

Tropical Clawed Frog ***Xenopus tropicalis* Biocontrol**

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Where to begin a non-native species story?

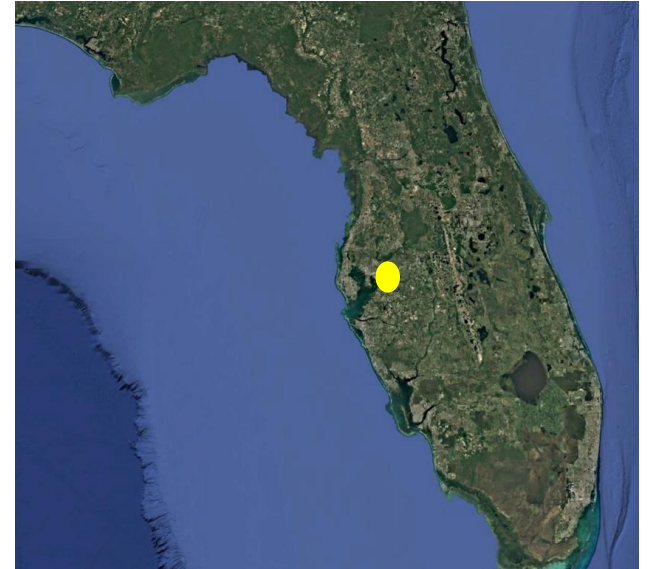
- Origin/timeline often unknown
- Story didn't originate as a mystery
 - Four globally invasive African Clawed Frogs collected in Florida (2013-2016) and vouchered (FLMNH; Krysko et al. 2016)



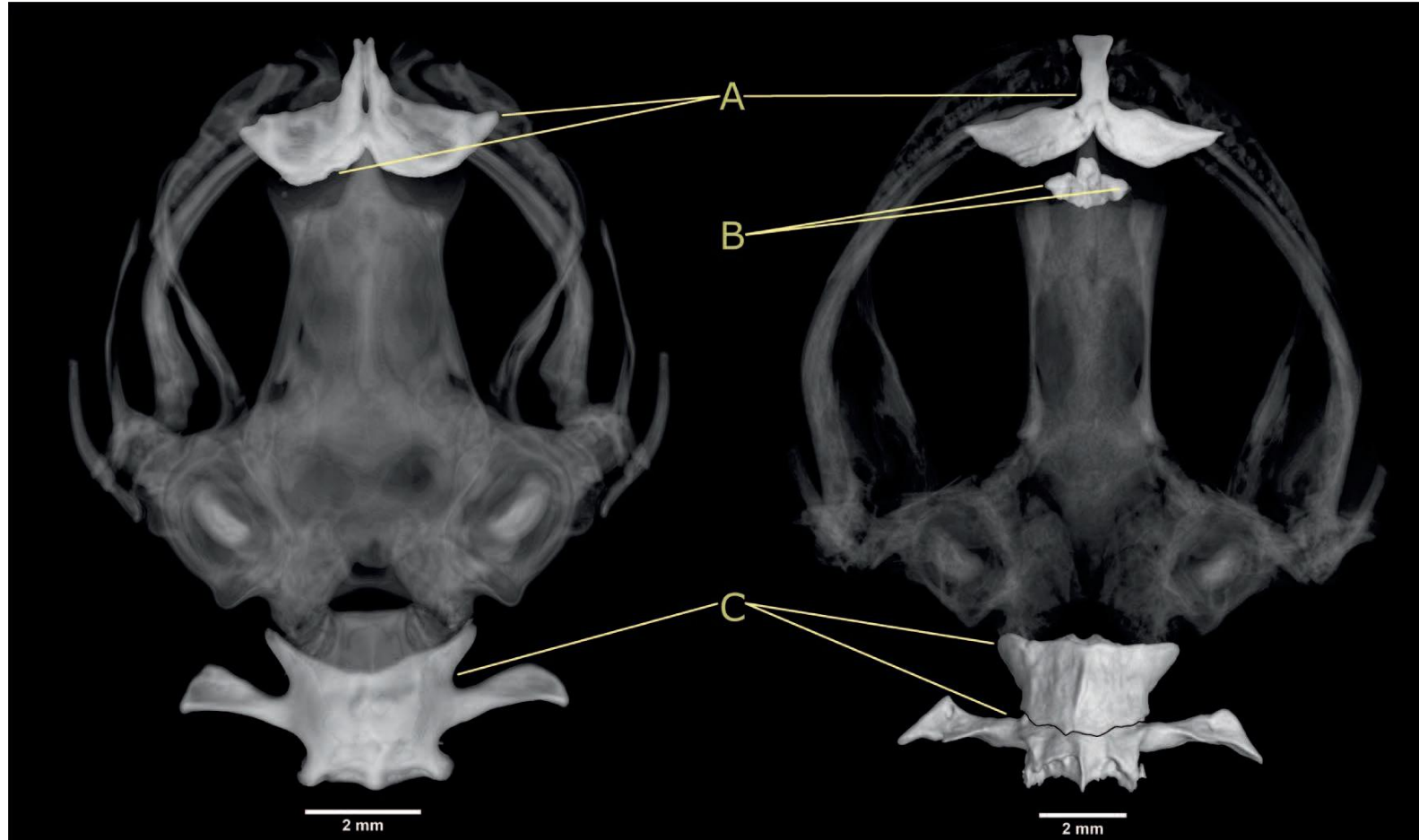
African Clawed Frog *Xenopus laevis*

Where to begin a non-native species story?

- Origin/timeline often unknown
- Story didn't originate as a mystery
 - Four globally invasive African Clawed Frogs collected in Florida (2013-2016) and vouchered (FLMNH; Krysko et al. 2016)
- 2016 report triggered a search
 - Breeding population discovered in Riverview, FL (Hill et al. 2017)



Later identified as the Tropical Clawed Frog *Xenopus tropicalis*



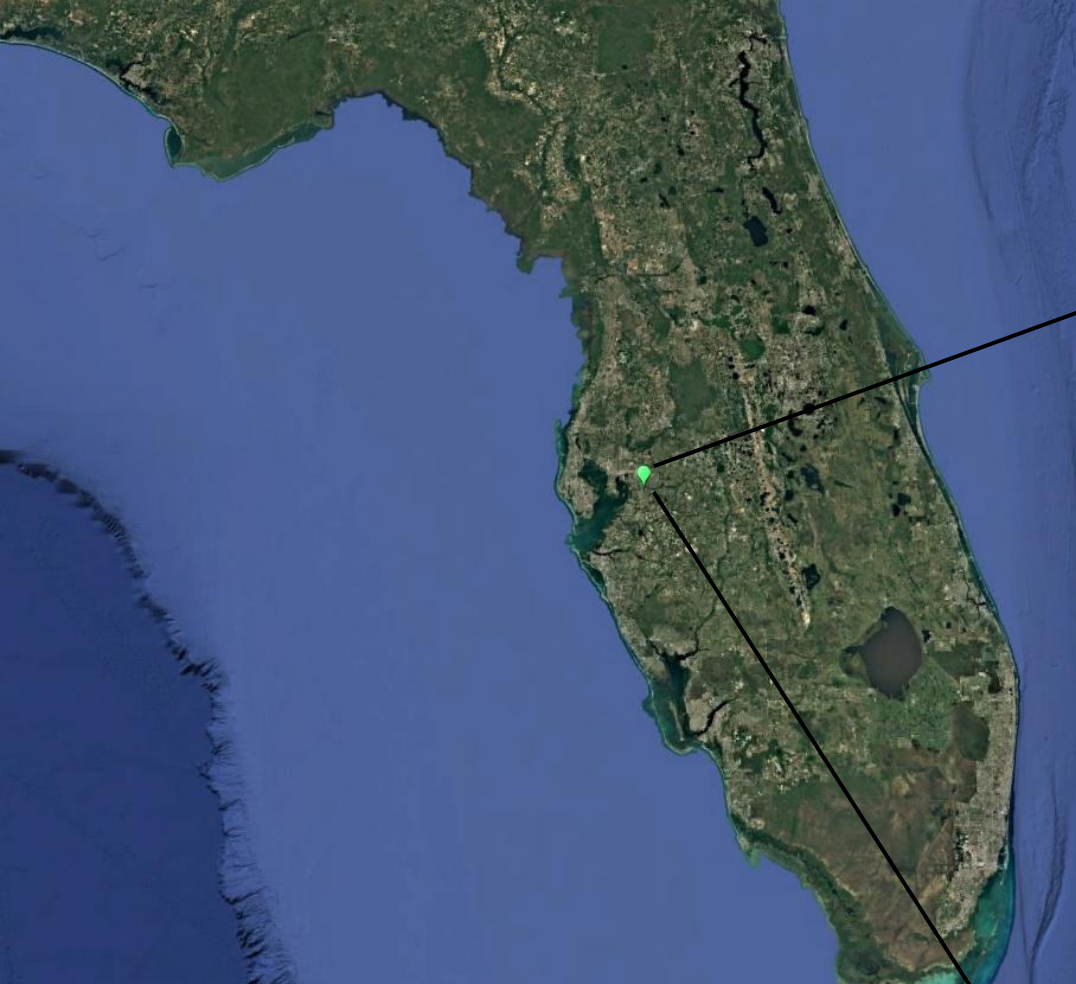
- CT scan comparison of *Xenopus tropicalis* (left) and *Xenopus laevis* (right)
- (A) fused/unfused nasals, (B) presence/absence of vomer; (C) fused/unfused presacral vertebrae

