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Testing low-cost control methods efficacy on giant apple snails (*Pomacea maculata*) egg masses

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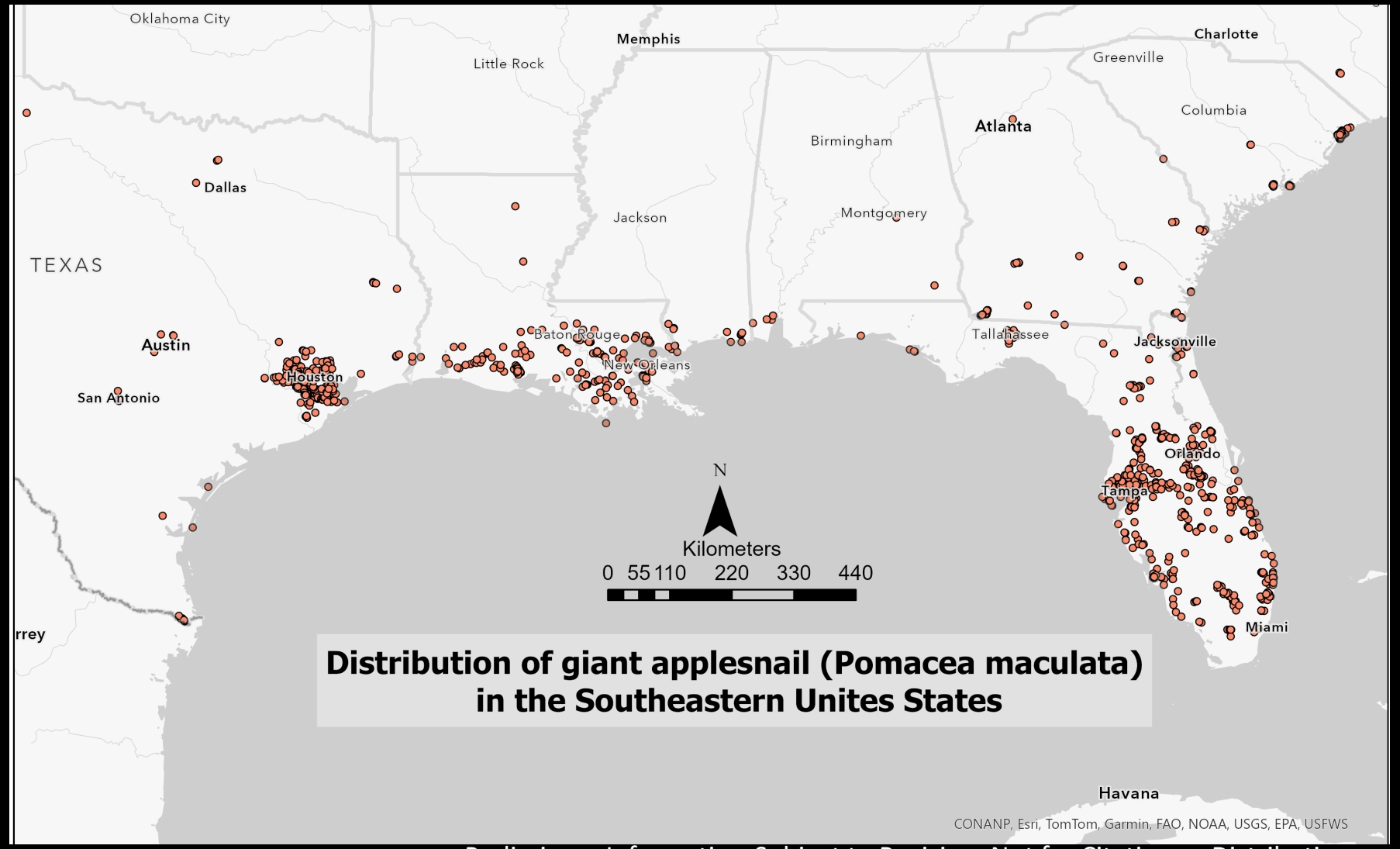
Pomacea maculata | *Invasion History & Life History*

- South American
- Split from *P. canaliculata*, "island applesnail"
- Florida 1989, in Louisiana 2006
- Now in nine states, PR
- Found in North Carolina in fall of 2023



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Pomacea maculata | *Impacts*

