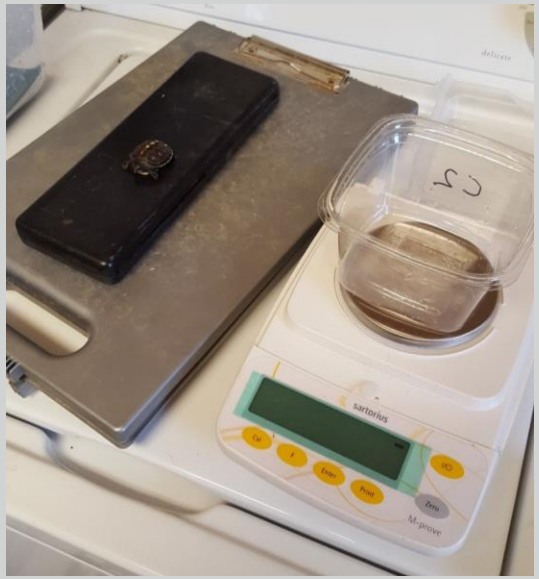


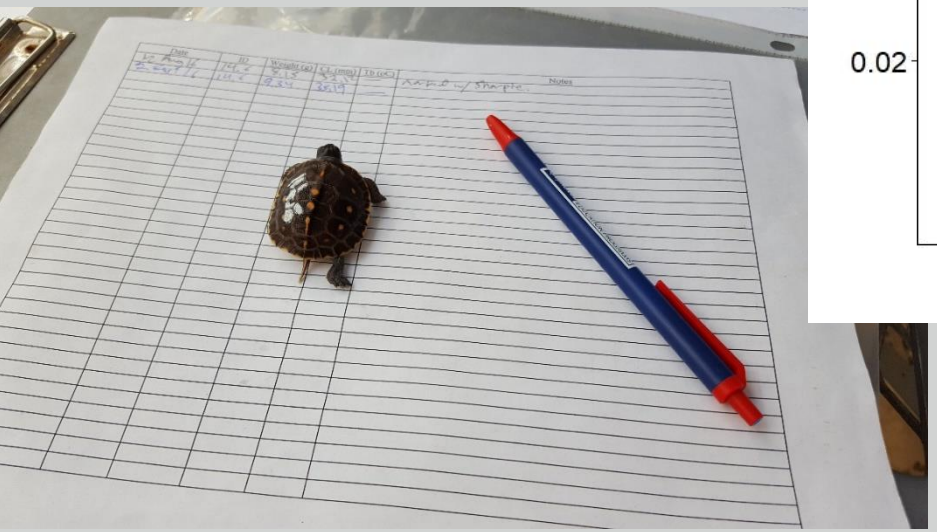
- 32 turtles hatched from 11 different clutches
- Half placed in enriched captivity and half in unenriched captivity