Tropical Clawed Frog *Xenopus tropicalis*

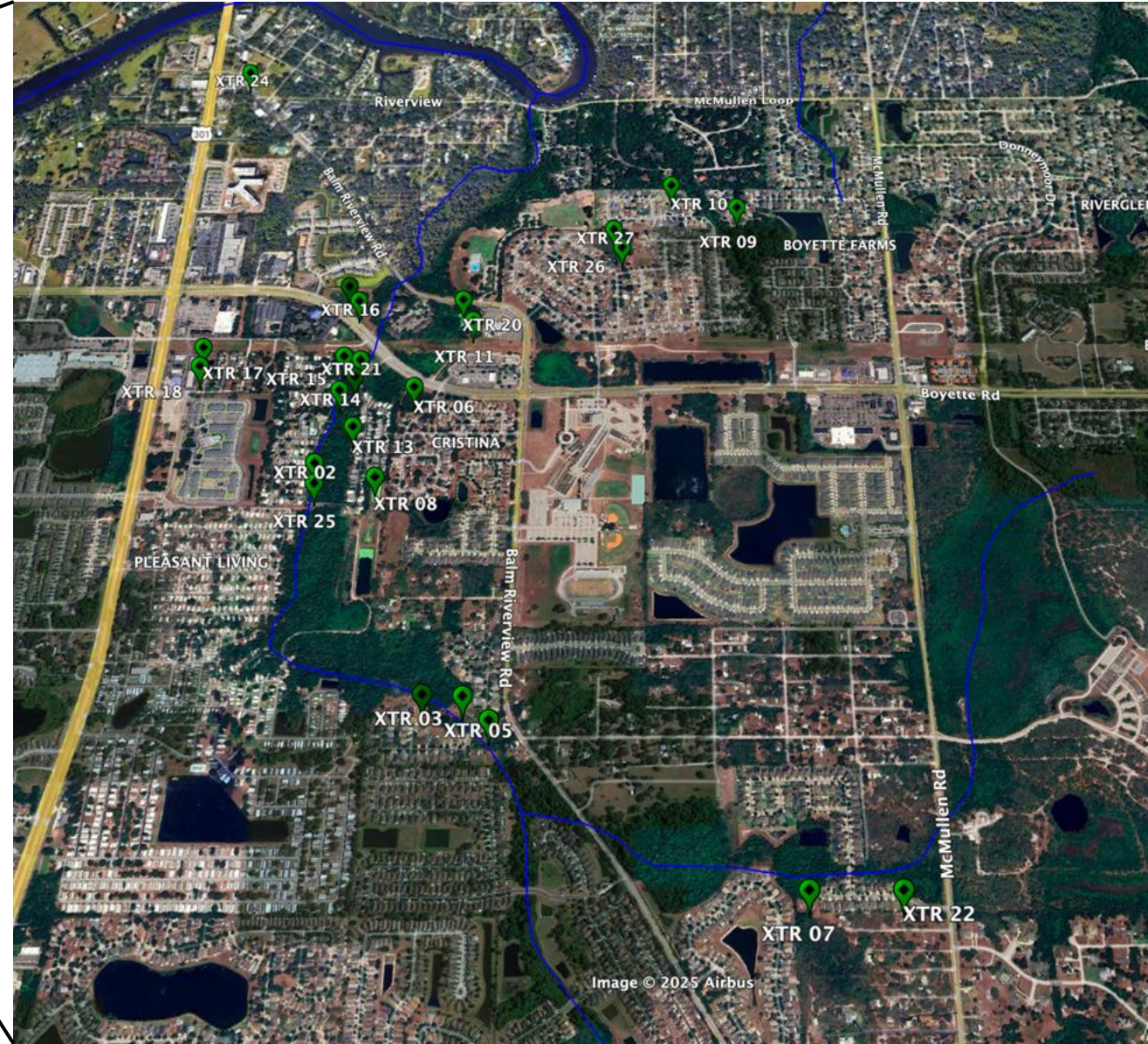
- Native range: west-central Africa
- Habitat: tropical/subtropical forests and rural areas
- Breeding: ephemeral habitats
- Uses: biomedical research and aquarium trade
- Impacts: unknown; no diet data; limited overlap with native tadpoles



Scope of the invasion



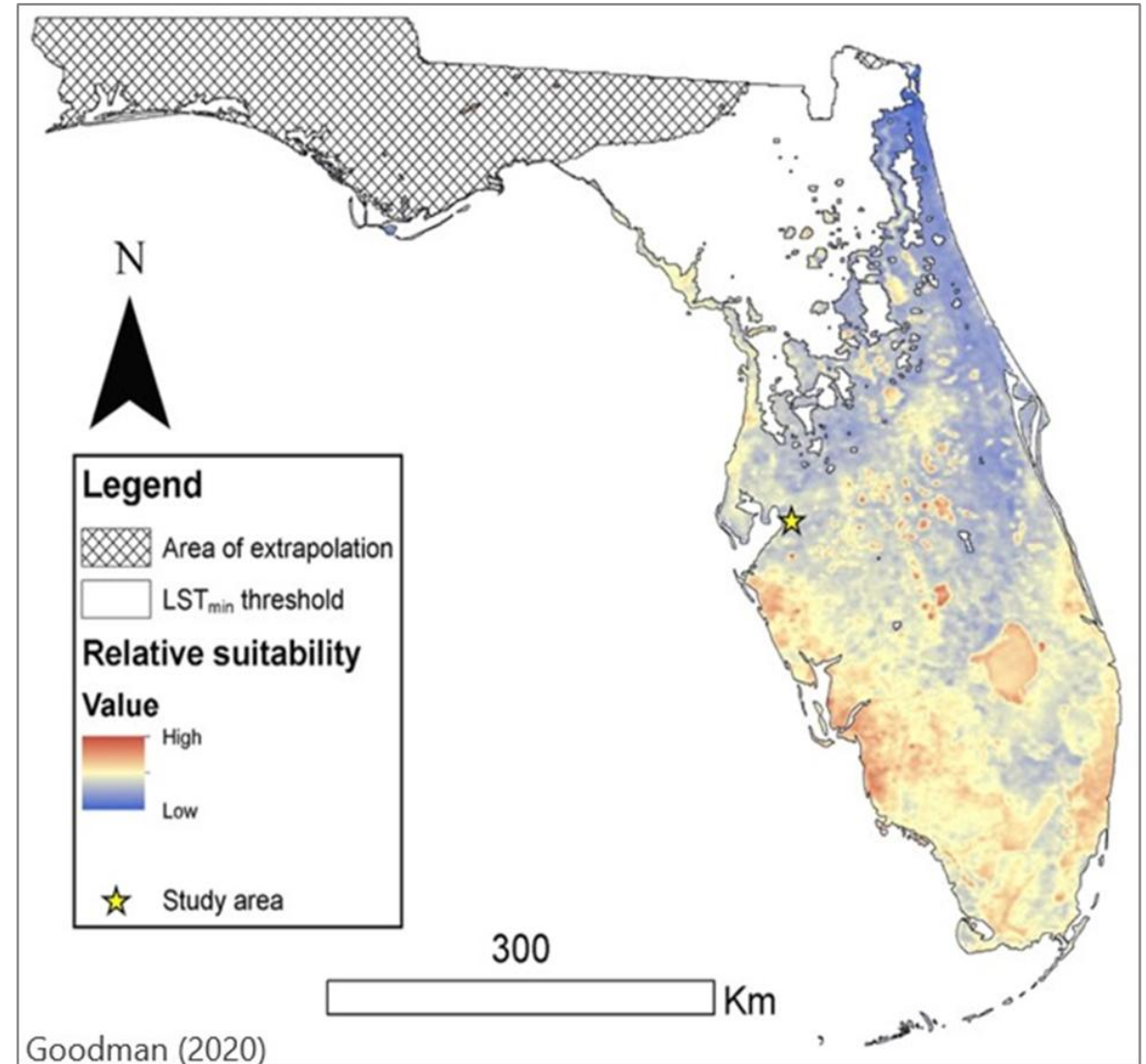
- Ephemeral and permanent stormwater ponds
- Adults: 28 ponds
- Breeding: 15 ponds