- Large macrophyte ingestion
- Prey item for natives; credited with the range expansion of snail kites and limpkins
- Potential competition with native Florida Applesnail (*Pomacea paludosa*) in Florida
- Vector for rat lungworm
  - Rat lungworm now found in Georgia (2022) and more widespread in Louisiana

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Pomacea maculata | *Impacts*

- Very impactful crop pest in Louisiana
  - Clogging crayfish traps, producing large amounts of biological waste

Pomacea maculata
Control

- Manual removal and trapping
  - Adults are large, but hatchlings numerous and tiny
- Copper sulfate and other chemicals
- Knocking eggs into the water
  - Common practice, how effective?

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Pomacea maculata

A need for control methods for egg masses

- Water submersion and vegetable oil exposure to reduce egg hatchout
  - Common practices in the field, how effective?

- Based on the work of Carter et al. 2017
  - Quantify the hatch rate for these methods in lab
  - Quantify development rate
  - Test for different developmental stages
  - Test the impact on incubation time

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Pomacea maculata
Egg treatment experiment

- Breeding colony of 60 snails

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Pomacea maculata

Egg treatment experiment

- Water submersion
  - Egg clutches <24hr old
  - Egg clutches laid 7days prior
- Vegetable oil treatment
  - Egg clutches 24hr old
  - Egg clutches laid 7 day prior
- Control (no treatment)

Treatment Type ID	Treatment	Clutch age
C	Control	NA
OD1	Oil	1 Day
WD1	Water	1 Day
OD7	Oil	7 Days
WD7	Water	7 Days

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Pomacea maculata

Egg treatment experiment

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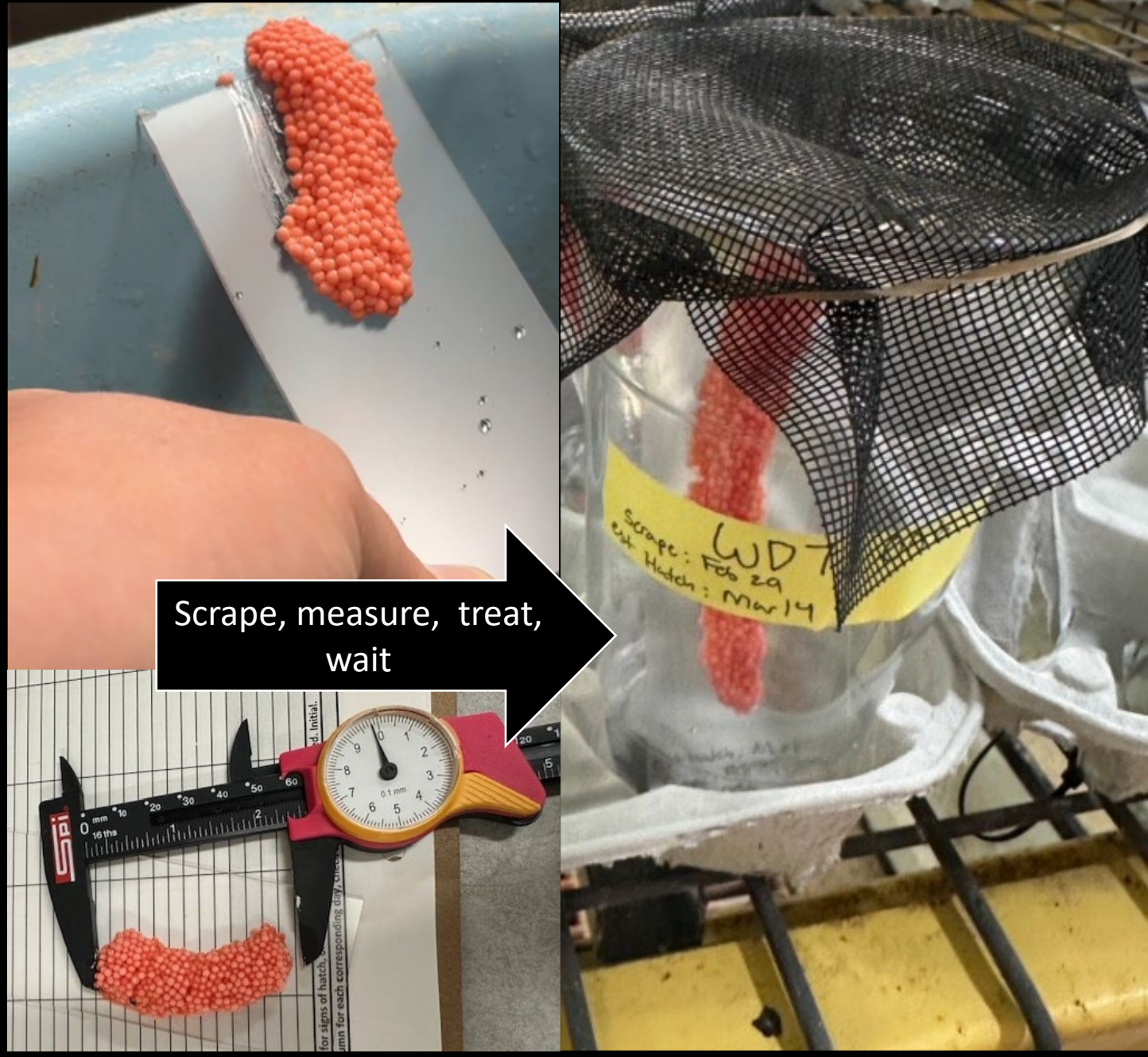