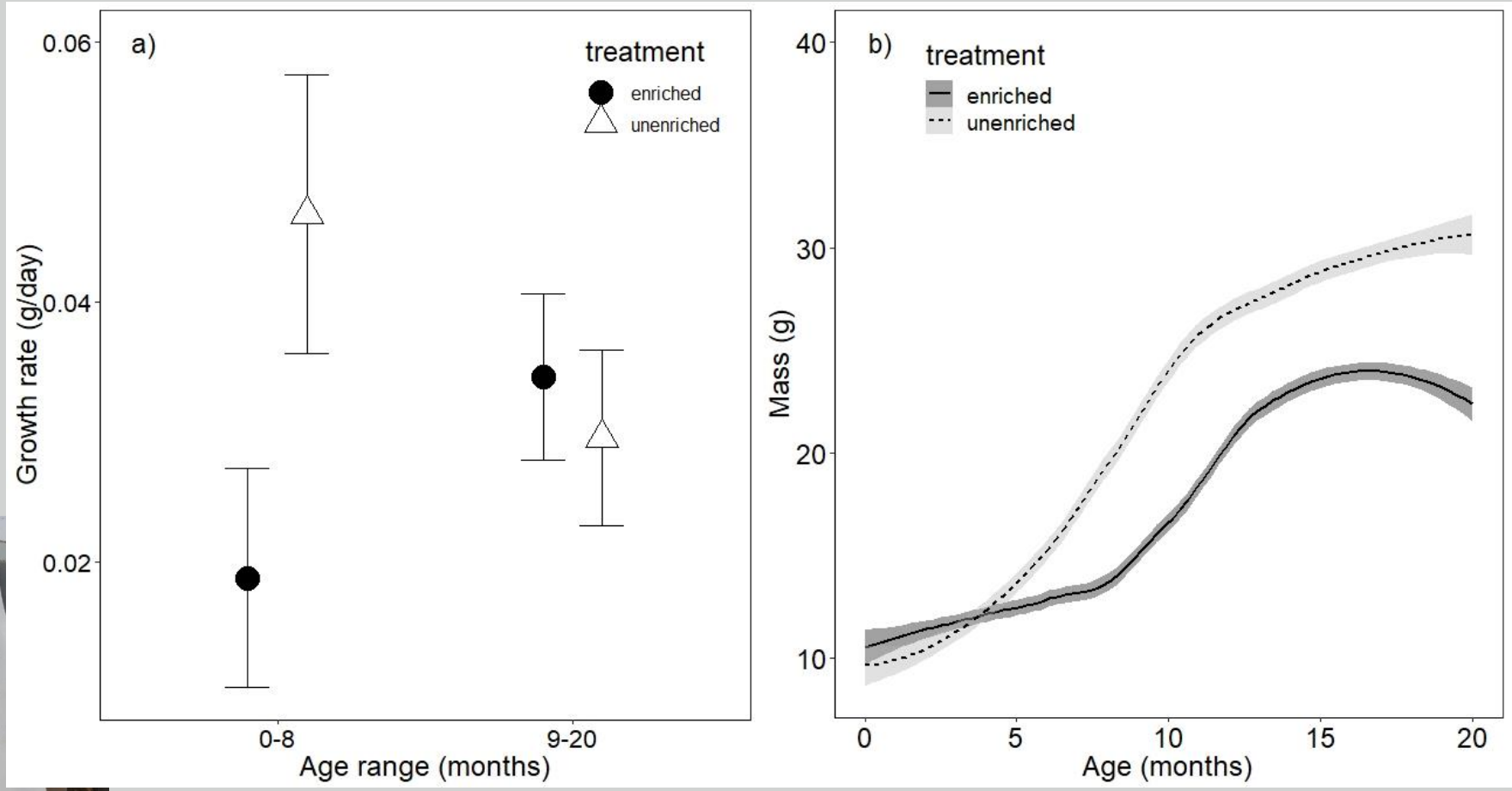
Rearing environments


4
3

Growth in captivity:



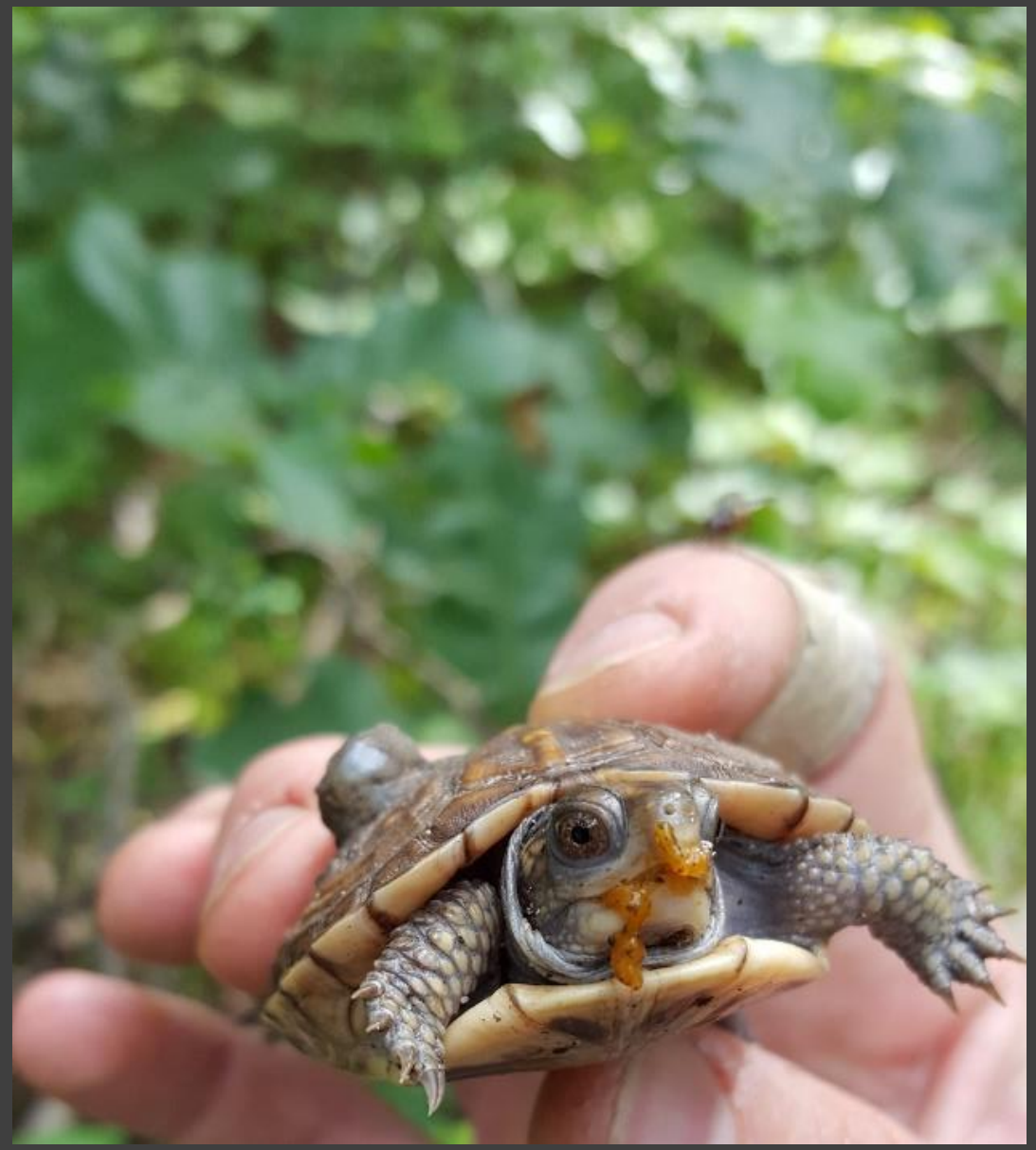




Unenriched turtles grew faster and overall attained and maintained larger body sizes until release