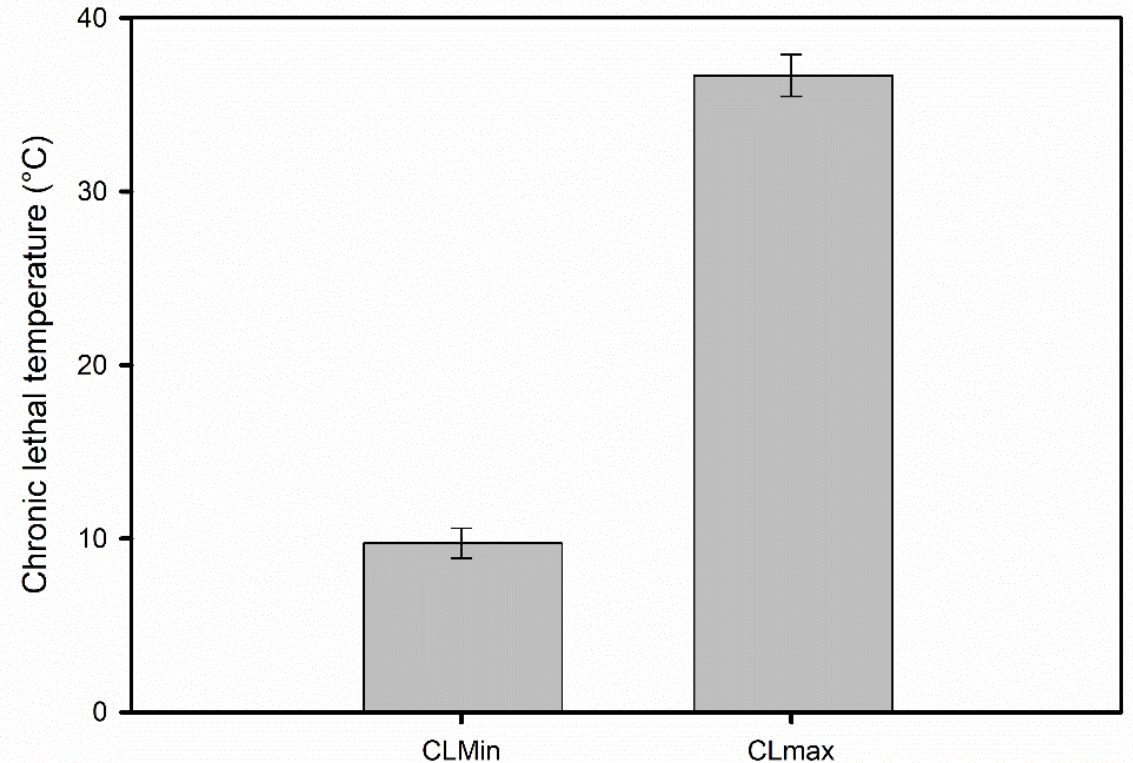
Potential for spread?

- Species distribution model: low-medium over most of Florida
- Relatively low for Riverview area where they are established



Potential for spread?

- Species distribution model: low-medium over most of Florida
- Relatively low for Riverview area where they are established
- Much of southern Florida is suitable based on thermal tolerance estimates
- Estivation may provide refuge



Ephemeral pond breeder Achilles heel

- Traits: short lifespan, high fecundity, rapid development, and tadpoles vulnerable to predation
- Can native Eastern Mosquitofish *Gambusia holbrooki* be stocked to ephemeral ponds to serve as a biocontrol?
- Native mosquitofish are aggressive; harass and prey on small-bodied fish and tadpoles