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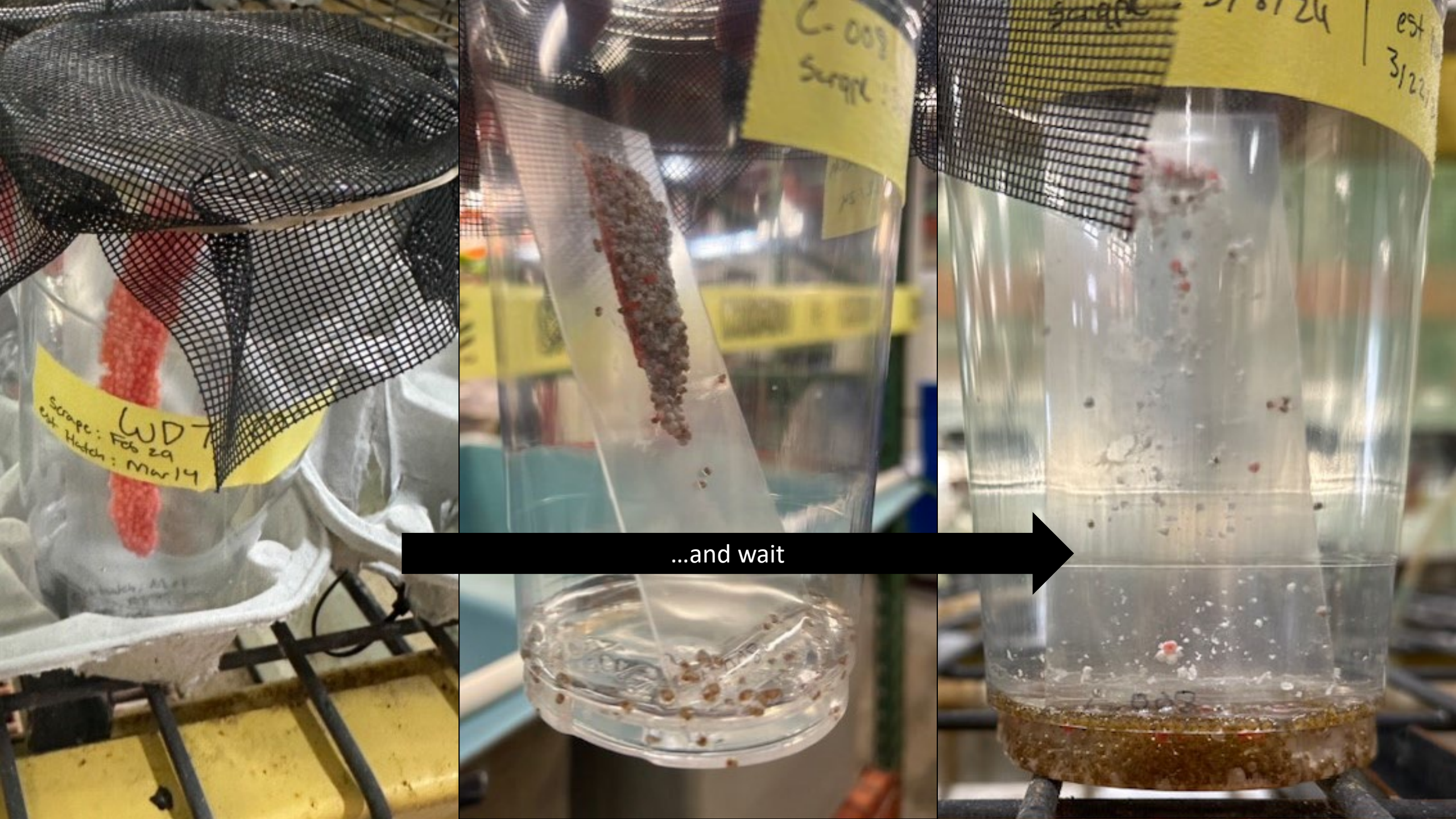
WD
Scrape: Feb 29
Est Hatch: Mar 14
...and wait