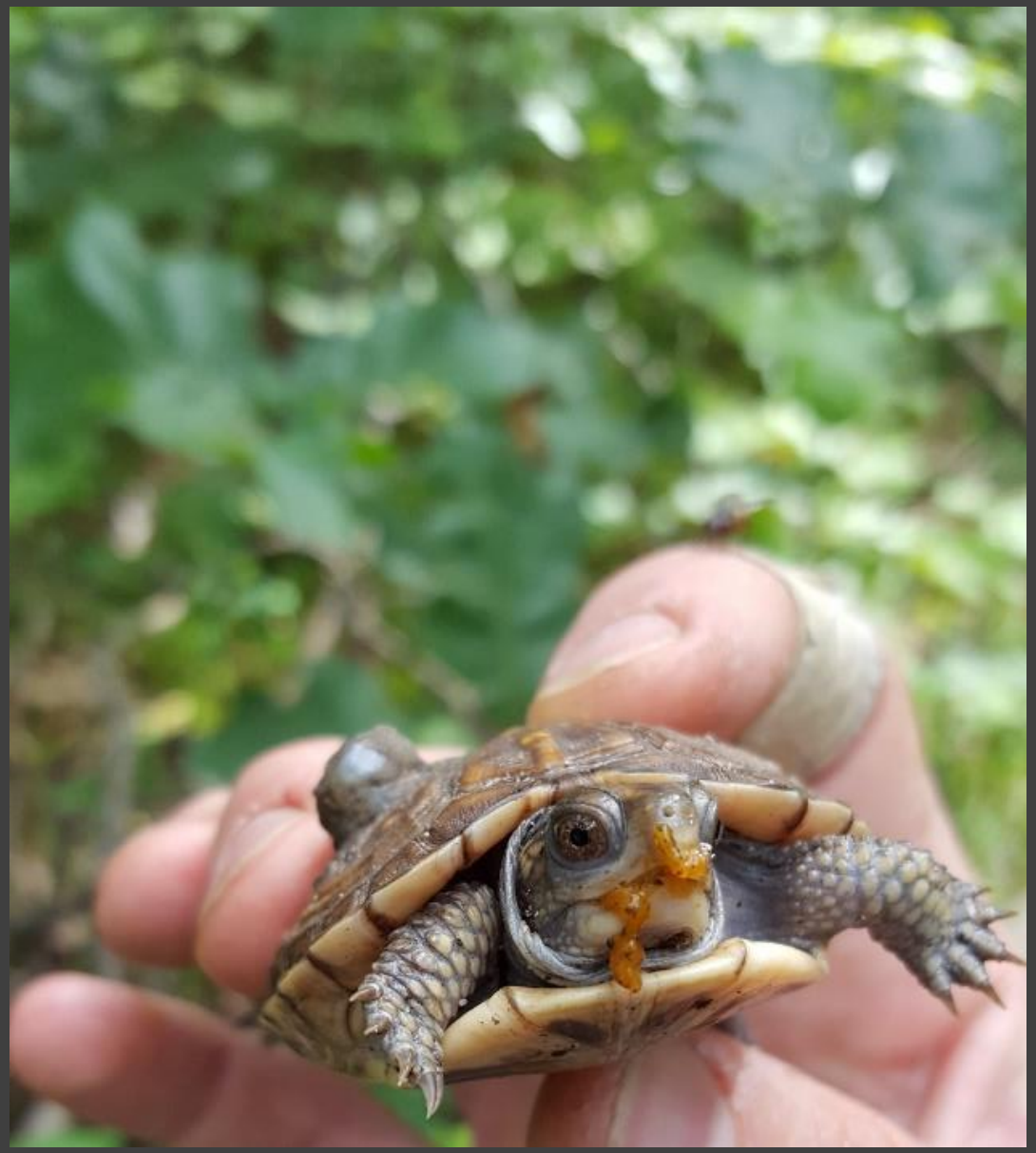
Behavior in captivity

- Each turtle went through a battery of behavioral tests:
  - Foraging in a complex environment
  - Foraging efficiency in a simple environment
  - Shelter emergence
  - Predator scent recognition and avoidance



Quick Take Home Message

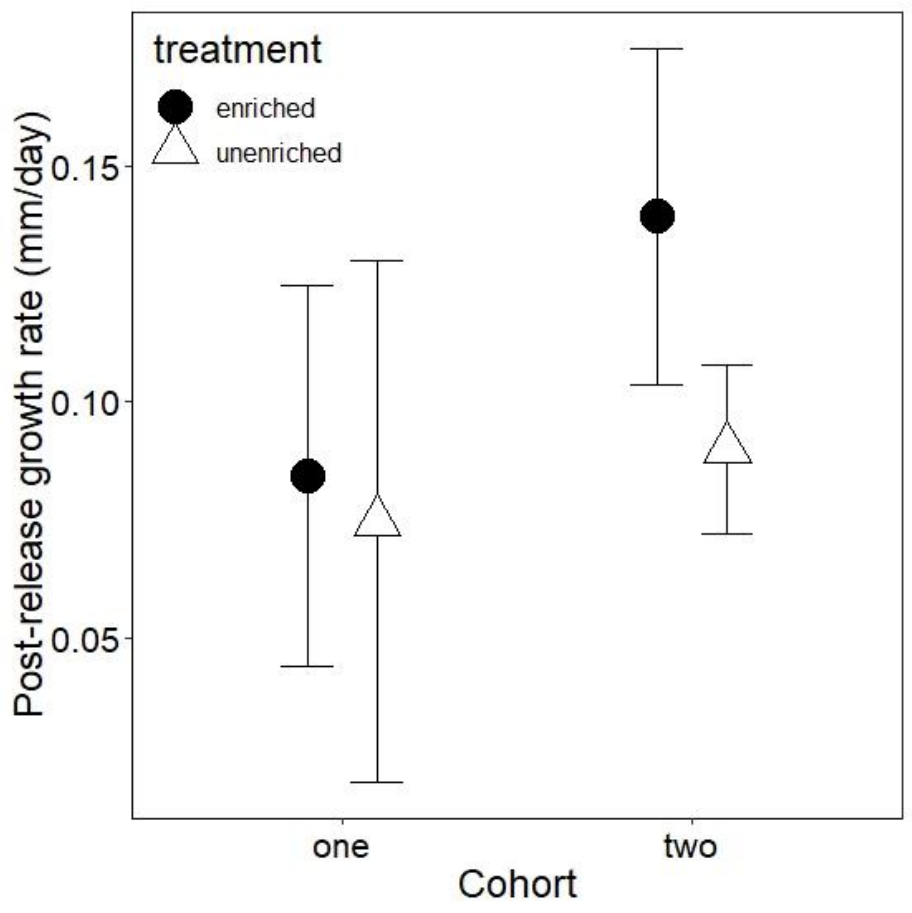
- Unenriched turtles were more food motivated and ate more and faster than enriched turtles in both trials
- Neither group had any ability to detect raccoon urine and avoid it.
- No difference in shelter emergence behavior



