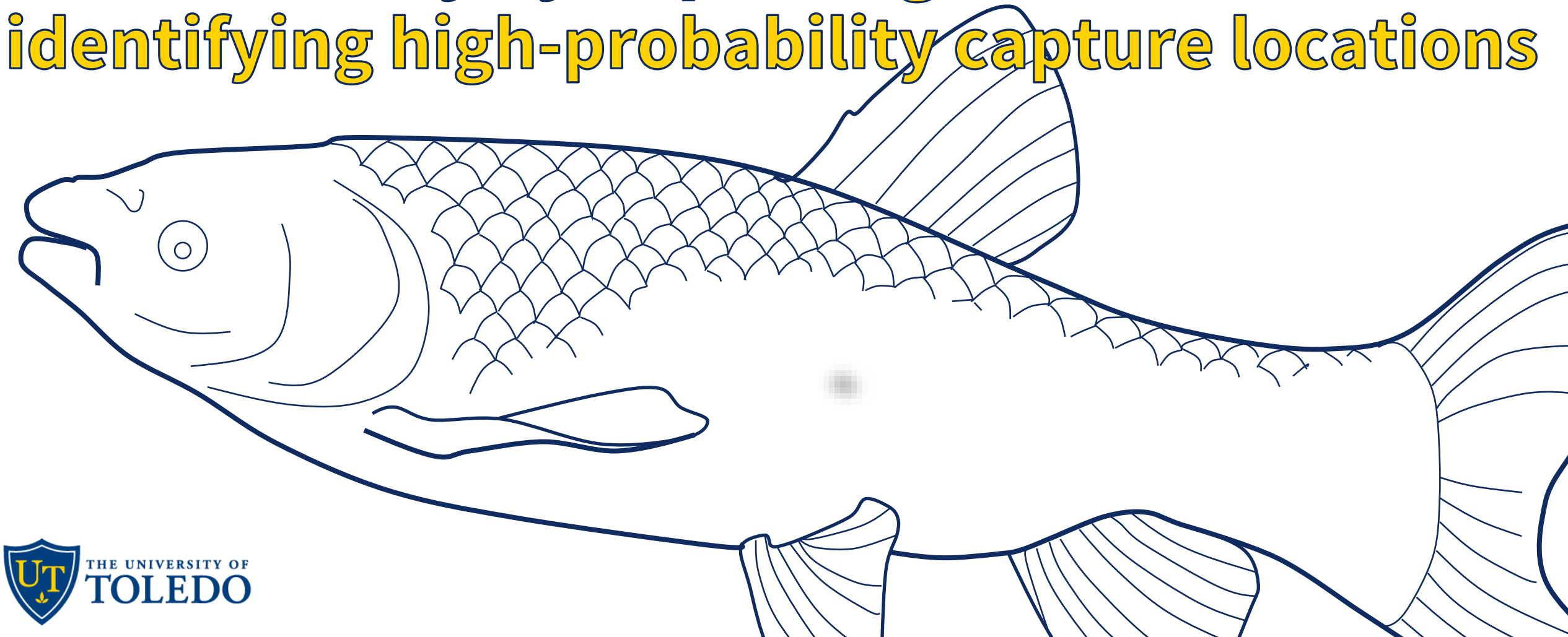
UT Research Updates: Increasing capture efficiency by improving methods and identifying high-probability capture locations



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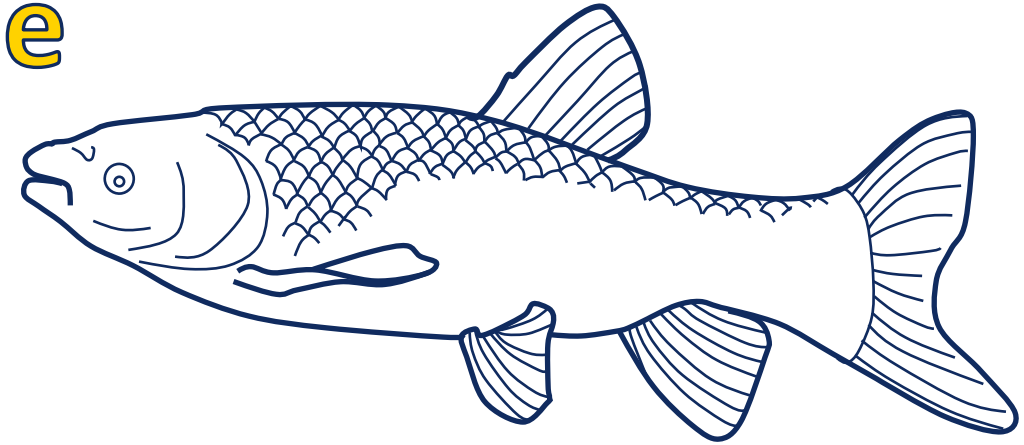
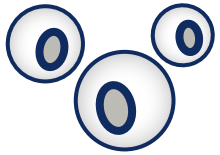
Grass carp invasion timeline





1963 — Imported to U.S. to control aquatic vegetation

1983 — Triploid (sterile) grass carp developed

1980's — Reports of grass carp captured by commercial fishers in Lake Erie

2012 — Diploid grass carp that originated from the Sandusky River were captured

2015 — Grass carp eggs found in the Sandusky River

2017 — First planned action event

2018 — First strike teams deployed, grass carp larvae found in Maumee River

2019-2023 — Continued effort

FUELING TOMORROWS

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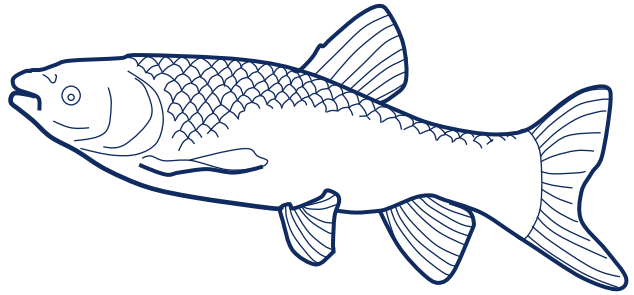
GC control and research collaborative structure

Lake Erie Committee & GLFC

Grass Carp Advisory Committee & Structured Decision Making



Removal

Early Detection

Research

Early Life History

Telemetry

Population Modeling

Novel Technology (Barriers, Attractants & eDNA)