Pomacea maculata

Egg treatment experiment

~24 days

- 14 days of incubation
- 10 days to complete hatching

- Dissolve any leftover egg matrix to separate eggs and hatchlings
- Count hatchlings and embryos

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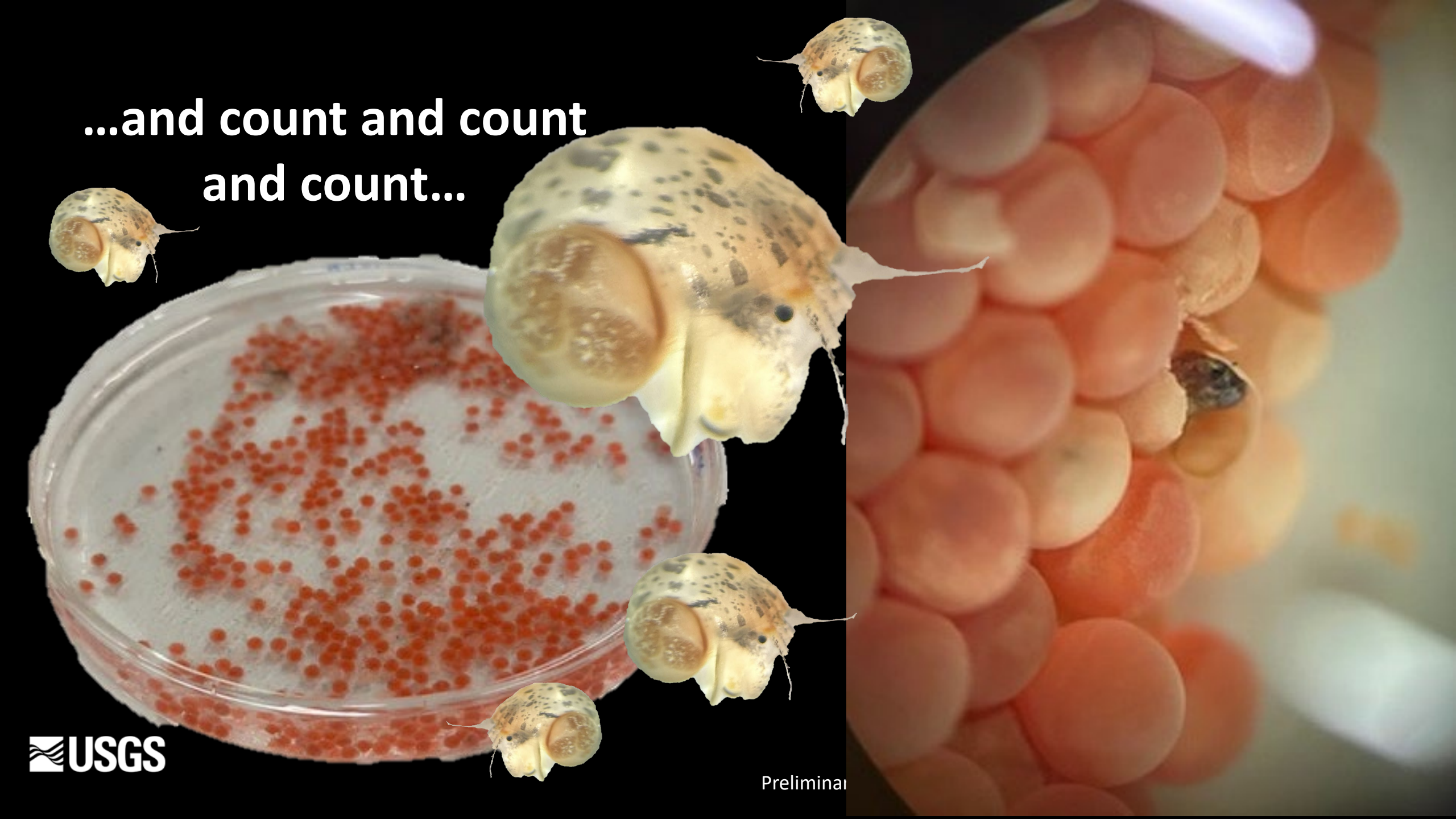
…and count and count
and count…
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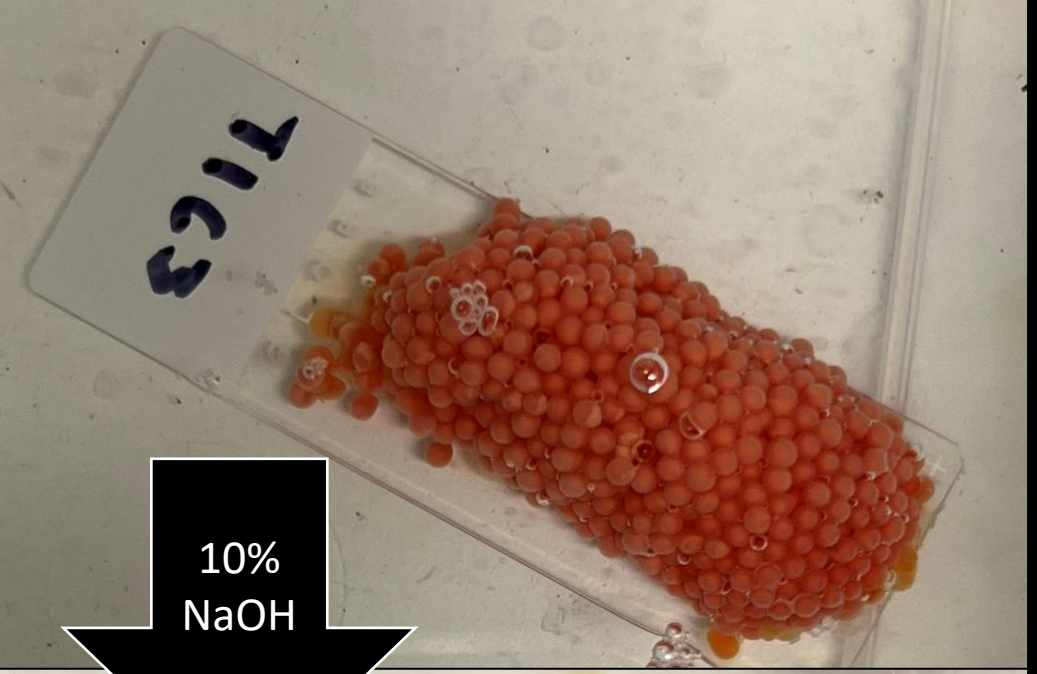
Preliminar



Counting eggs

Calculating effectiveness of treatment

- **Fifty additional clutches were measured and dissolved in 10% NaOH to dissolve the egg matrices of each clutch, separating individual eggs for count (Kyle et al. 2013)**
- **To estimate the number of eggs per clutch (EPC), we followed the protocol of Kyle et al. (2013), which predicted that clutch length and depth were the most important components of calculating EPC**
- **Using a Generalized Linear Model to predict the EPC for each treatment clutch based on the measurements to estimate hatch out rate**

Results

- **Both egg and water submersion greatly reduced the number of hatchlings developed, with hatchling dispersal reduced by 83%-98.4% (Table 2)**

Table 2. Totals for each treatment type of the of the 25 replicates: total sum of developed hatchlings, total sum of hatchlings dispersed, total sum of eggs in clutches, , total developed hatchlings (%), and total dispersed hatchlings (%).