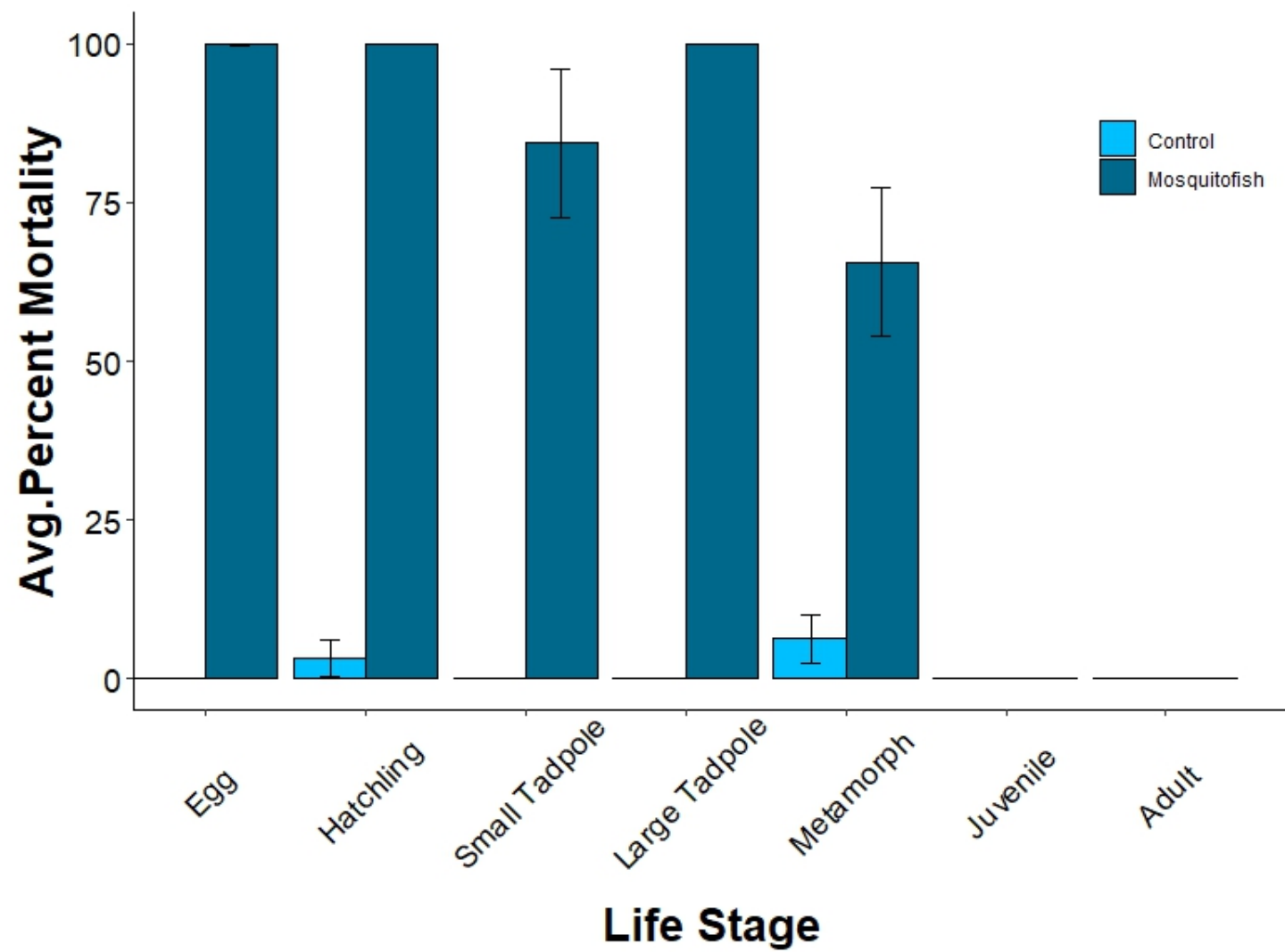


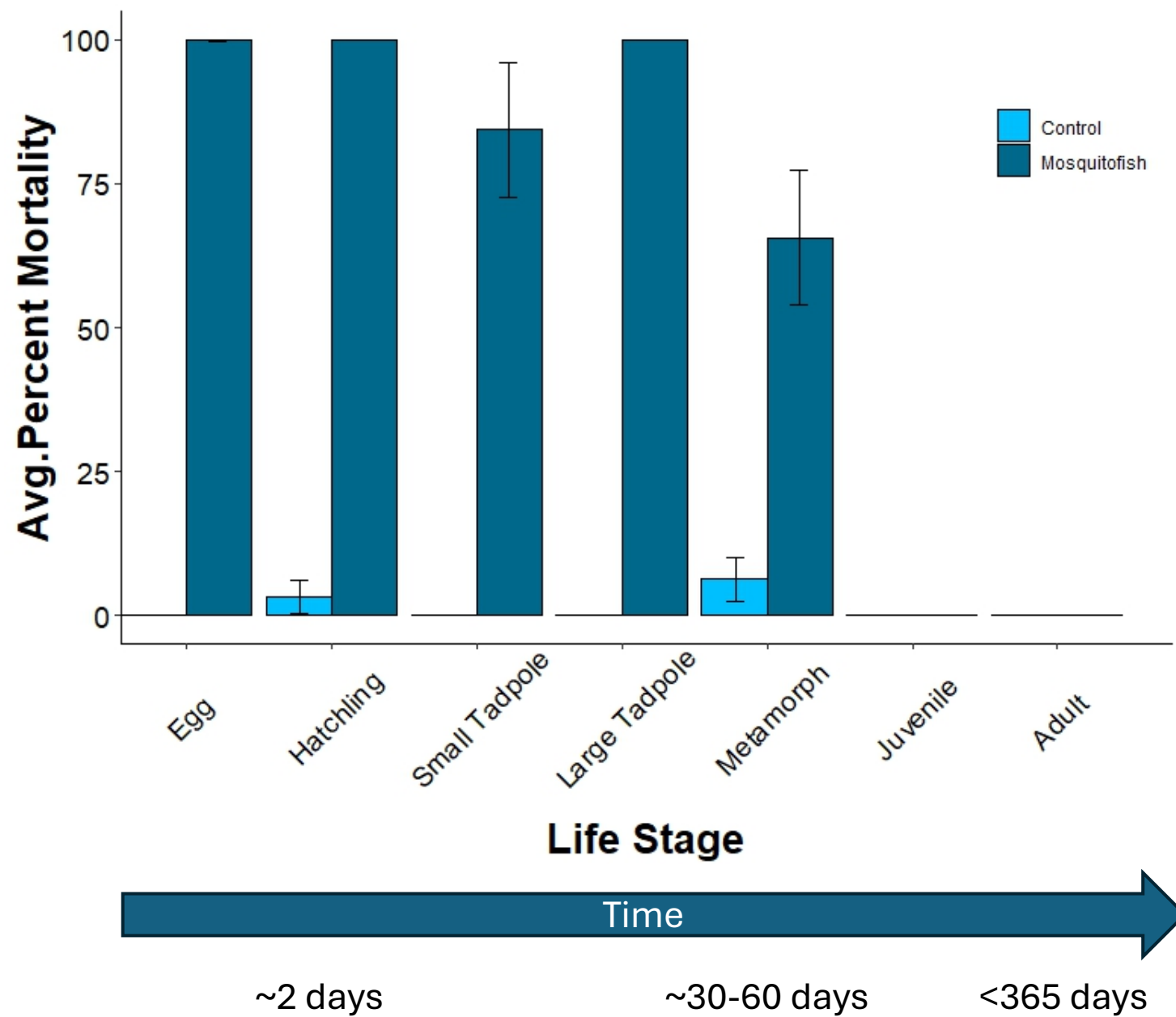
Image: FMNH

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- **To inform stocking, identify stage-based vulnerability using aquaria/mesocosm trials**





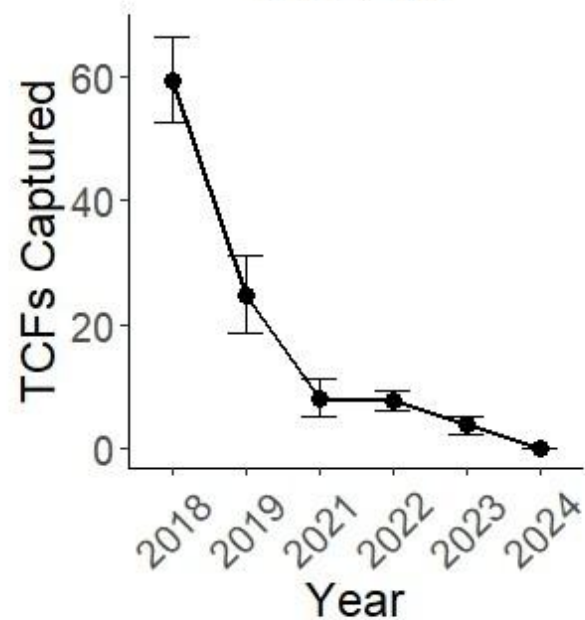


Eastern Mosquitofish pond stocking

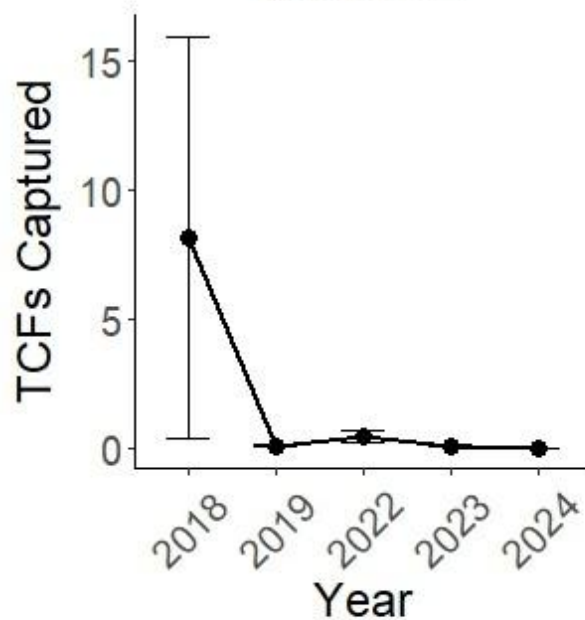
- Target tadpoles before metamorphosis
- Narrow window for stocking
- Yearly since 2022 (limited in 2021)
- To date: >30,000 mosquitofish in >50 stocking events to >20 ponds