FUELING **TOMORROWS**

Early life history informs removal efforts

1. USGS Flu-egg and SpawnCast

a) Spawning location

b) Spawn timing

2. Egg and larval collection

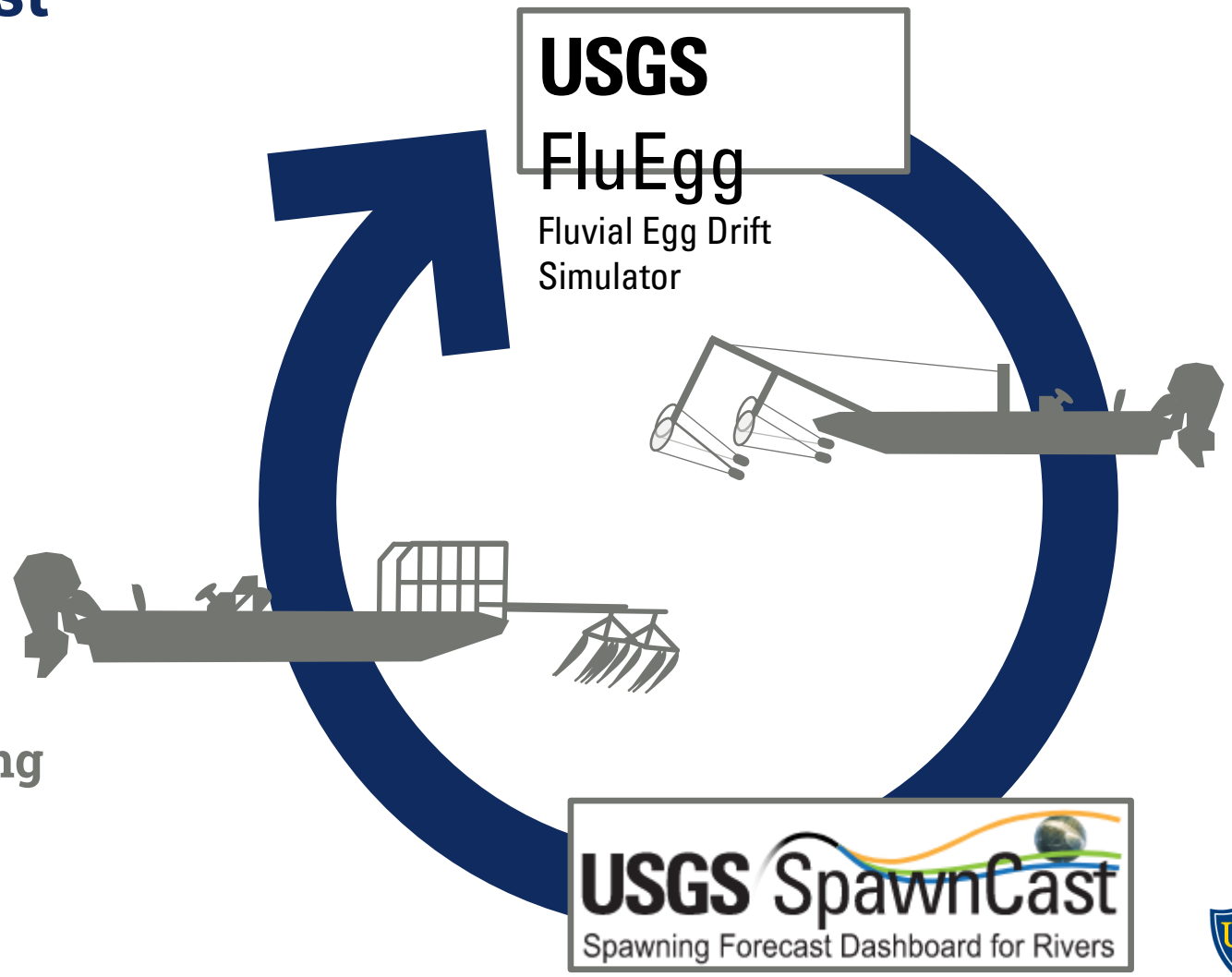
a) Confirm spawning upstream

3. Spawning response

a) Confirm adult spawning location

b) Control adult numbers

c) Most efficient capture method/timing



Telemetry: phenology, distribution, catch…

1. Pantelopoulos et al. 2022

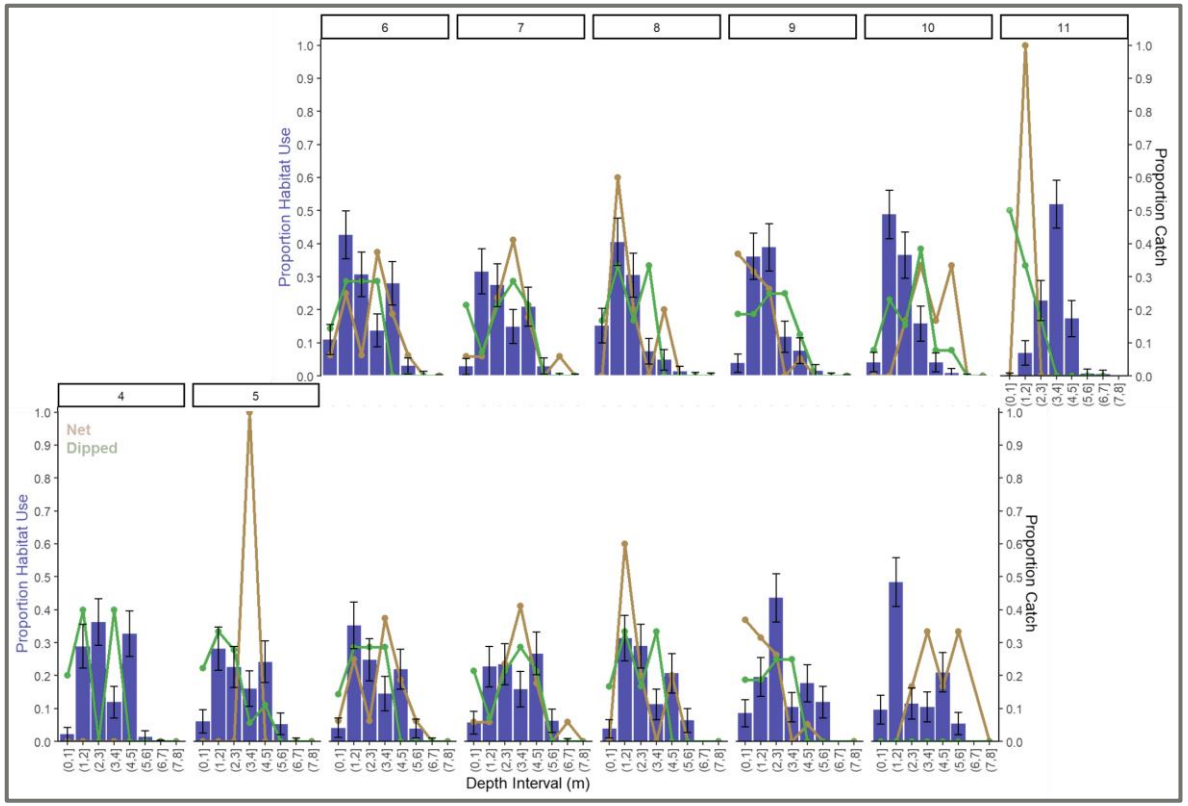
a) Occupied depths vs. capture depths

b) Grass Carp use shallow areas

c) High overlap in maximum depths in occupied areas and capture locations for each gear type

2. Catchability?

3. Habitat use?



Pantelopoulos et al. 2022

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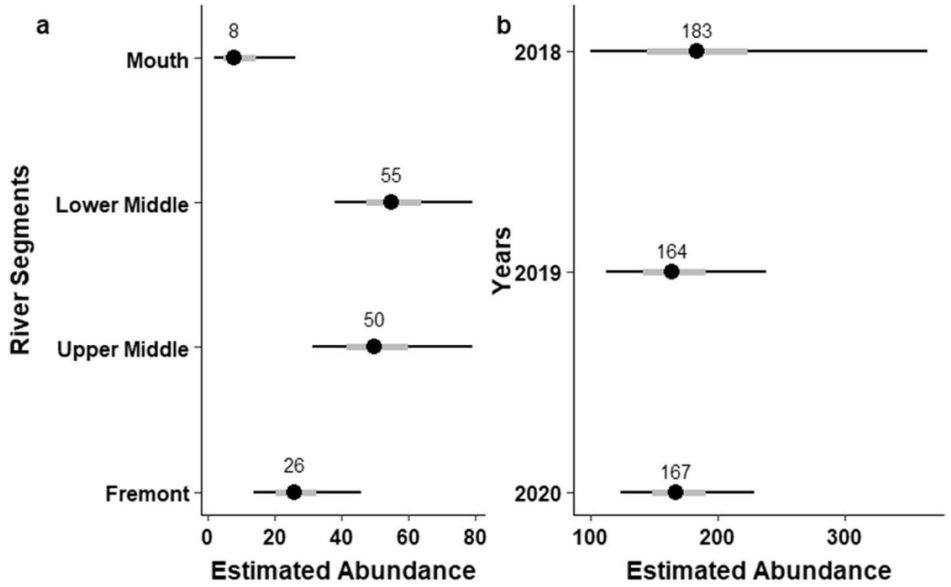
Population Modeling:

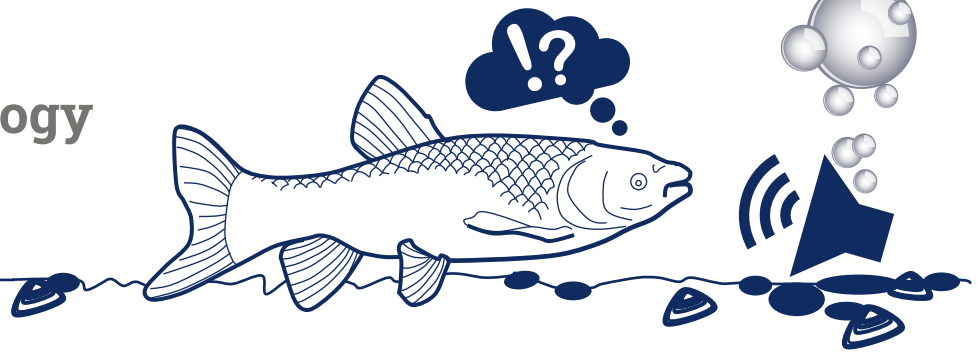
1. Song Qian
2. Gouveia et al. 2023
3. Katherine Curtis (MS student UT)



Gouveia et al. 2023

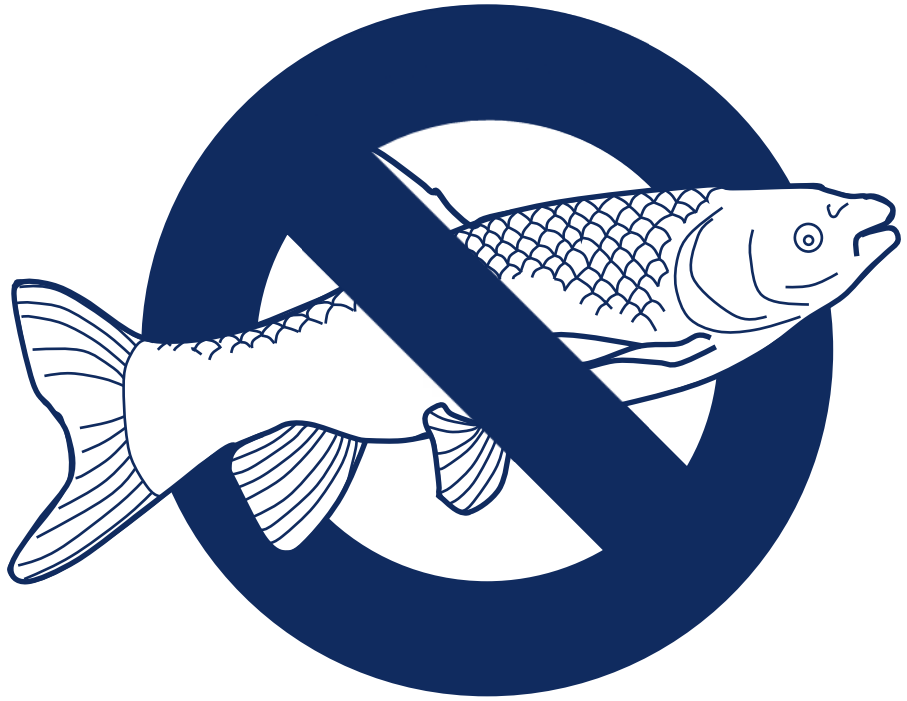
Novel Technology: telemetry & barrier

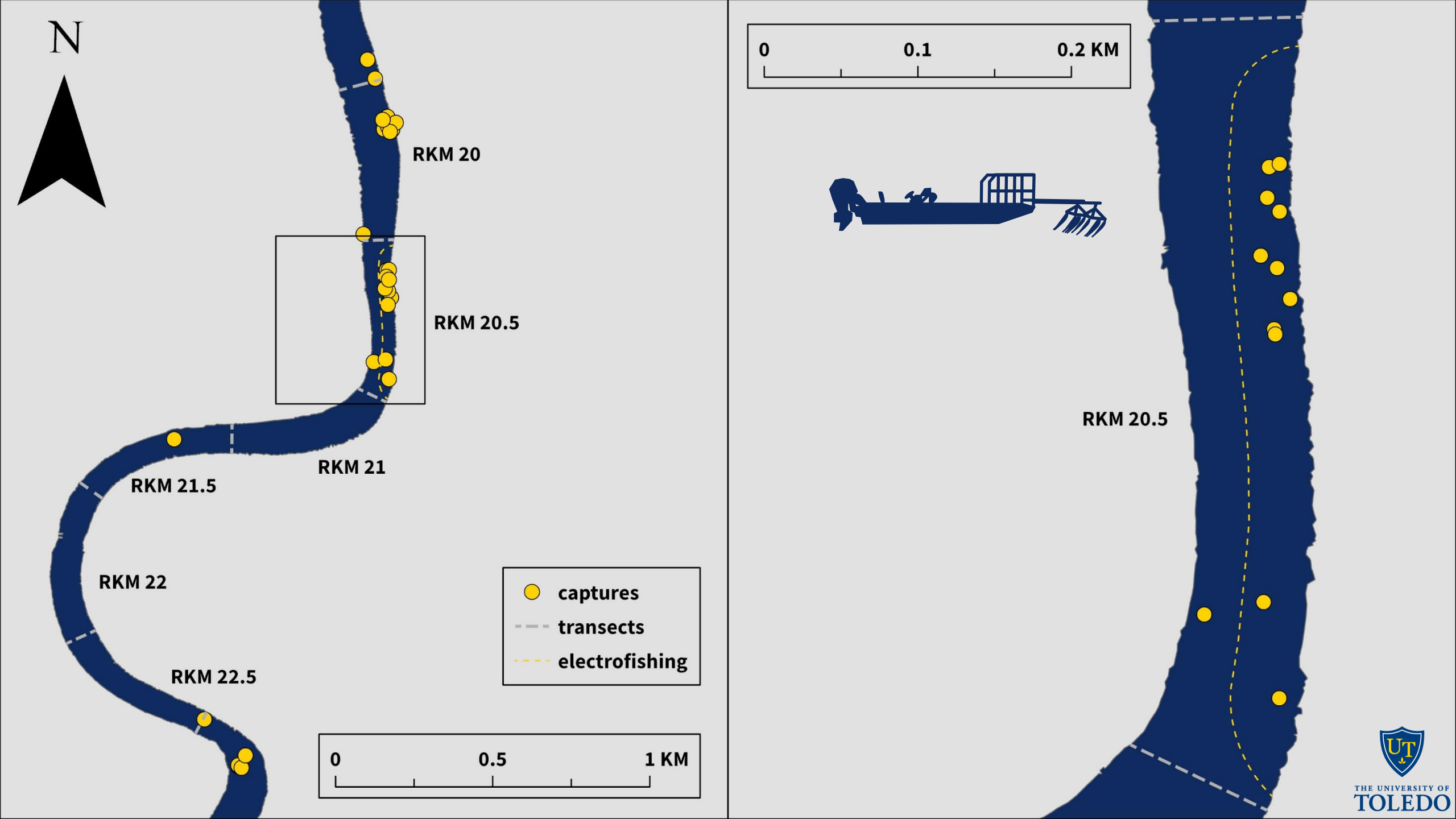
1. Bopp et al. 2023 - Walleye spawn timing does not overlap.
2. Evelyn Pantelopoulos (MS student UT)
   a) Native fish tributary use depends on lotic spatial ecology
   b) Distribution and phenology