Turtles released in two cohorts (after 9 mo in captivity and after 21 mo). Each put in transitional or soft-release pens for approximately 1 month before being allowed to disperse

Tracked 5 days a week. Confirmed survival, behavior, exposure, mass and length (bi-weekly), then caged for winter

Growth Rates



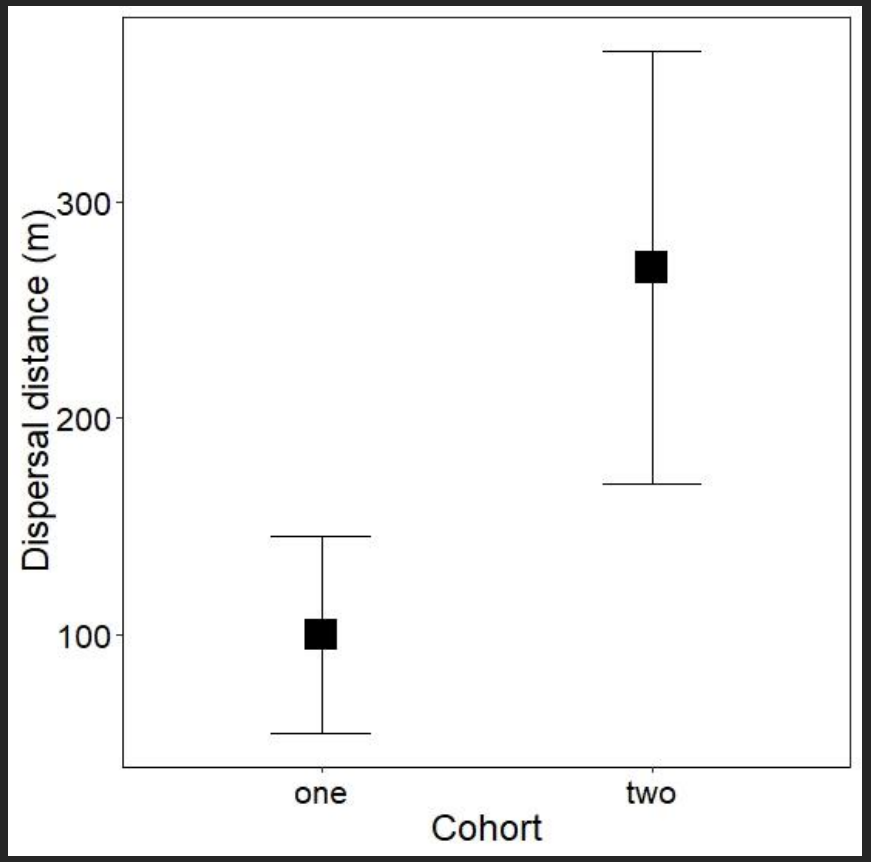
- Similar growth rates across most groups, although:
  - Enriched tutles in cohort 2 had highest growth rates