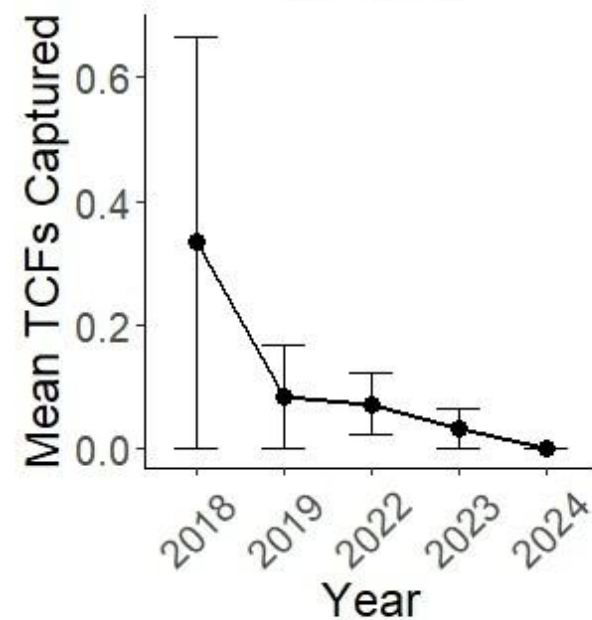
XTR 01



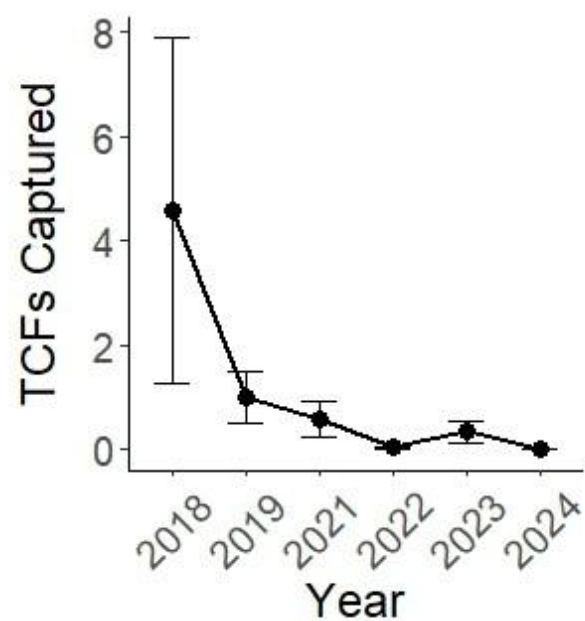
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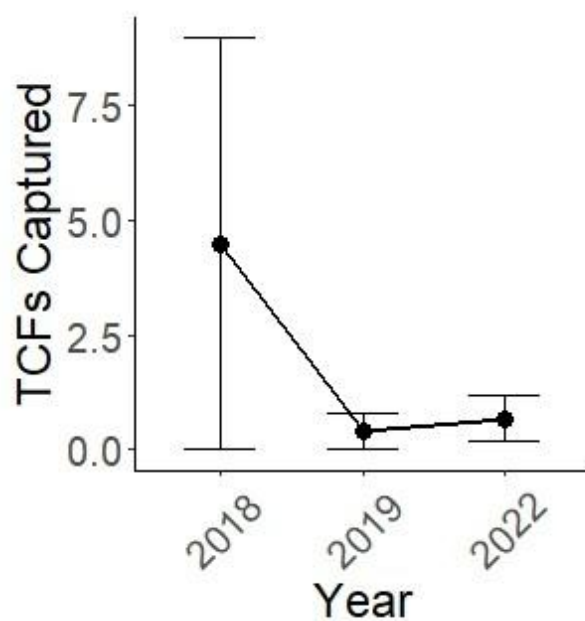
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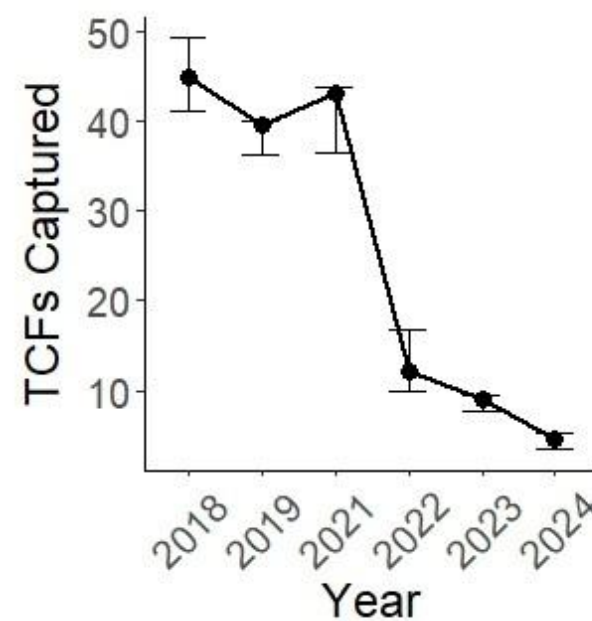