Increasing Capture Efficiency

1. **Understand grass carp population dynamics, behavior, and impacts to inform management**
    a) Preferred habitats, movement, behavior
    a) Densities
    b) Aggregation factors
2. **Implement control**
    a) Remove grass carp
    b) Conduct applied research
3. **Minimize likelihood of introduction and establishment of new breeding populations**

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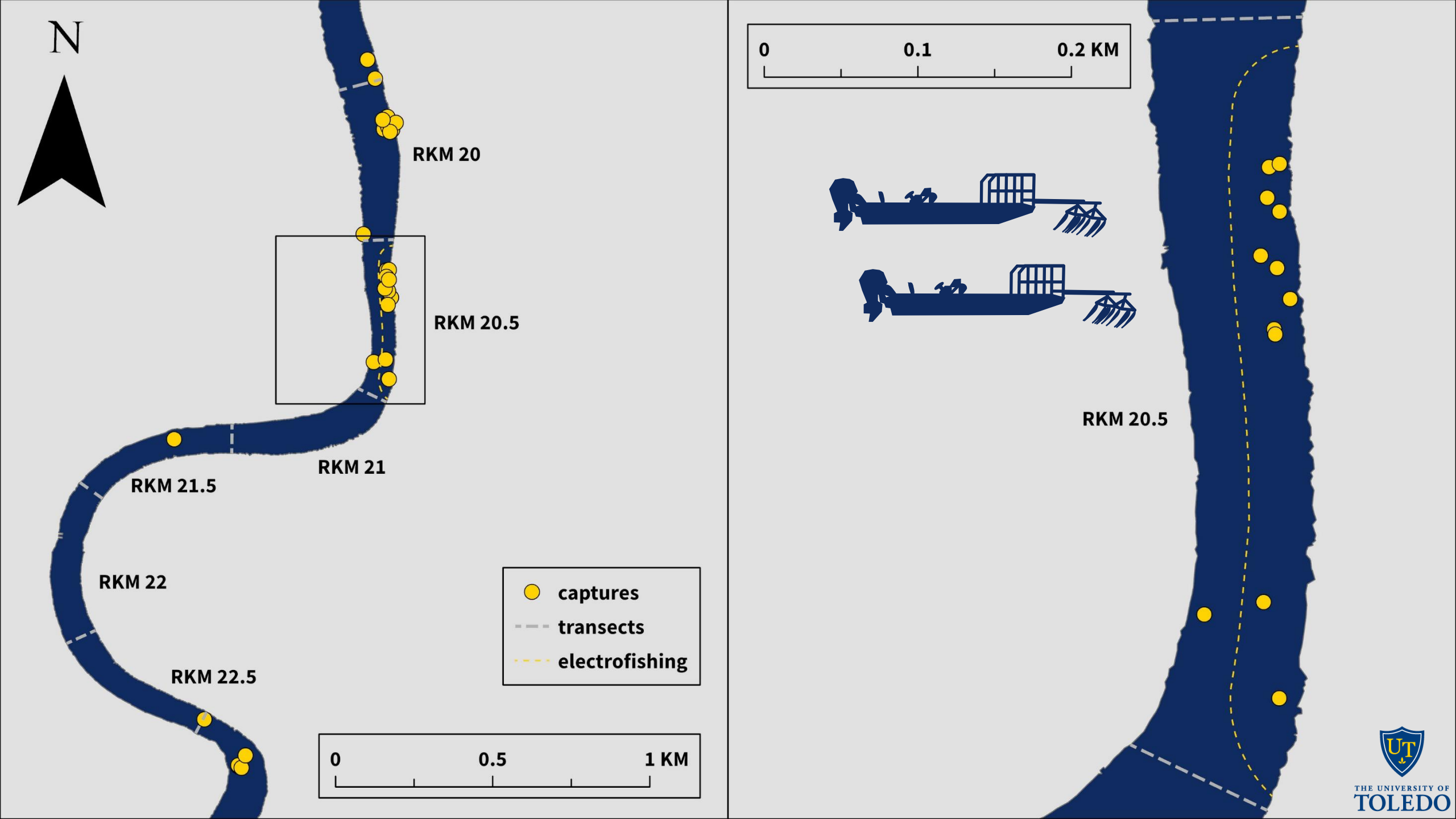
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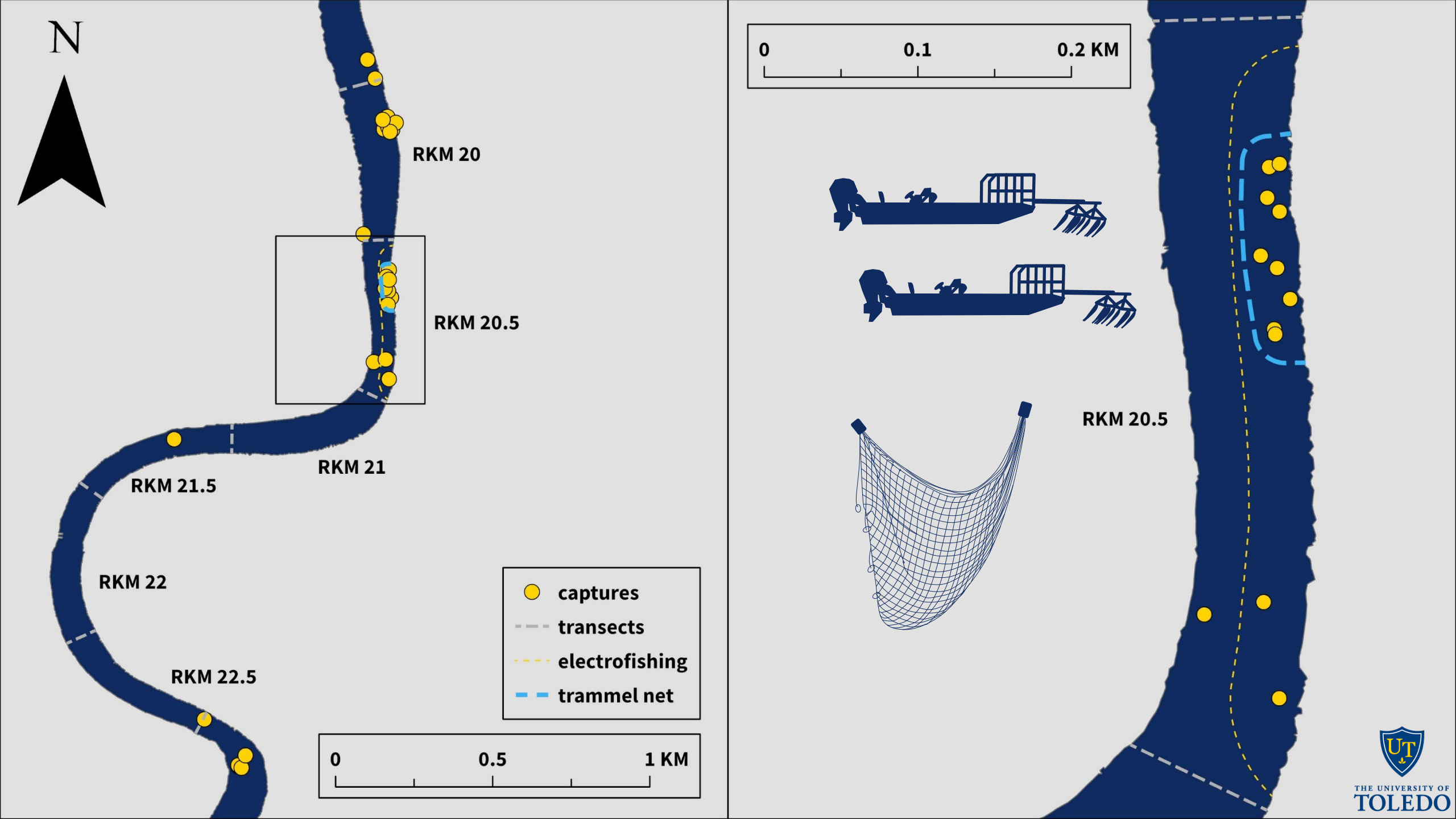
THE UNIVERSITY OF TOLEDO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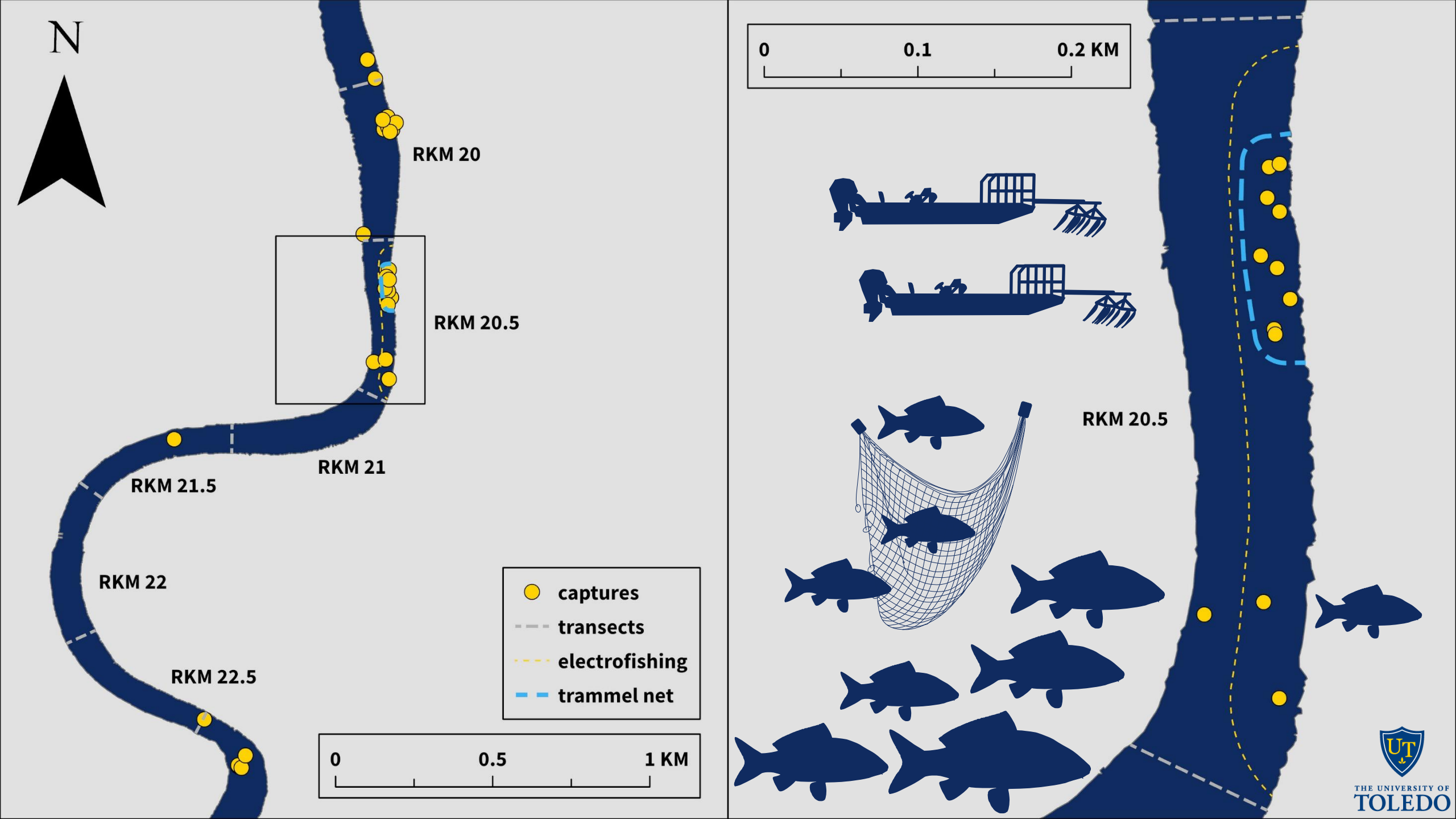
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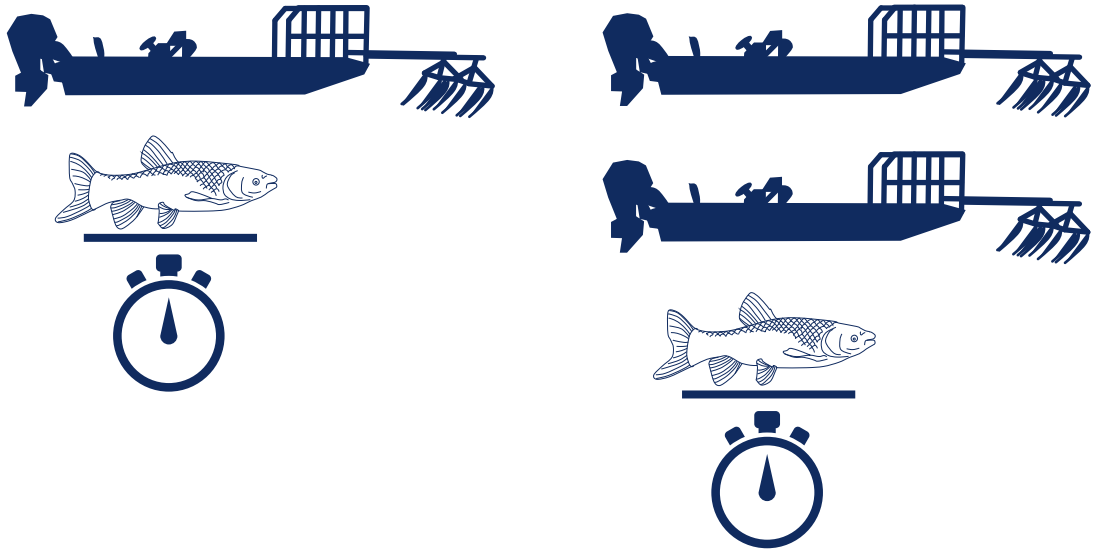
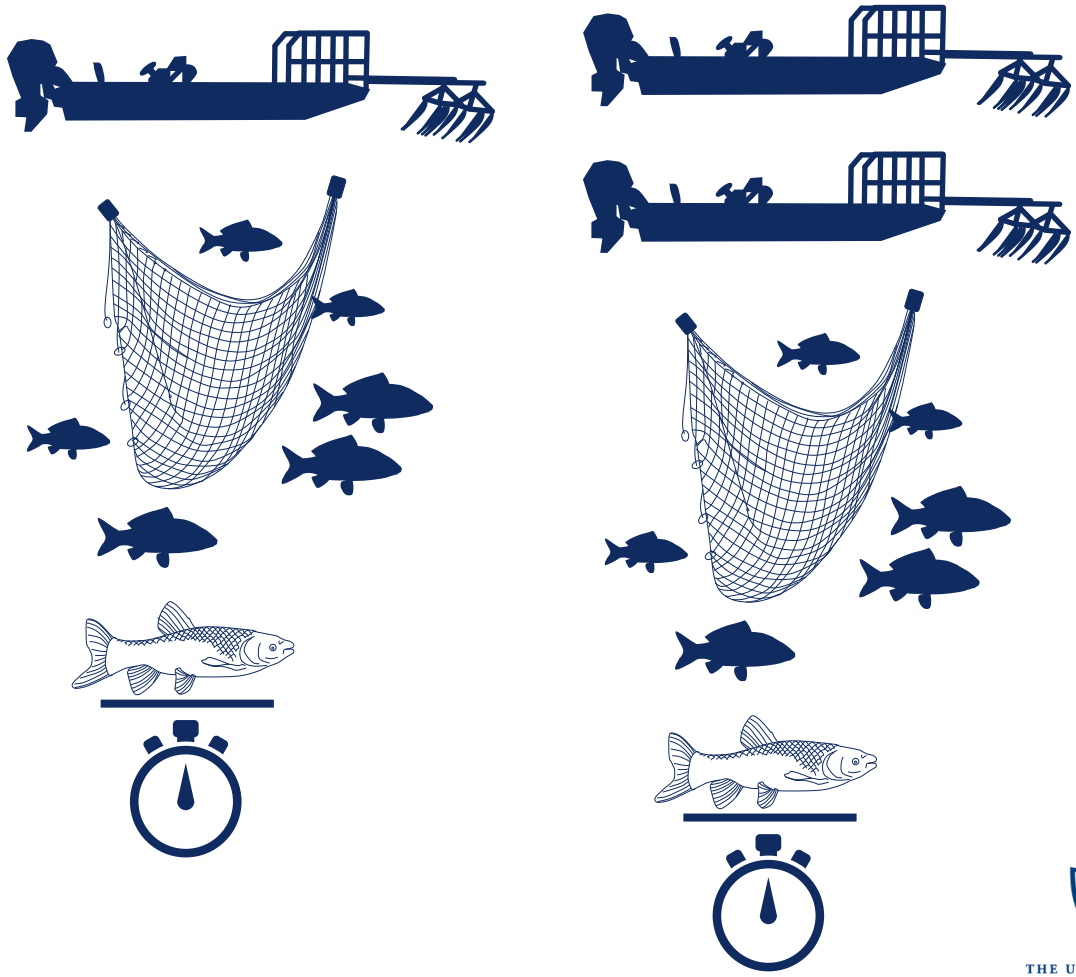
Efficiency ⟷ Detection