Exposure

Cohort	Treatment	% locations fully exposed
one	enriched	54
	unenriched	50
two	enriched	39
	unenriched	40

No effect of treatment or cohort

Movement



Cohort 2 dispersed further than cohort 1

No treatment effects

Survival

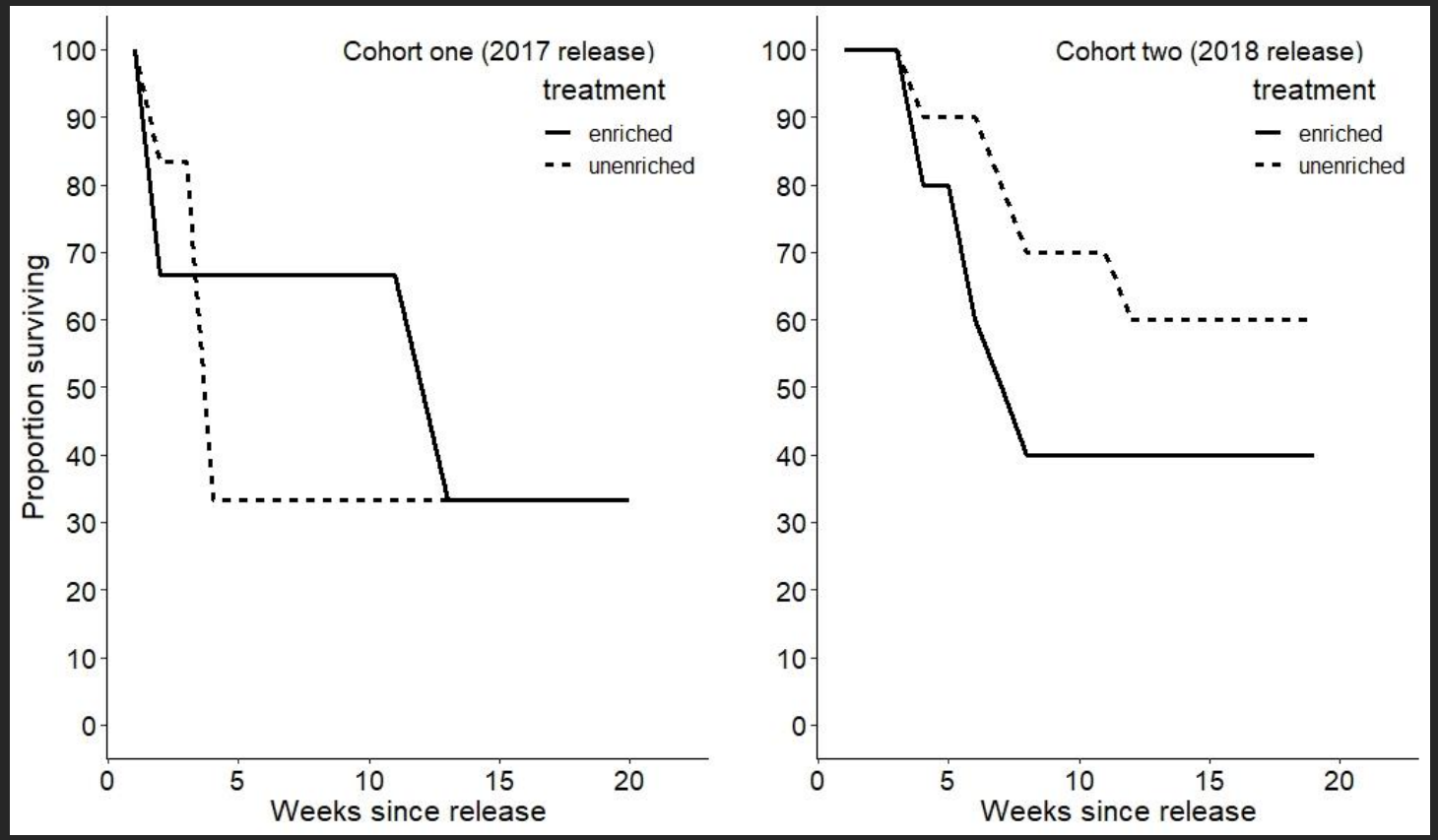
Cohort	Treatment	Survived/total (%)
one	enriched	2/6 (33%)
	unenriched	2/6 (33%)
two	enriched	4/10 (40%)
	unenriched	6/10 (60%)