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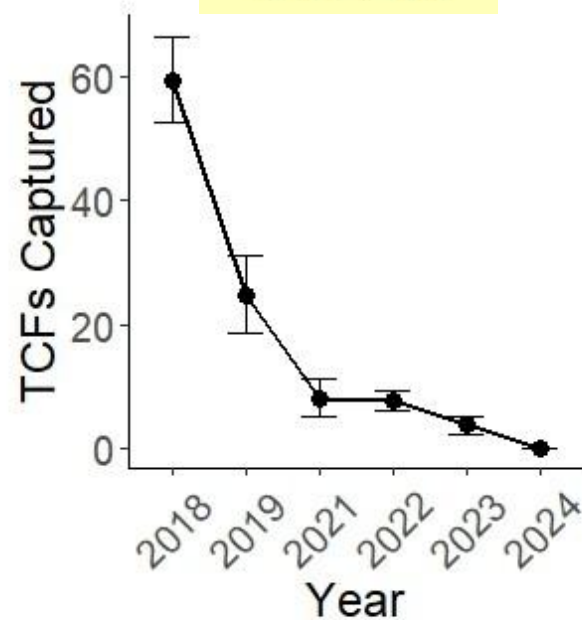
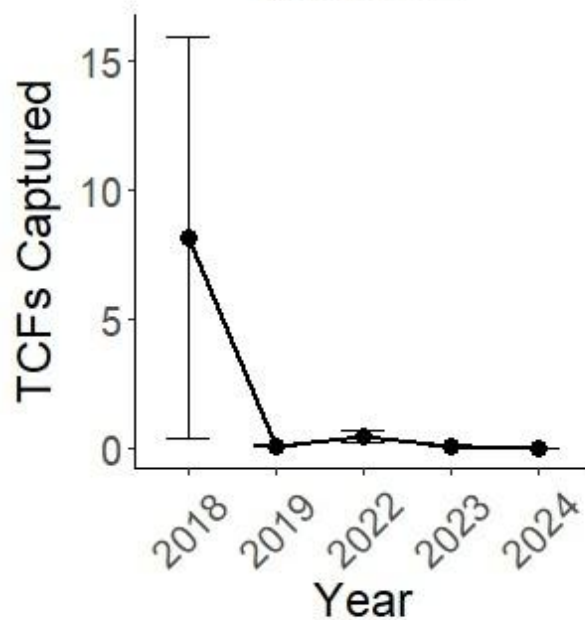
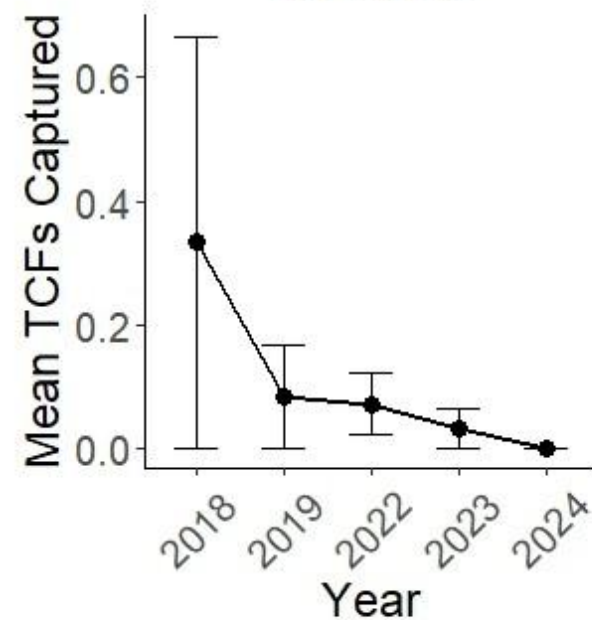
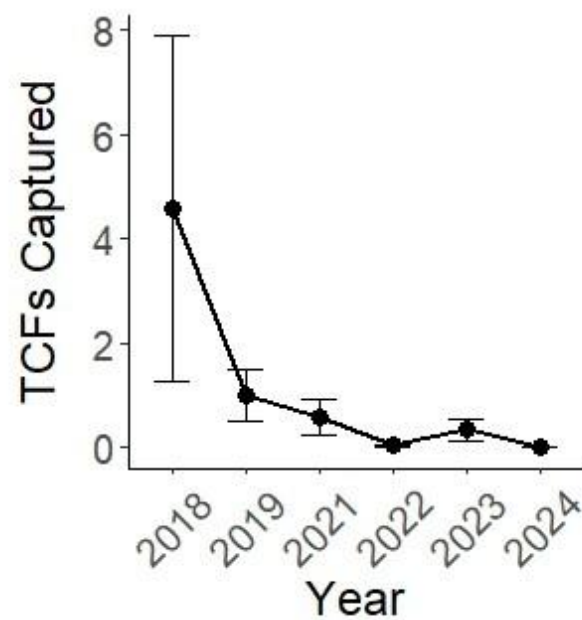
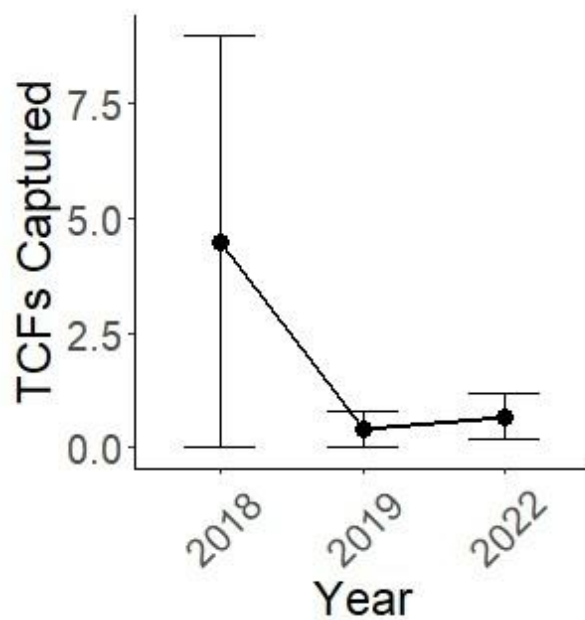
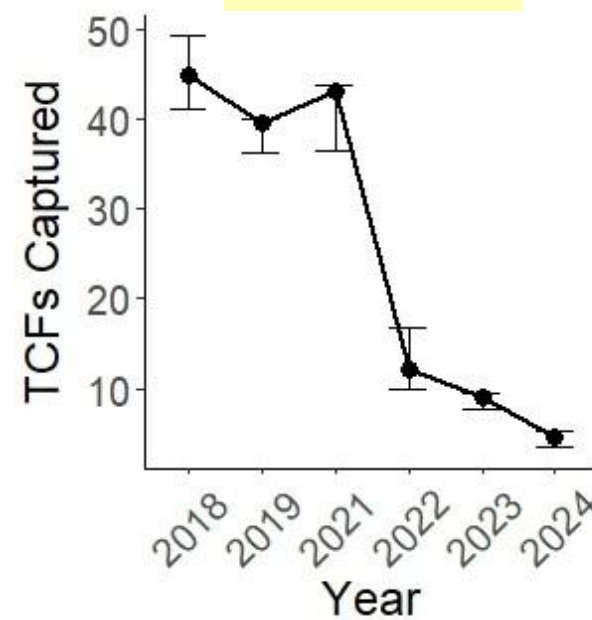