Treatment Type ID	Sum of developed Hatchlings in clutch	Sum of Hatchlings Dispersed	Sum of eggs in clutch	Total % developed hatchlings in clutch	Total % dispersed hatchlings
C	9971	2427	18410	54.2%	13.2%
OD1	3894	50	19372	20.1%	0.26%
OD7	6050	403	21238	28.5%	1.9%
WD1	4	4	16499	0.0%	0.24%
WD7	85	85	20589	0.0%	0.41%

Results

- Water submersion for egg clutches 1 day old proved to be the most effective at reducing embryo development and hatchling dispersal

- Both treatment types were more effective at preventing dispersal and embryo development with Day 1 clutches

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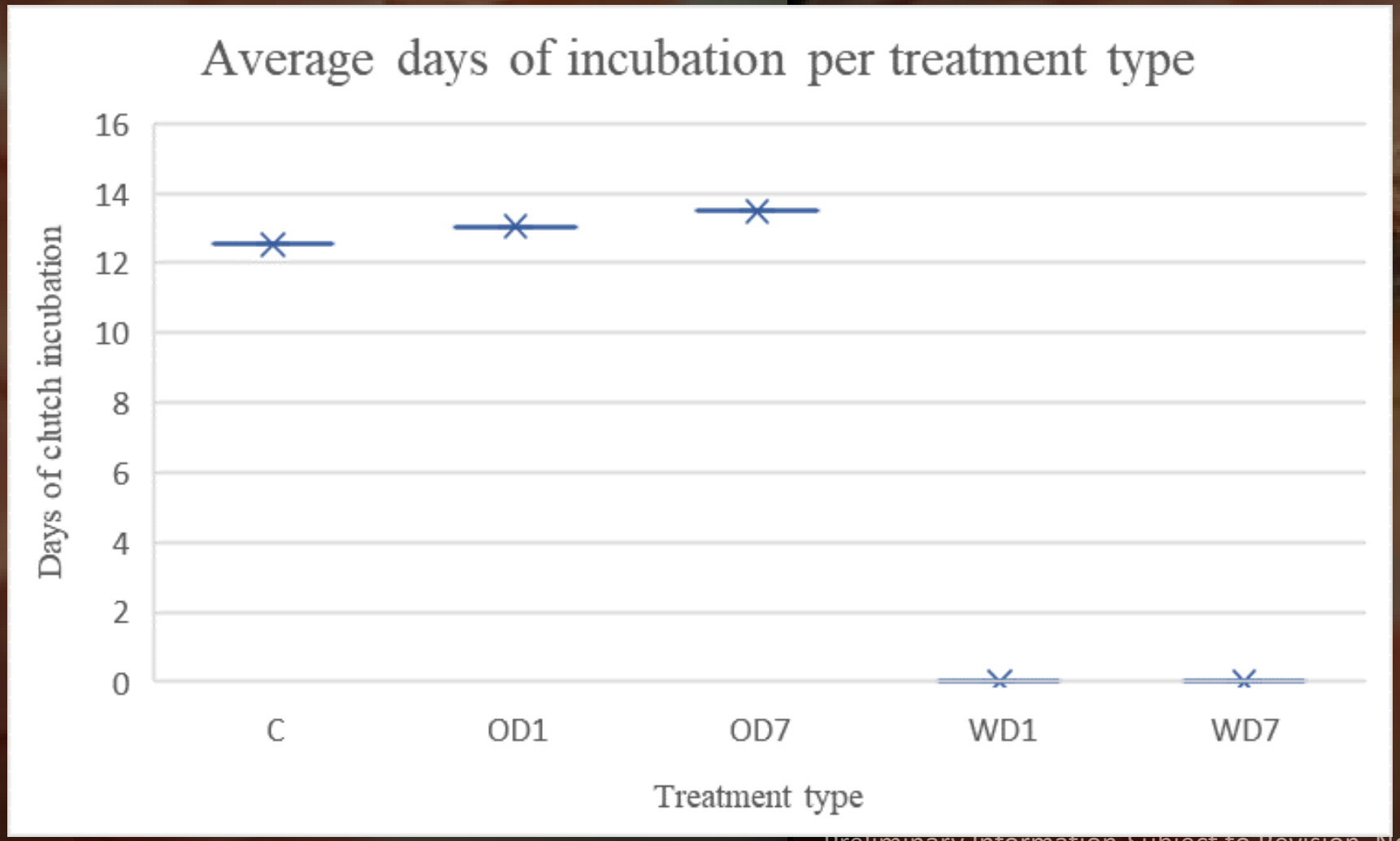
Results