E-fishing



Combination



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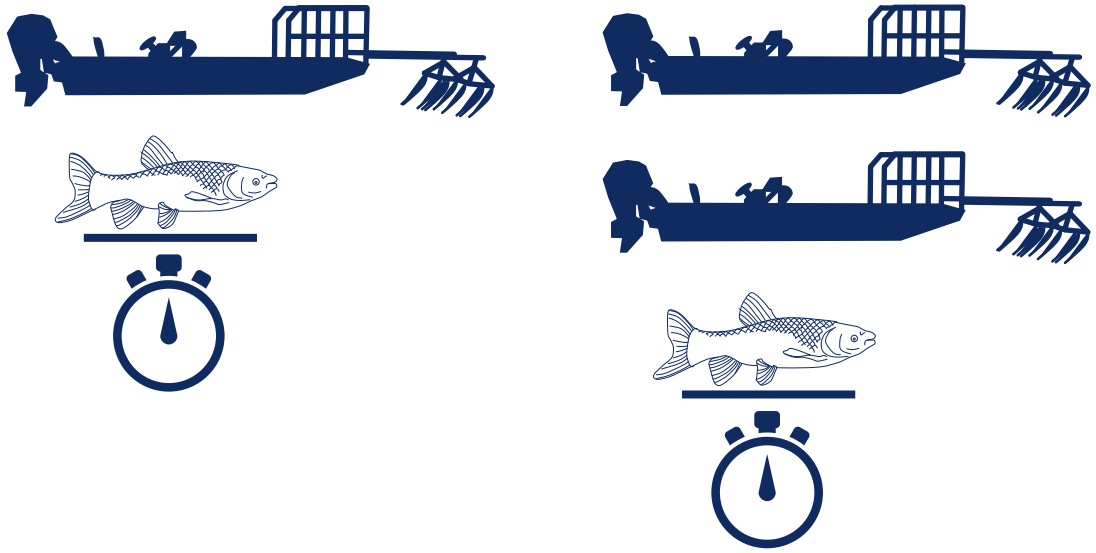
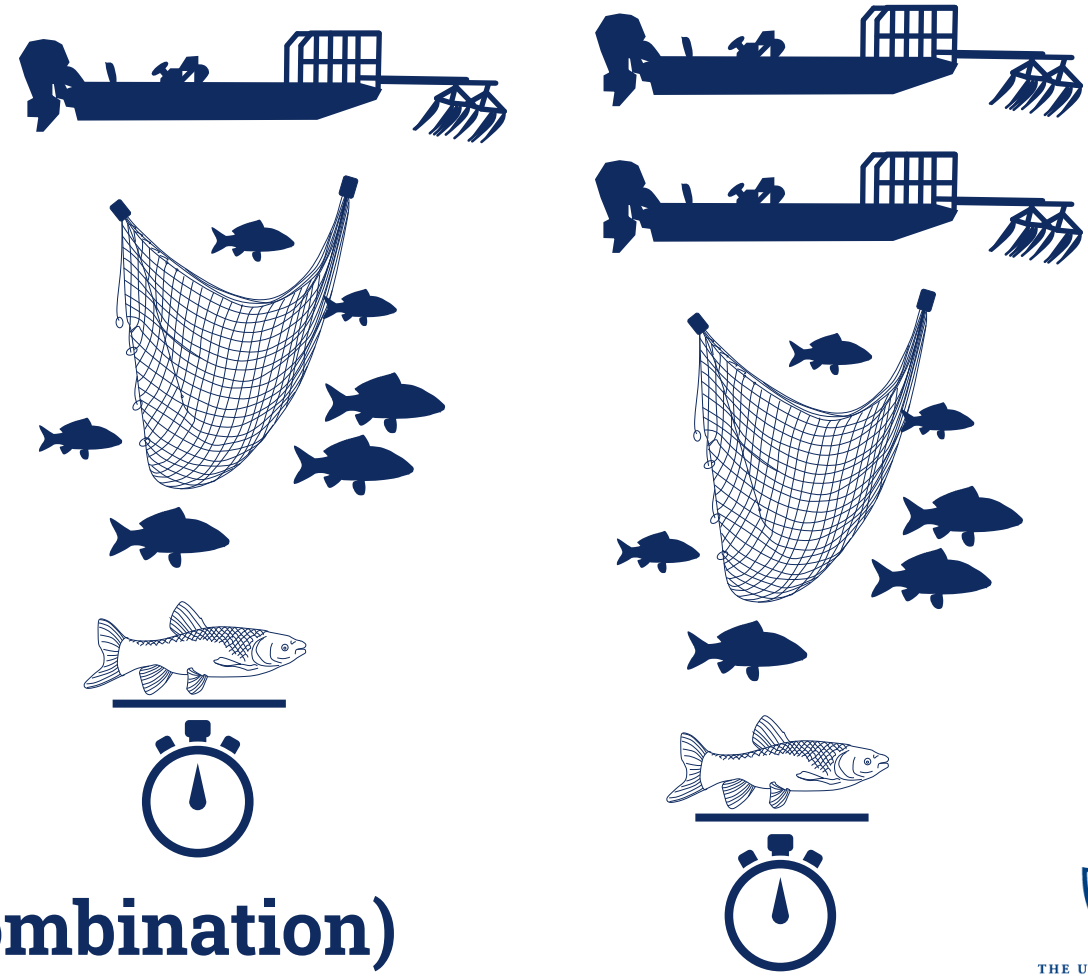
Efficiency ⟷ Detection