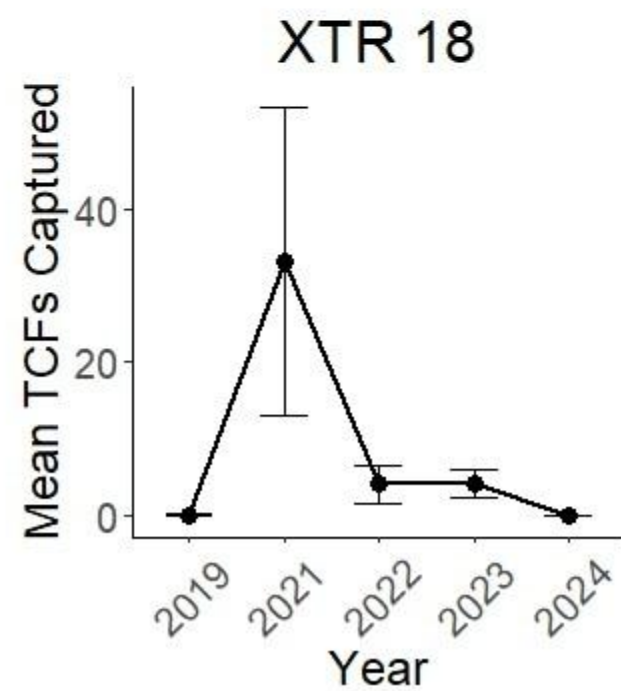
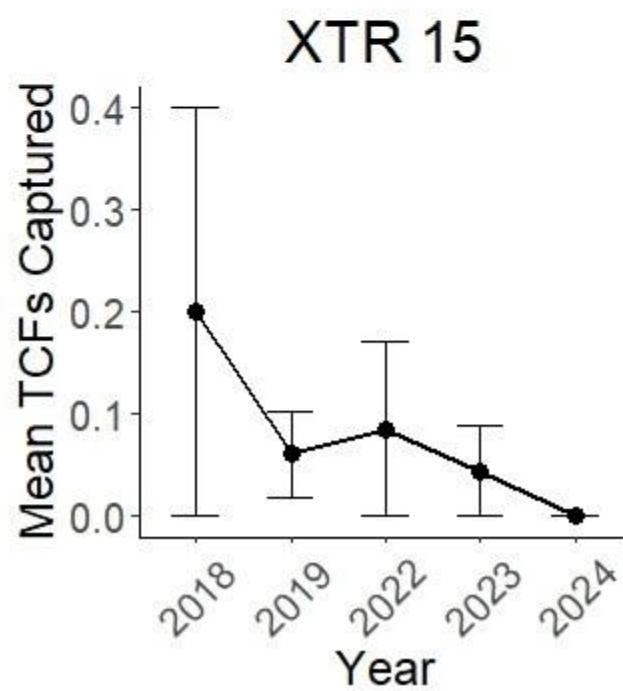
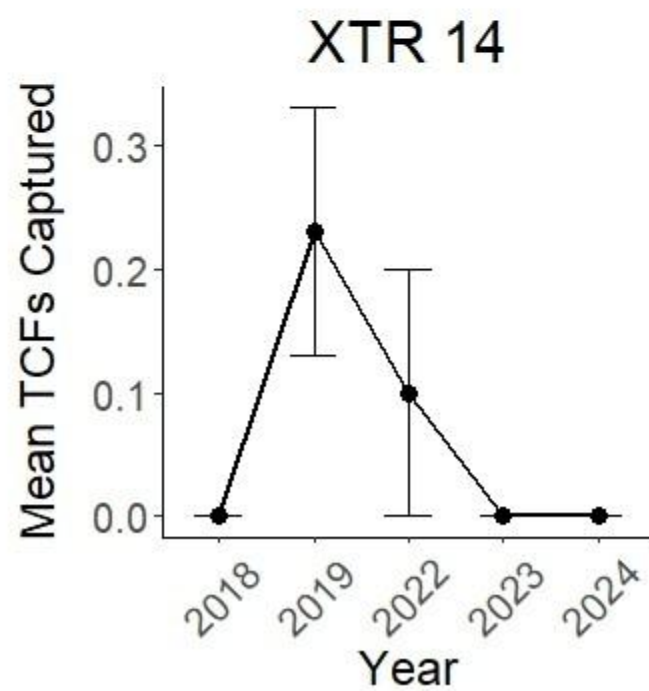
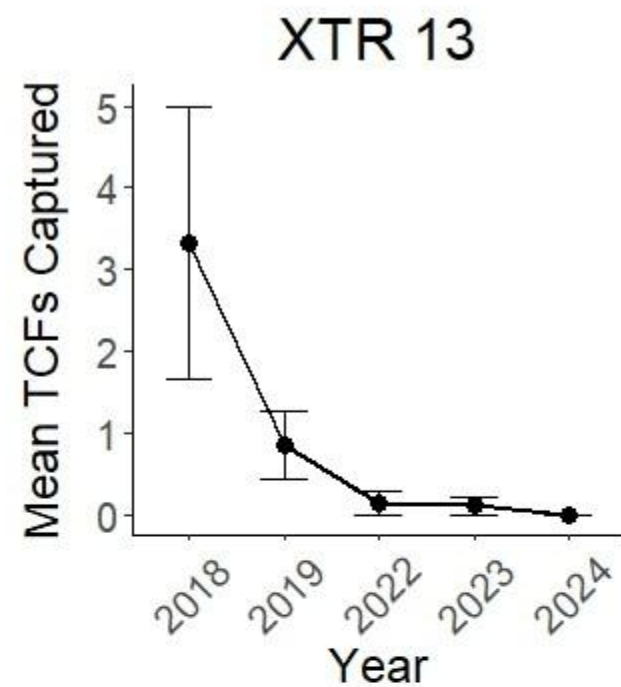
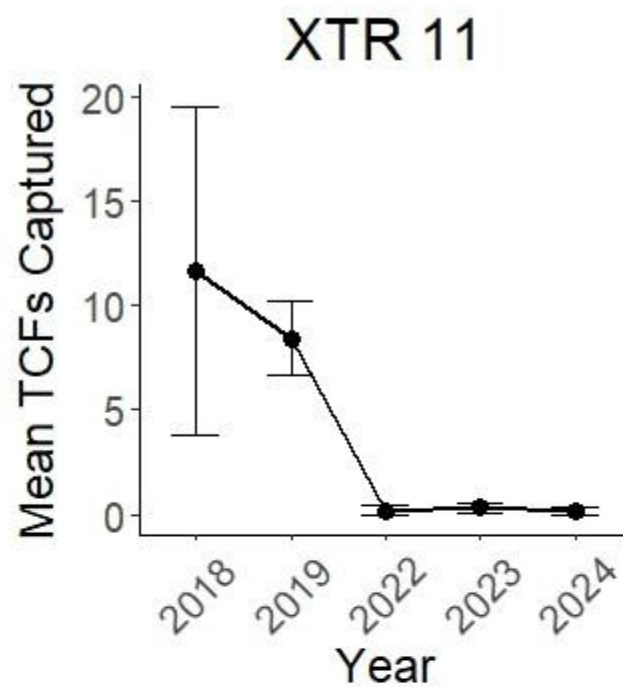
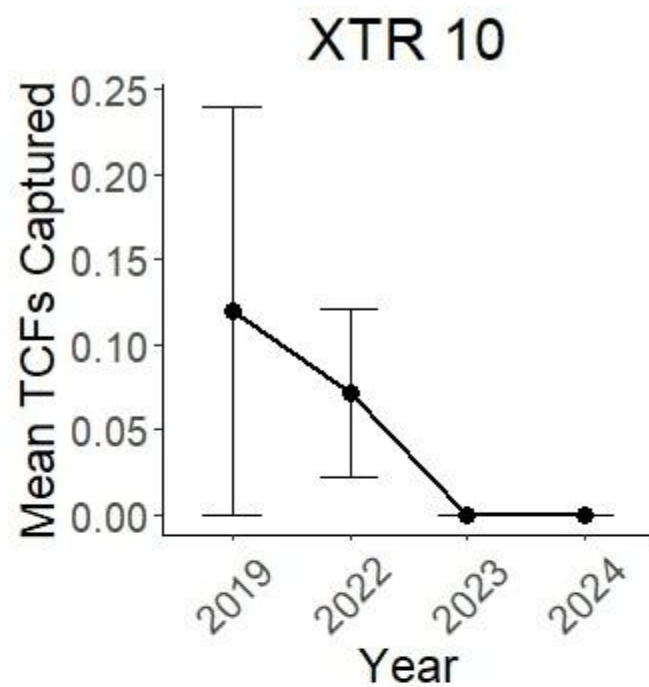
XTR 05