- **No change in incubation time for the treatments**



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Results
In the future

- **Due to the efficacy of both treatments on week old clutches, a weekly treatment routine may be effective for farmers**

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Results

In the future

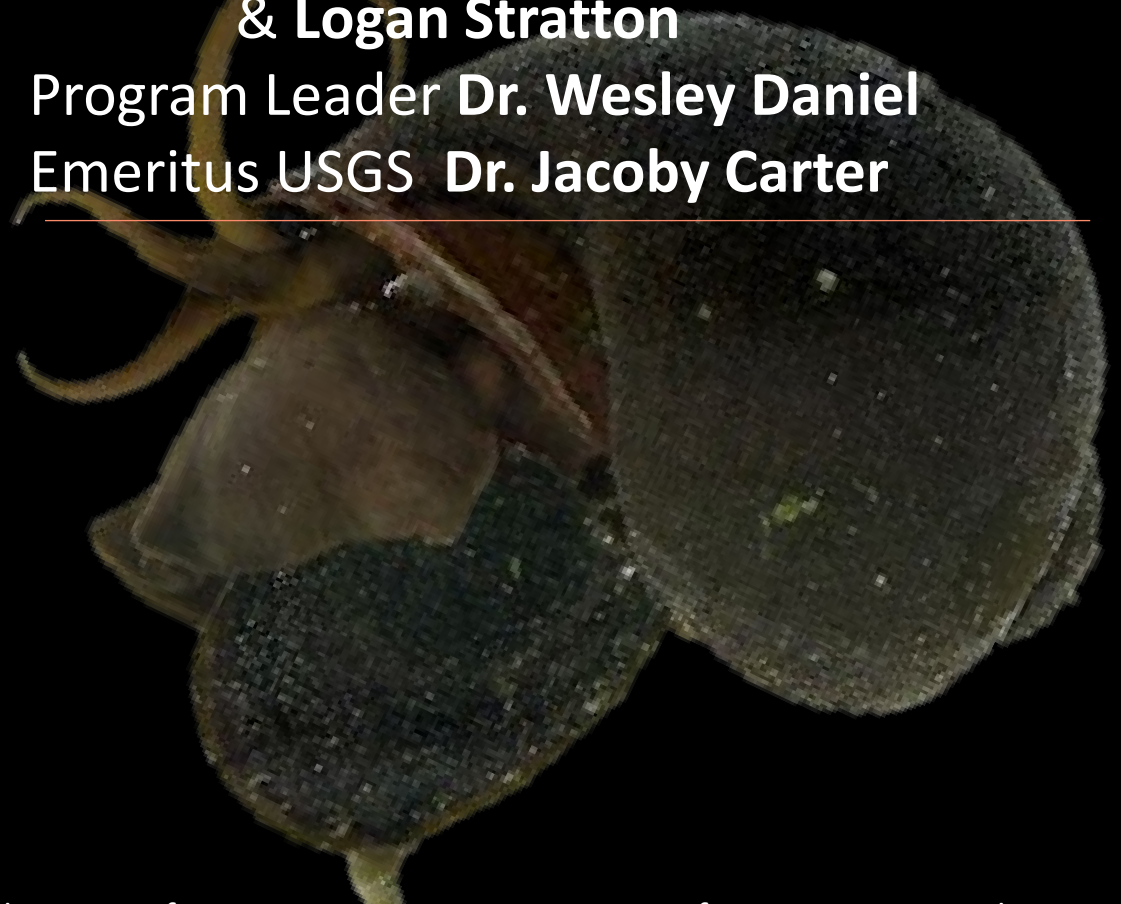
- **Observations in the lab showed that clutches undergoing temporary water submersion began to hatch more vigorously that permanent water submersion, although is treatment was not part of the study, therefore:**

- **The impacts of temporary water submersion should be tested in the future to show the efficacy of temporary flooding on egg clutch hatch rate**

Questions?

Thank you to my team at USGS

Lab personnel **Audrey Jordon**
& **Logan Stratton**
Program Leader **Dr. Wesley Daniel**
Emeritus USGS **Dr. Jacoby Carter**



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