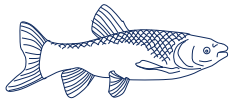
E-fishing



Combination



Proportion successful:

 = 0.090 (E-fishing); 0.077 (Combination)

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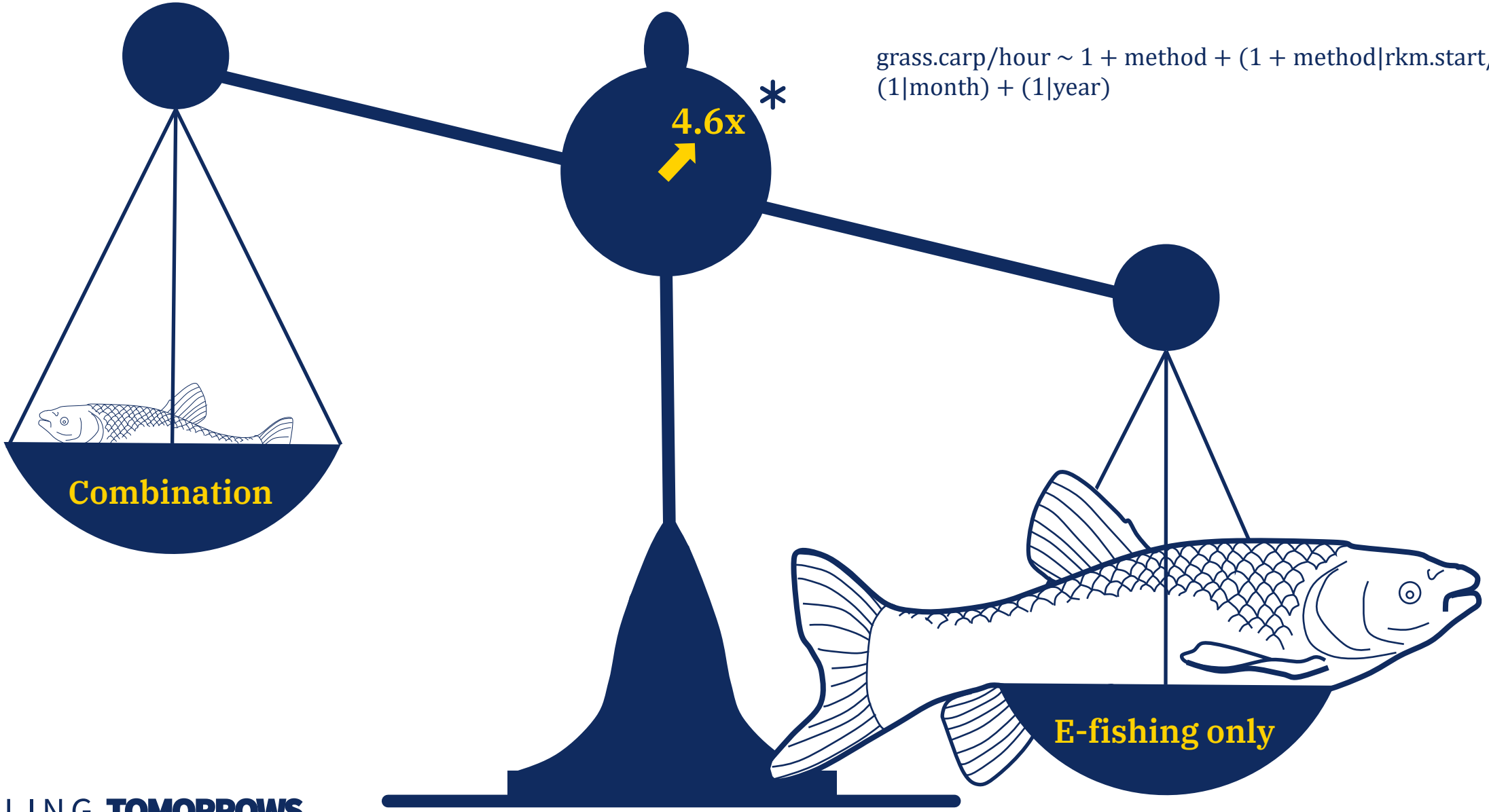
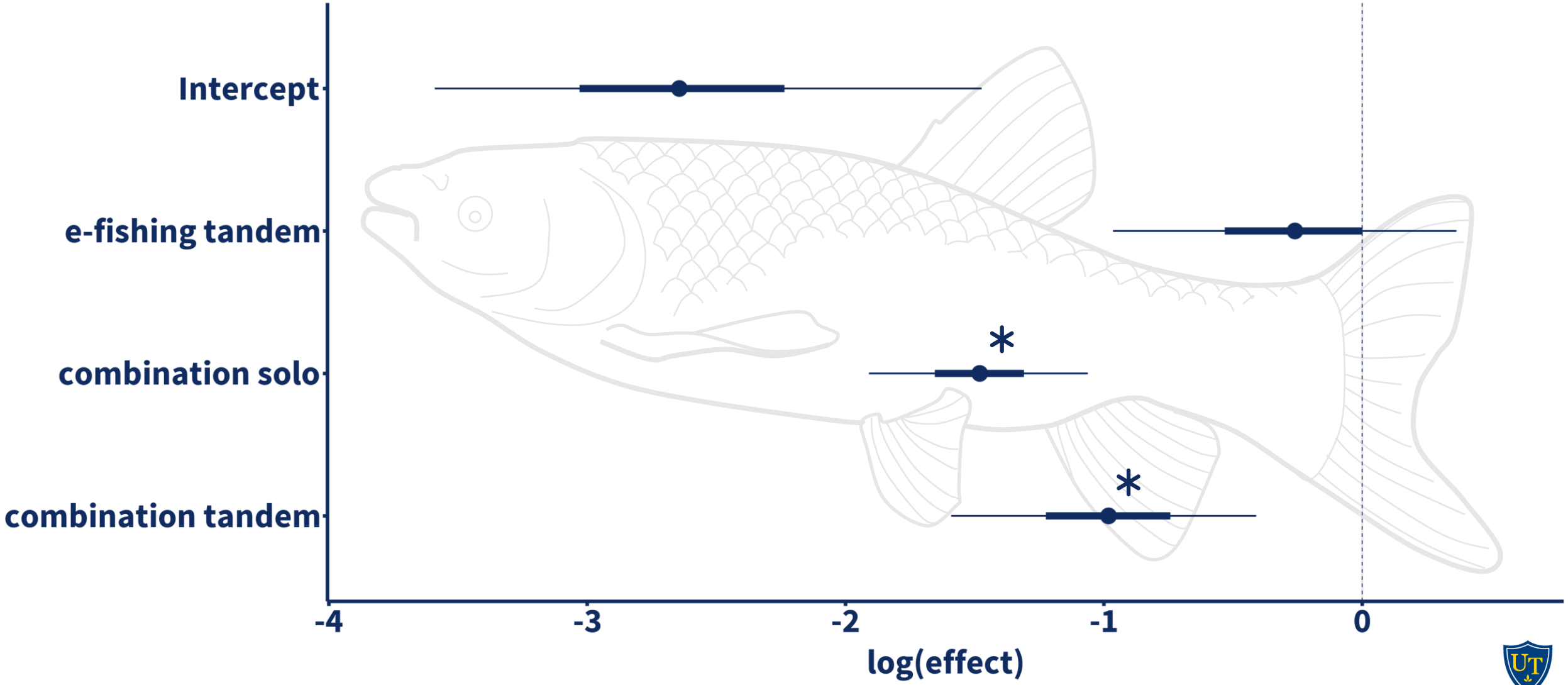
Tradeoff between detection and efficiency