XTR 06

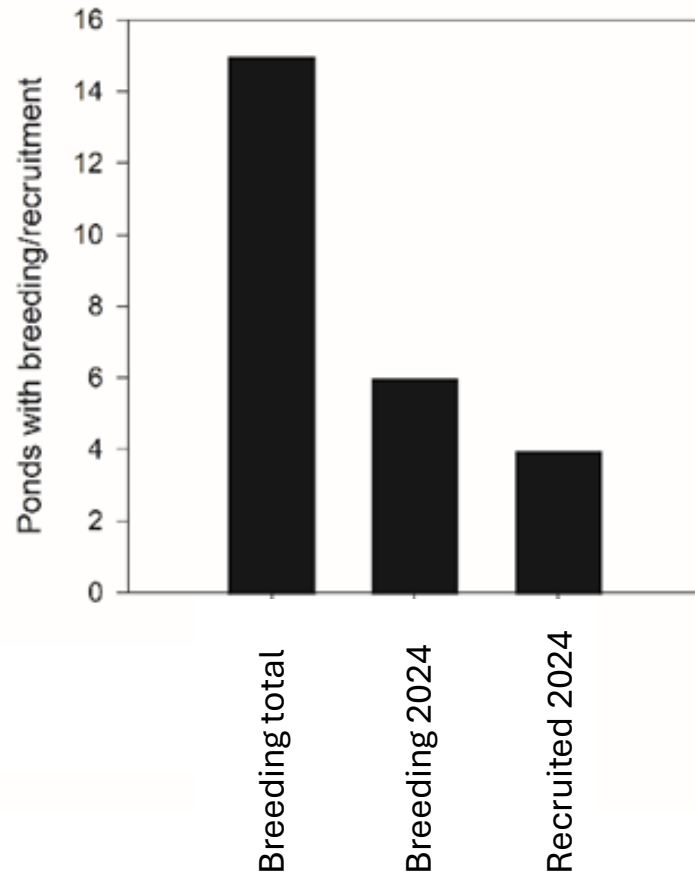


XTR 01**XTR 02****XTR 03****XTR 04****XTR 05****XTR 06**

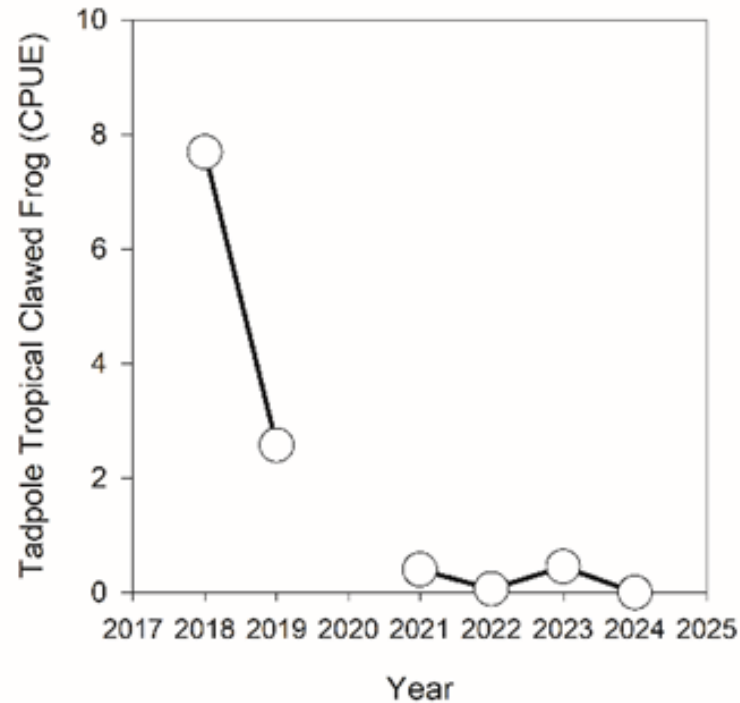


Overall trends from 2018 through 2024

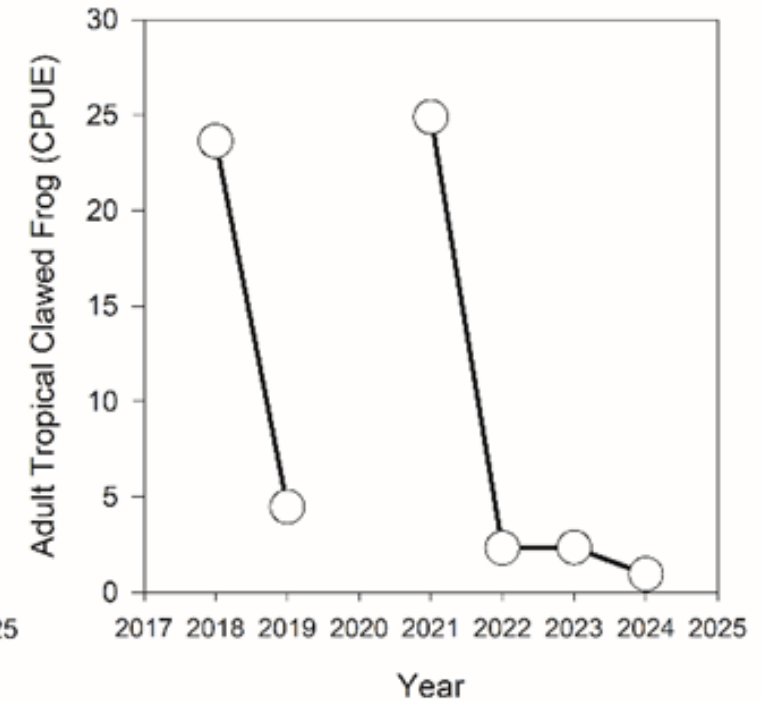
Breeding ponds declined



Tadpole CPUE declined

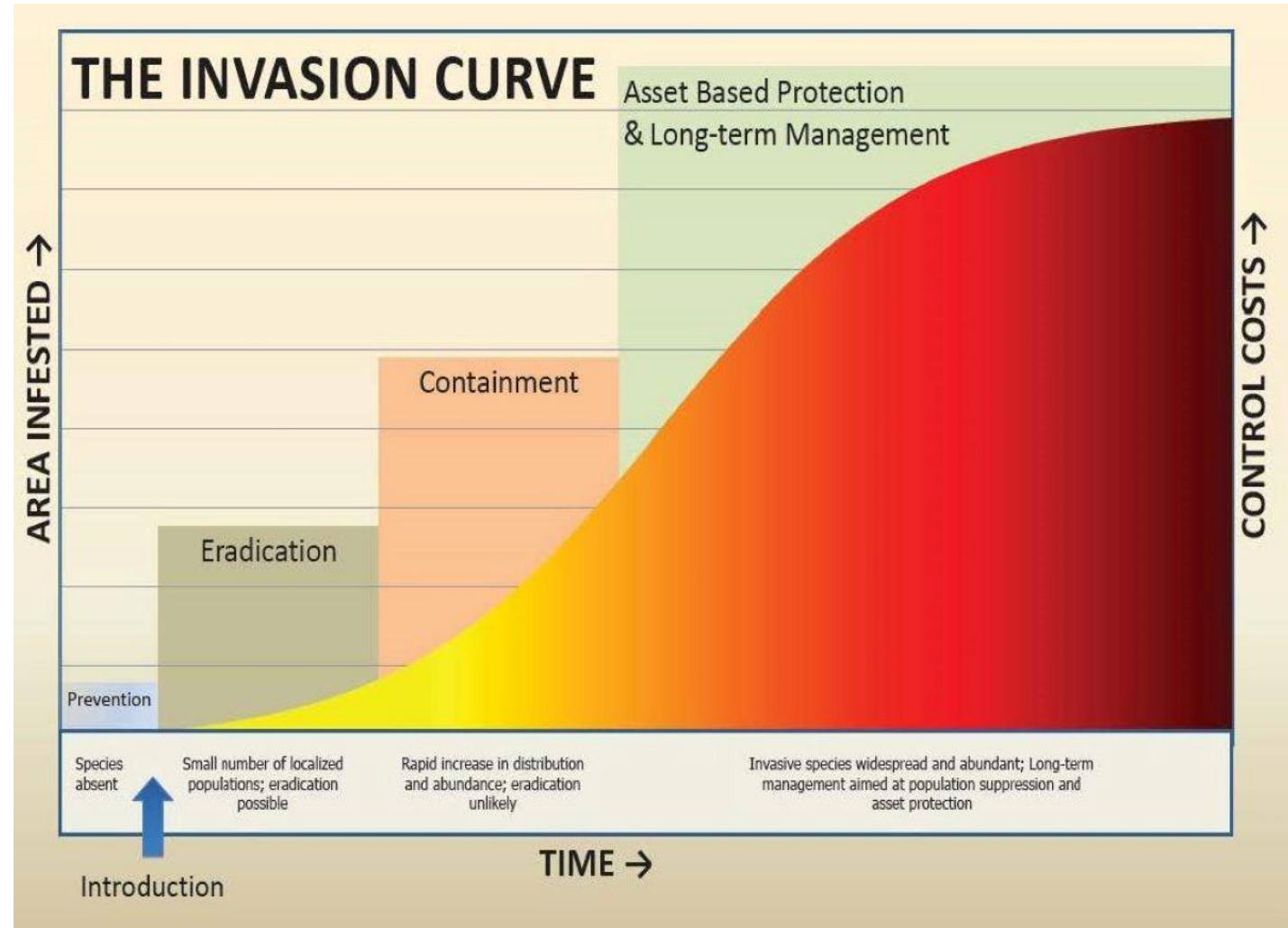


Adult CPUE declined



Some success; what now?

- Need information: eradication probability
- Invasion curve: logistic model with exponential growth and density dependence
- Population viability analysis (PVA): stochastic model for small populations
- Typically used for threatened species





Florida Panther
Image: Florida Audubon



Florida Scrub Jay
Image: Florida Audubon



Key Deer
Image: National Wildlife Federation



West Indian Manatee
Image: Marine Mammal Commission



Snail Kite
Image: USFW

PVA models applied to non-natives/invasives

- Control strategies can be evaluated in a PVA alongside small-population stochasticity
- Frog PVA with stochasticity and management actions:
 - Mosquitofish stocking: \$ but adults are still in the environment
 - Intensive trapping: \$\$ but only targets adults
 - Pond deepening: \$\$\$ but likely most effective

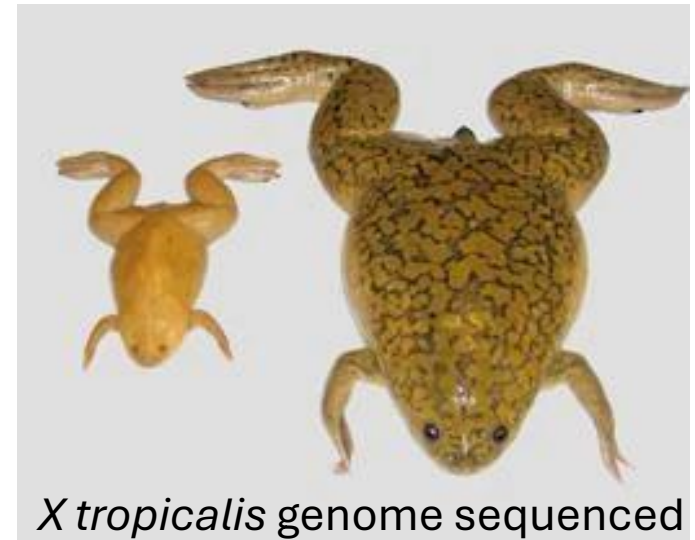
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Result: eradication cost, timeline, and probability based on control strategies

Future directions

- Fit the model: PVA
- Work with Hillsborough County to make breeding ponds inhospitable
 - Verbal commitment in 2024; Hurricane Milton led to more pressing issues
- Landscape modeling, object detection to identify ephemeral ponds (spread)
- eDNA; better way to conduct surveillance?



Acknowledgements

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Tropical Aquaculture Laboratory