Survival was generally high for this age class

Overall survival 44%

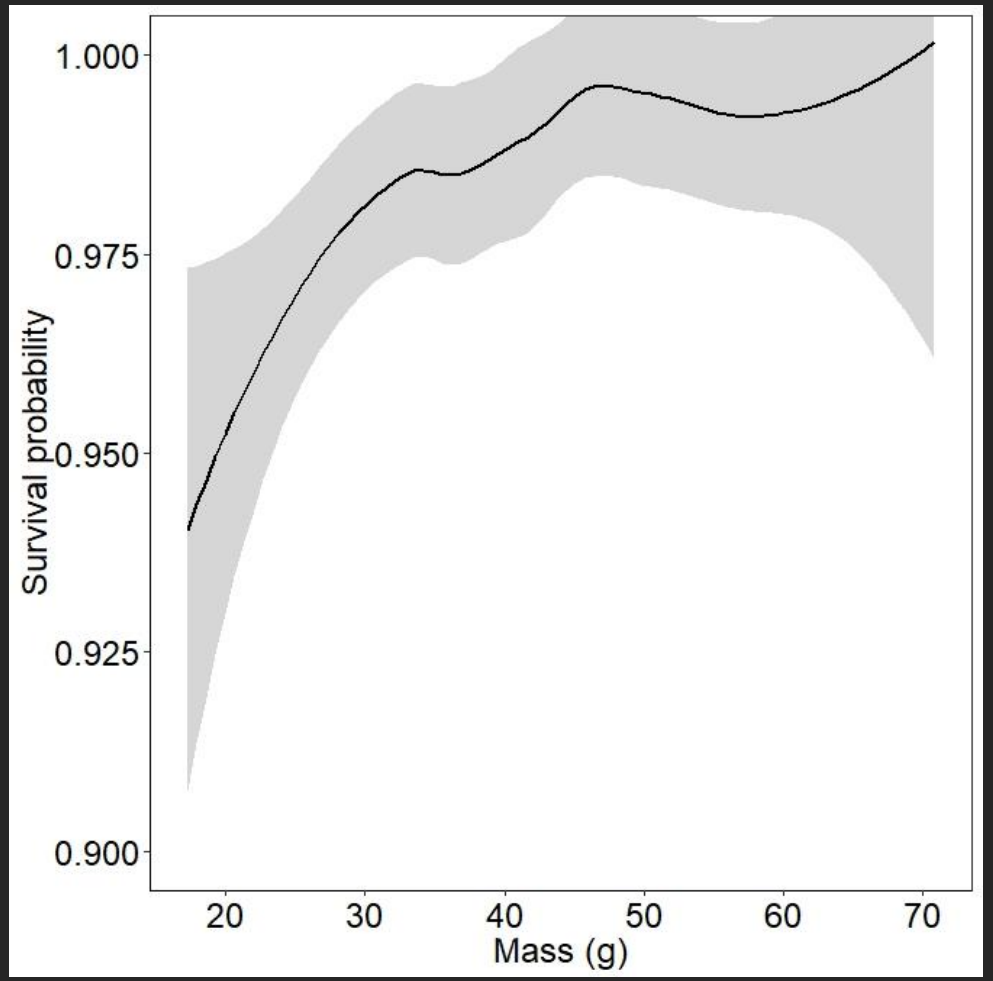
Cohort two had overall higher survival than cohort one

Survival



No effects of enrichment on survival

Survival



Body mass at release most influenced survival rate

Post-release conclusions

- Bigger is better
  - Cohort two (50% survival) was larger at release than cohort one (33% survival)
- Body size is likely important for juvenile turtle survival


Predation was the primary

3-D printed turtle models provide hints as to the identity of likely predators at site

Final Conclusions

- Meta-analysis revealed that pre-release behavioral conditioning can benefit translocations
  - May be most beneficial for juveniles
  - Predator training may provide strongest results, although evidence is limited
- For box turtles, size at release trumped pre-release conditioning

Thanks for your attention!





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chambanaturtles.weebly.com