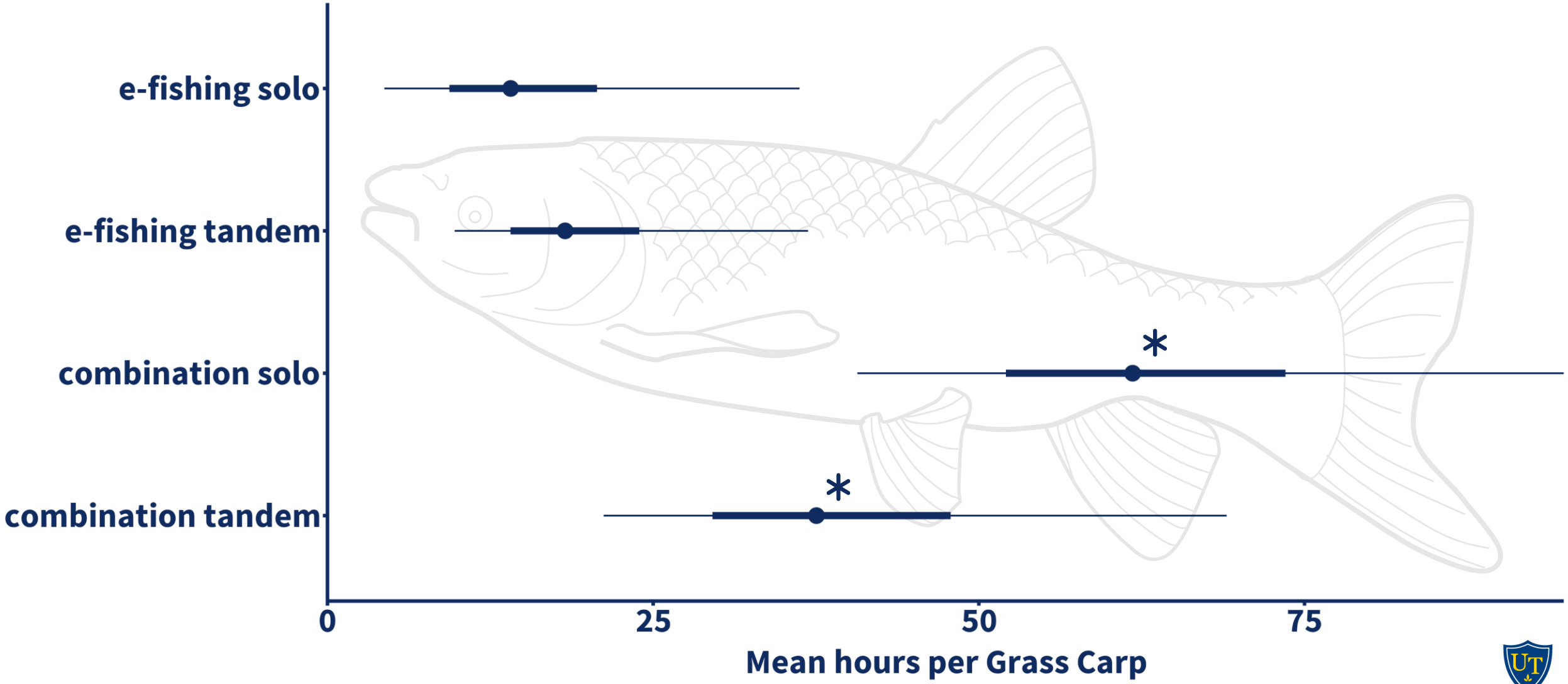
grass.carp/hour ~ 1 + method + (1 + method|rkm.start/year) + (1|month) + (1|year)



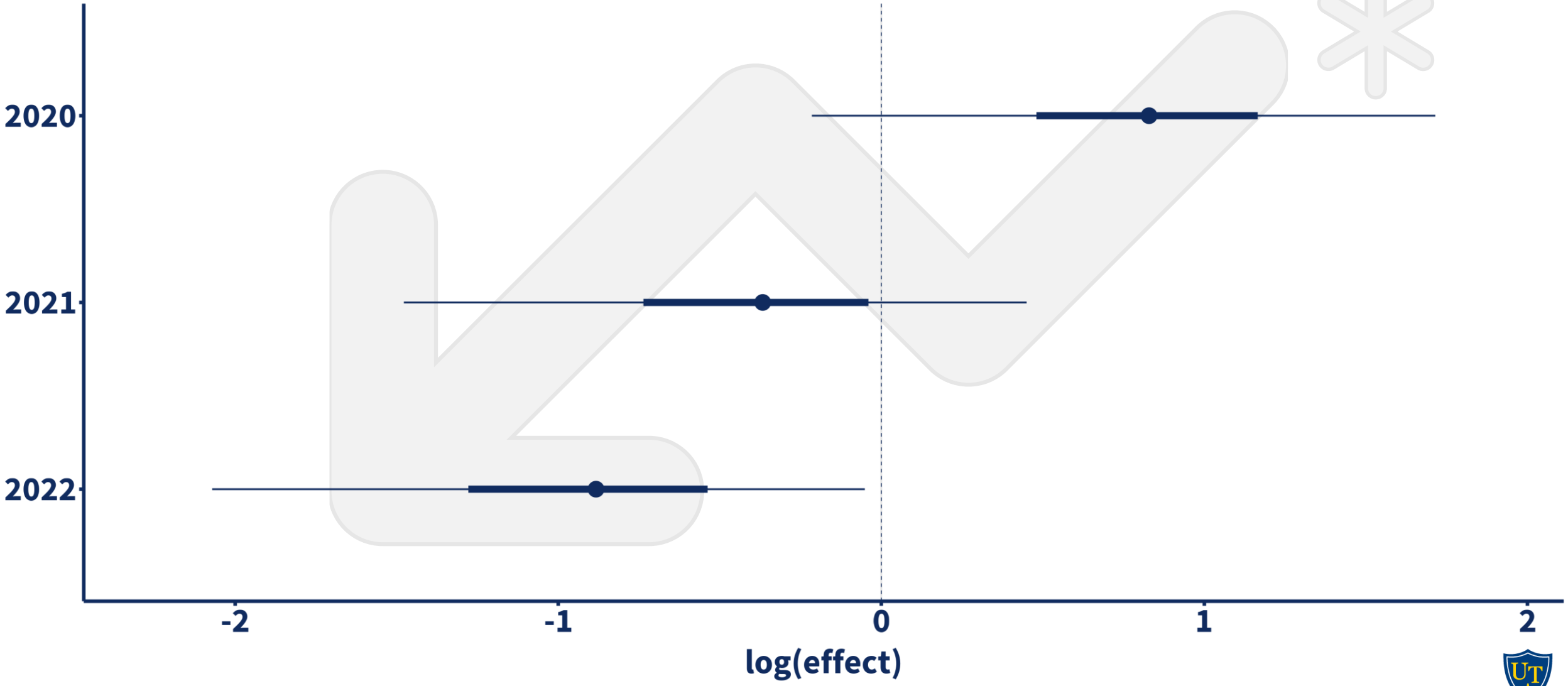
E-fishing alone is 4.6x more efficient



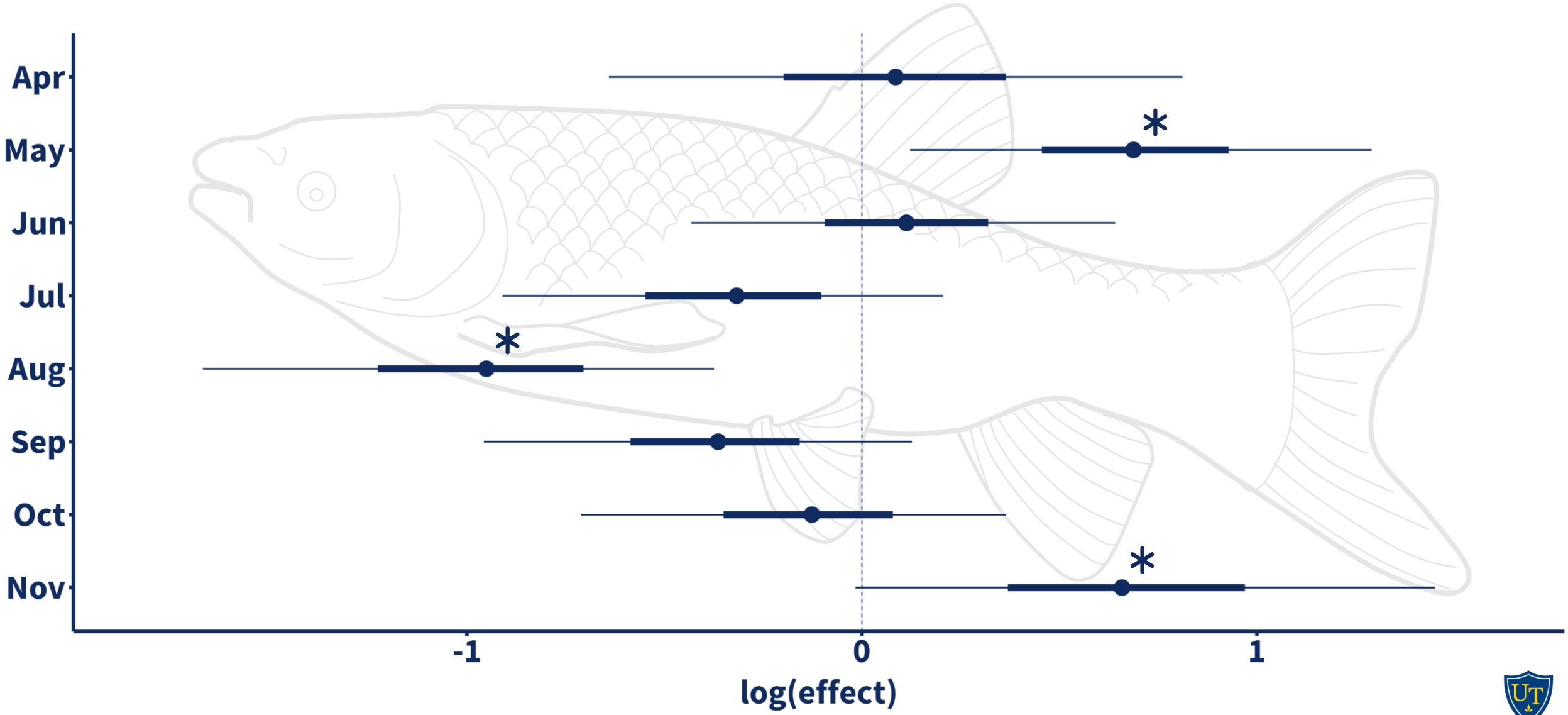
Difference is significant and large



Captures vary by year (Sandusky River)



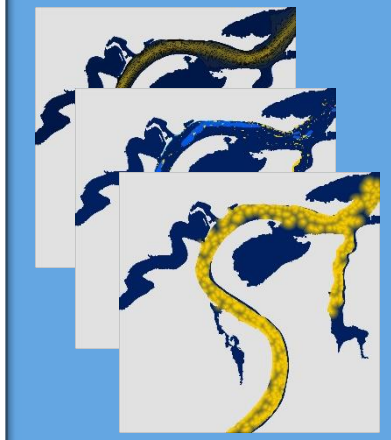
CPE varies by month (Sandusky River)



Species distribution modeling *(Next Steps)*

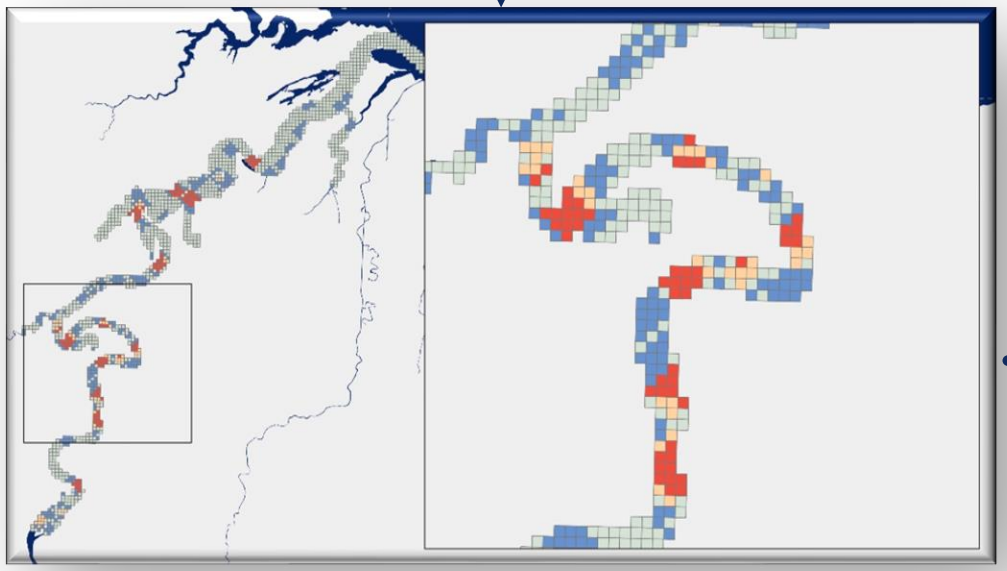
Environmental data

- NHDPlus
- Side-scan sonar data



Statistical relationship

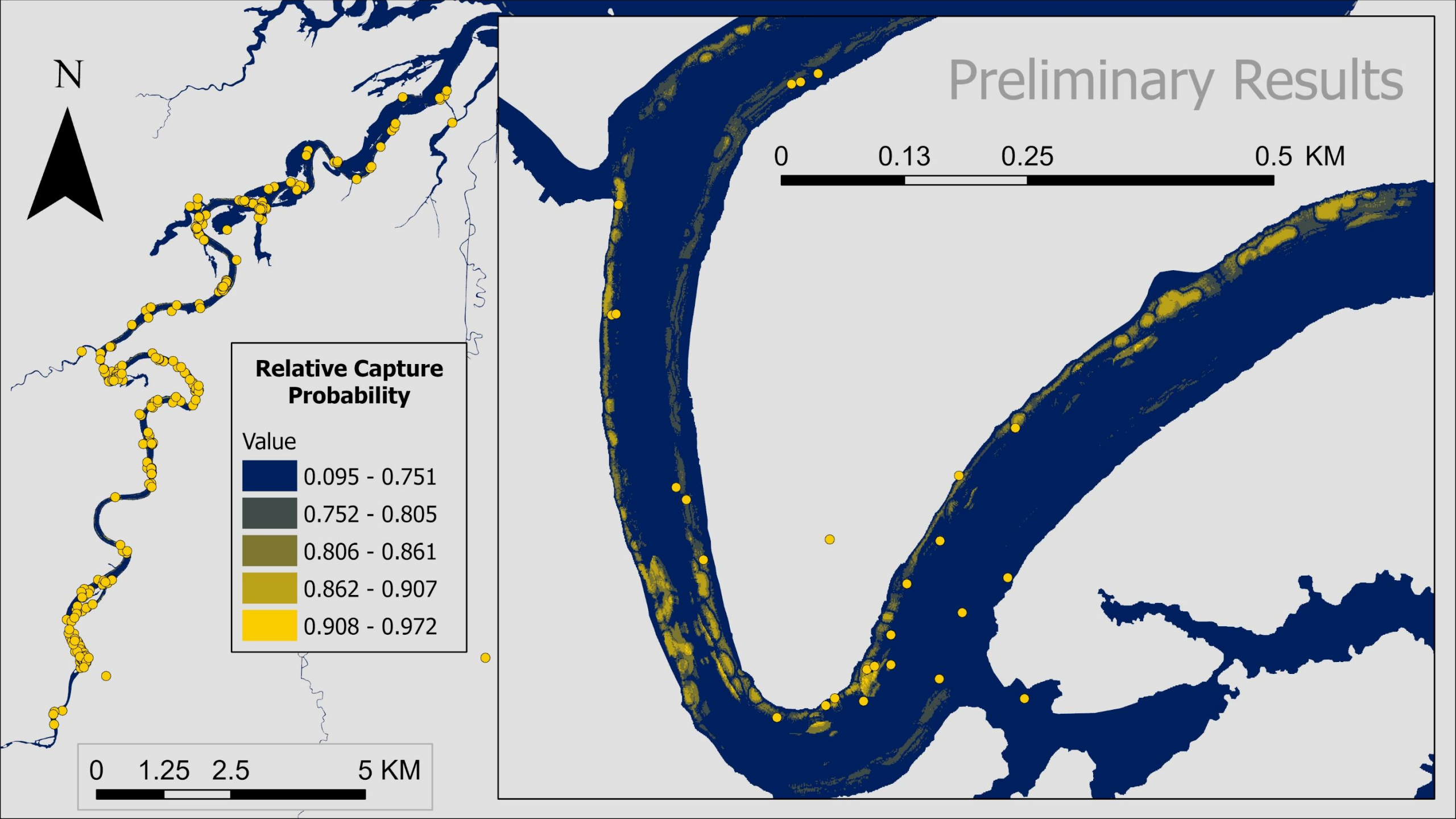
Predictive maps

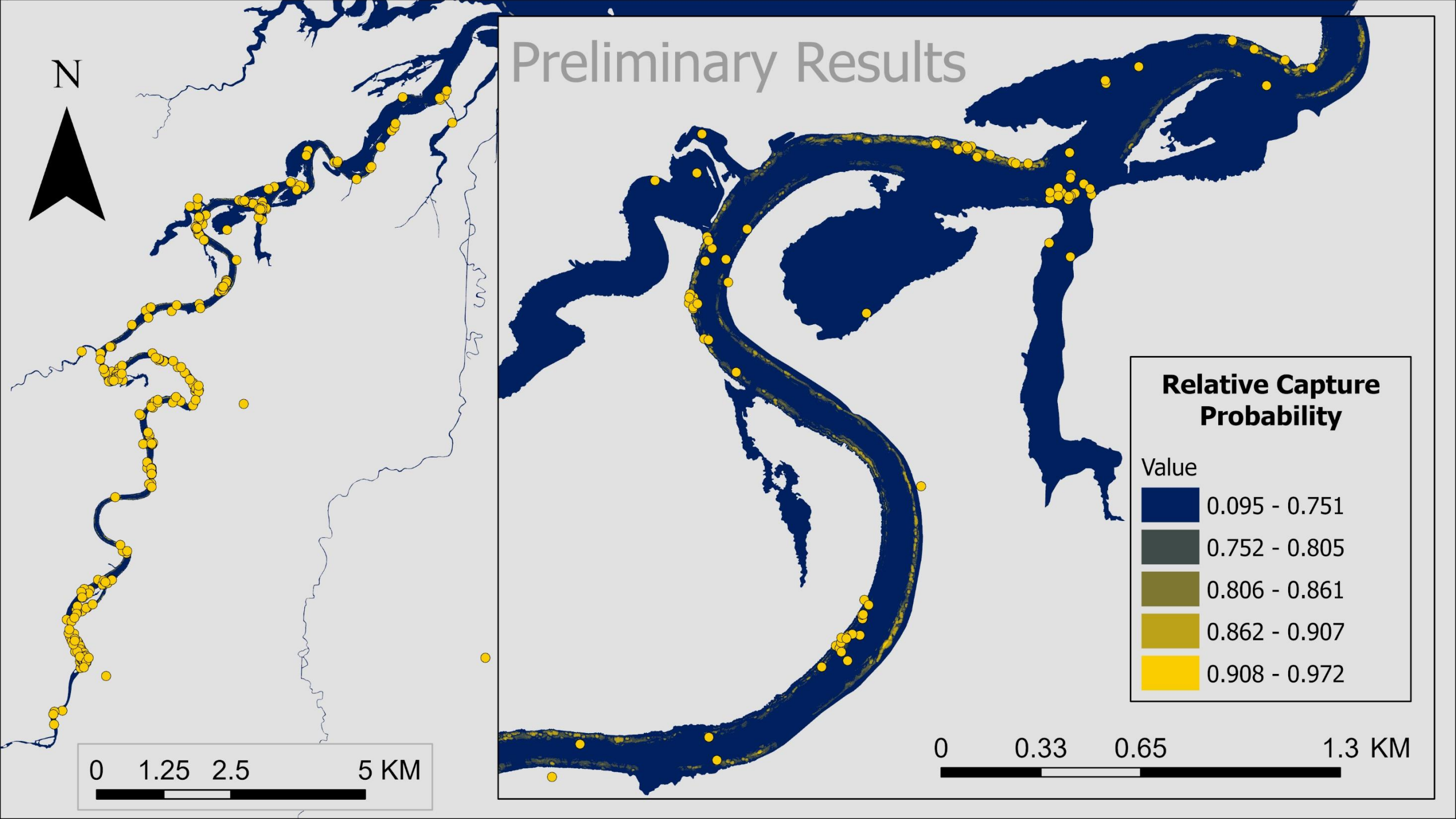


Occurrence data

- Capture data

Validate


Preliminary Results
N
Relative Capture Probability
Value
0.095 - 0.751
0.752 - 0.805
0.806 - 0.861
0.862 - 0.907
0.908 - 0.972
0 1.25 2.5 5 KM
0 0.13 0.25 0.5 KM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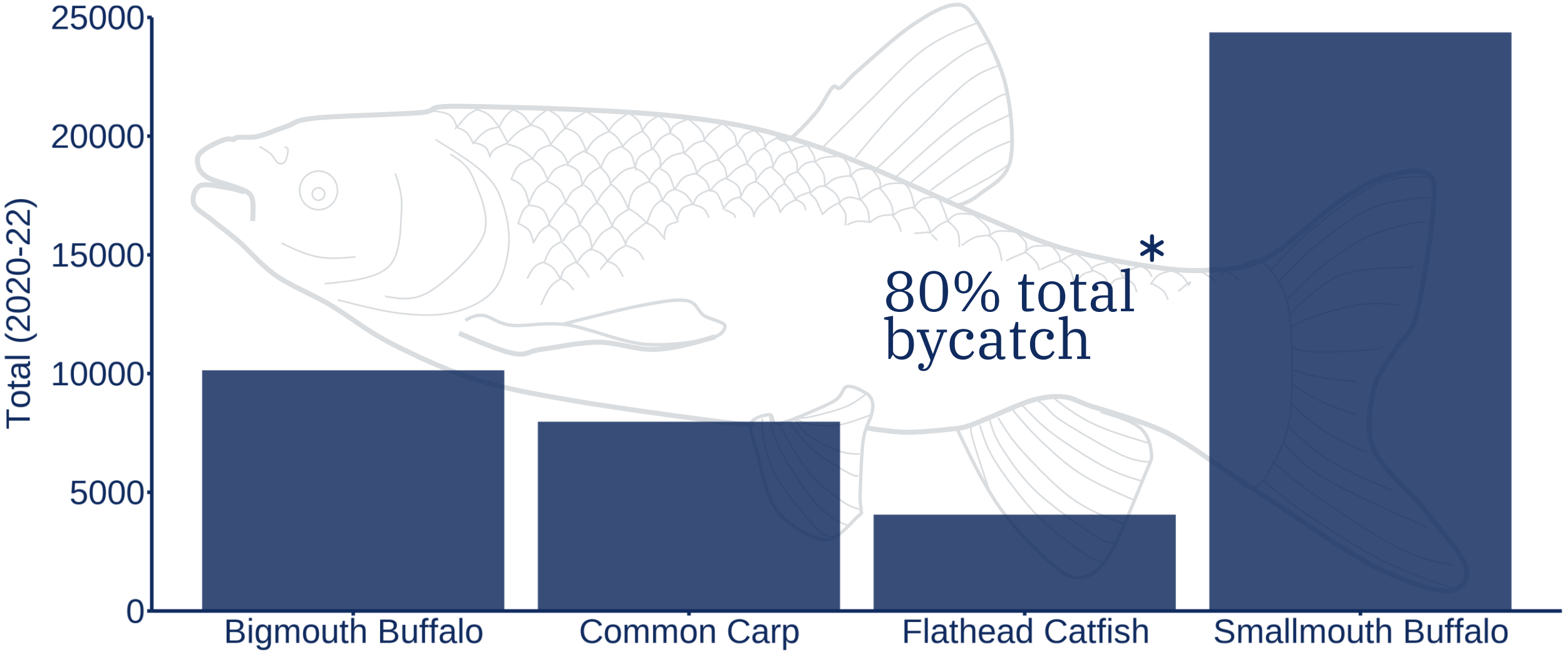
0.806 - 0.861
0.862 - 0.907
0.908 - 0.972
0 1.25 2.5 5 KM
0 0.33 0.65 1.3 KM

Modeling trammel net bycatch *(Next Steps)*



Conclusions

1. Electrofishing only results in more fish per hour.

a) Including trammel nets is 4.6x less efficient in per-hour catch.

b) The effect is significant and large regardless of where or when removals occur..

2. Tandem efforts do not catch more fish per hour.

a) One boat or two, what ever floats your boat or… boats.

3. Prioritize high probability times and locations.

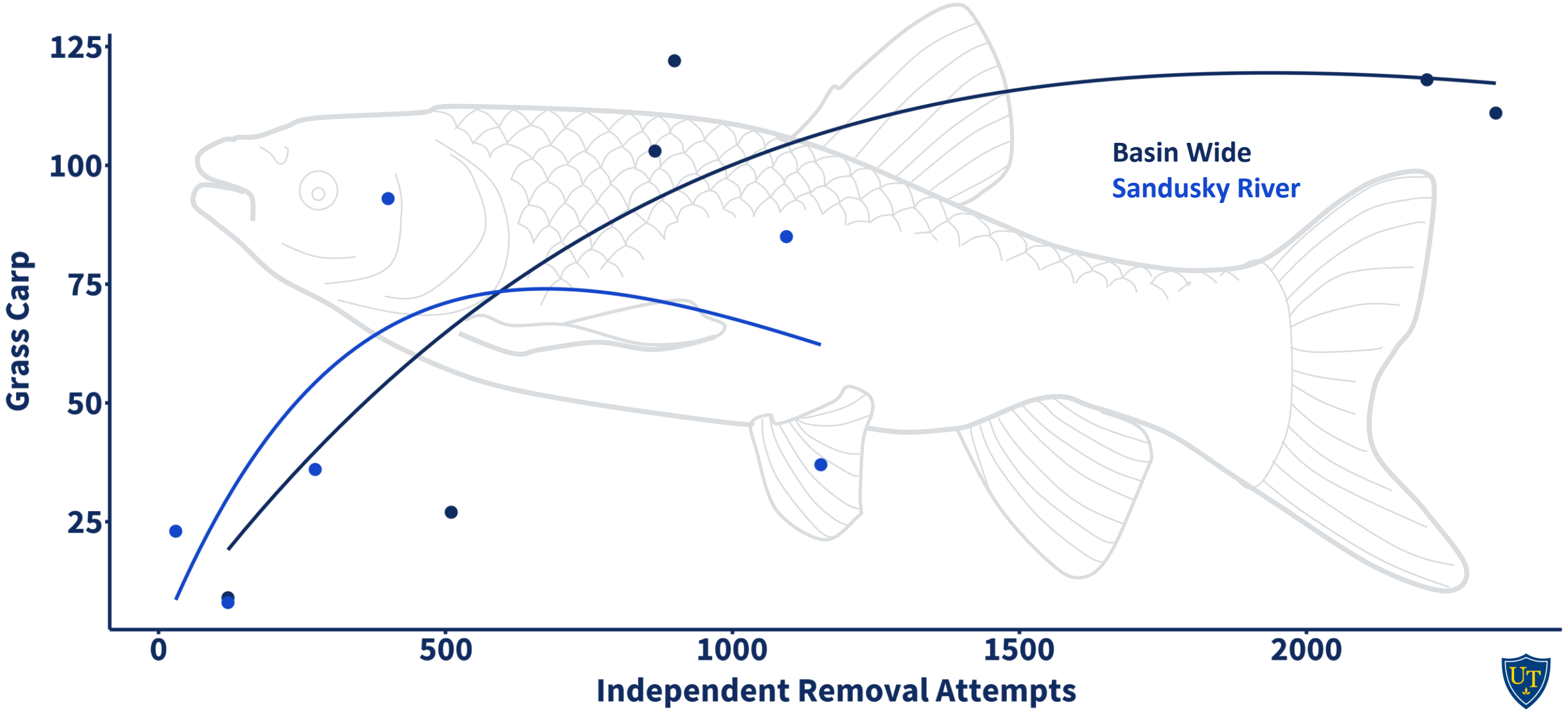
a) Evidence of spatial and temporal structuring.

b) When and where we sample matters as much as how.

4. We may be having a local impact.

a) Declining CPE in Sandusky River since protocol standardization. (*only 3 years*)*

Non-spawning CPE trends vary by extent



Thank you

Robert Hunter

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Department of Environmental Sciences
Lake Erie Center
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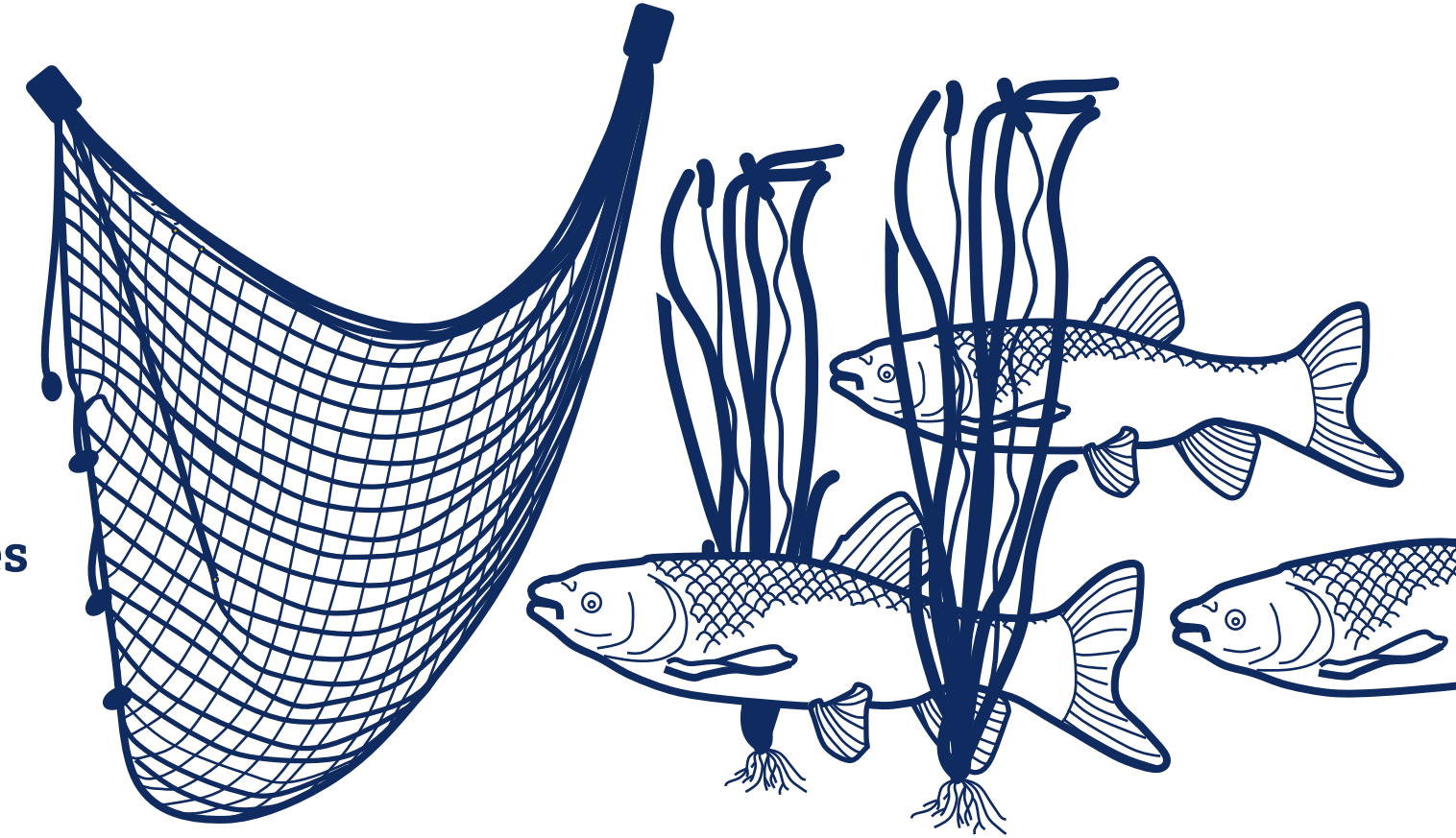
517.420.3154



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