



Rates of *Crassostrea virginica* metamorphosis and fatality due to varying concentrations of epinephrine



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Introduction:

- *Crassostrea*, or Eastern Oysters, are found along the East Coast of North America, including the Gulf of Mexico.
- Eastern oysters are vital to the health of many ecosystems.
- Populations of eastern oysters have decreased by 85% compared to the original population size decades ago.
- One of the largest barriers to success of individual eastern oysters is low rates of metamorphosis.
- Epinephrine directly induces settlement and therefore triggers metamorphosis.

Figure 1: Settled cluster of oysters in the bay



Methods:

Randomly divided larvae into experimental groups, with 3 trials per concentration level. Created a concentration curve from 0 (control) to 0.0001 M (highest). Introduced of each group to designated concentration. Measured the proportion of oysters living but unsettled, living and settled, and fatalities. Made oyster solution uniform by stirring and select random sample to find proportions of each group.

Figure 3: Gulf coast - the primary target for oyster restoration

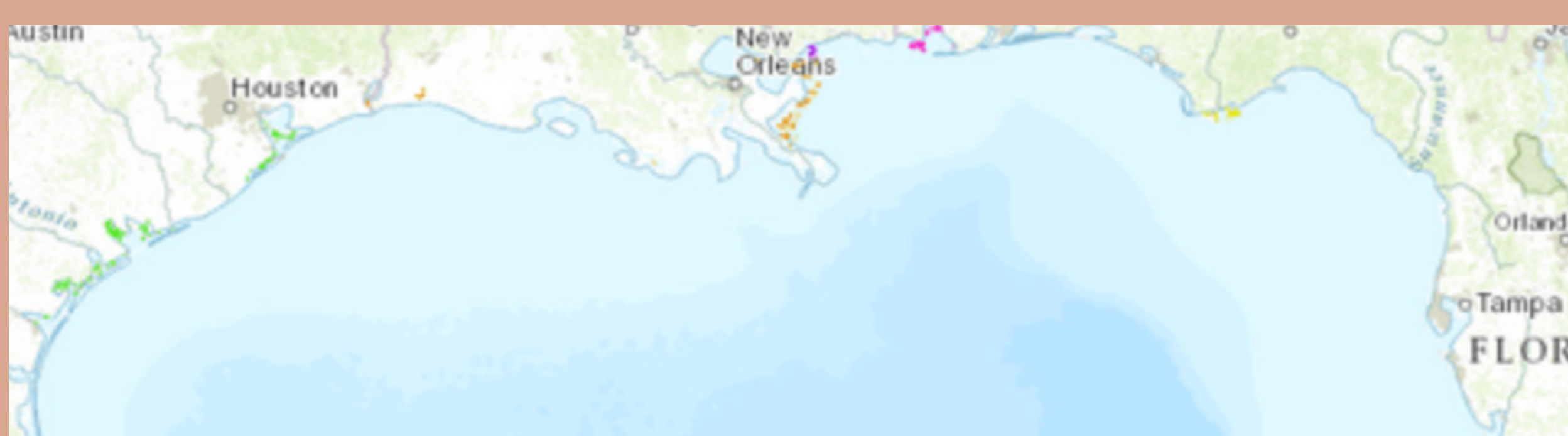
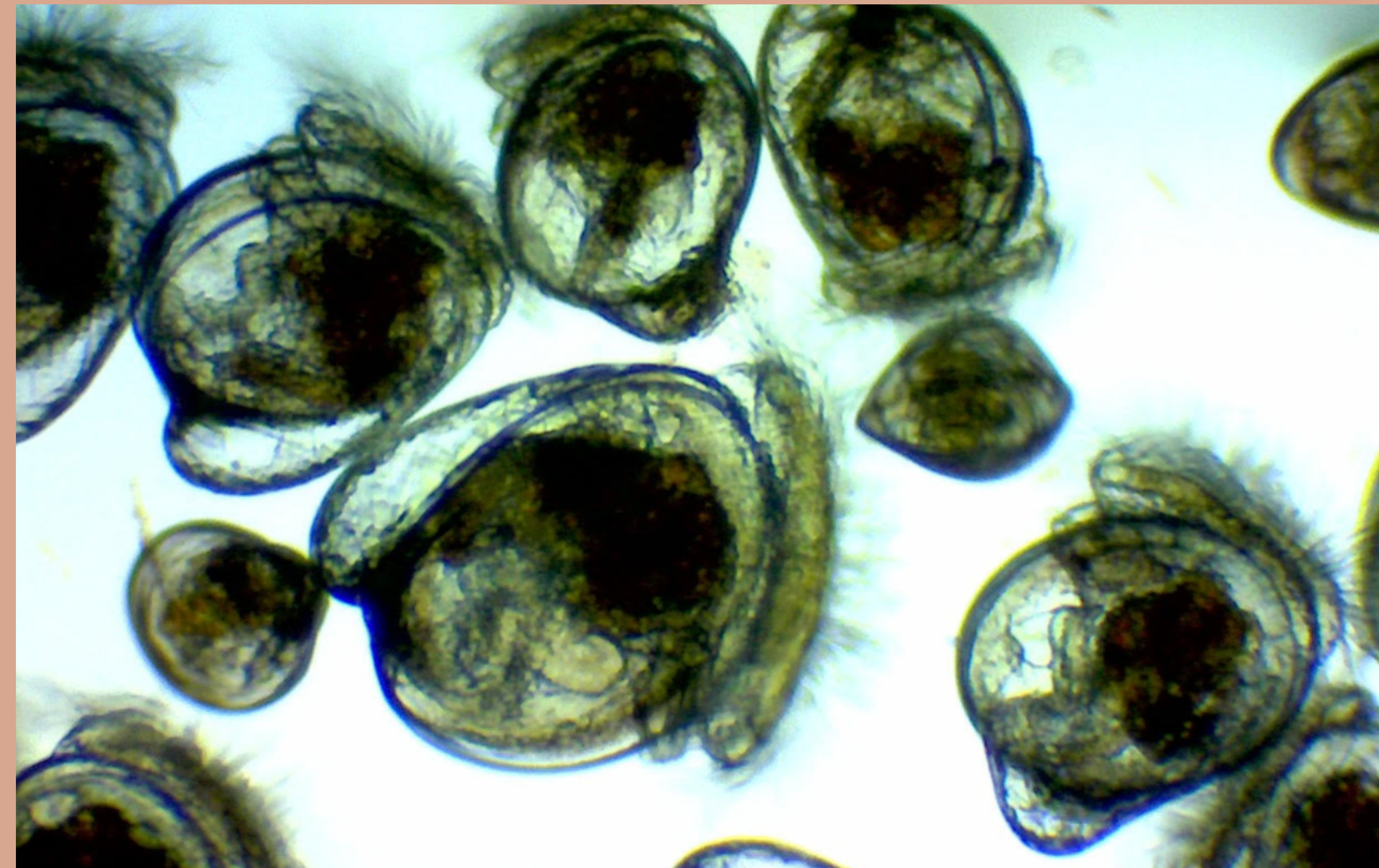


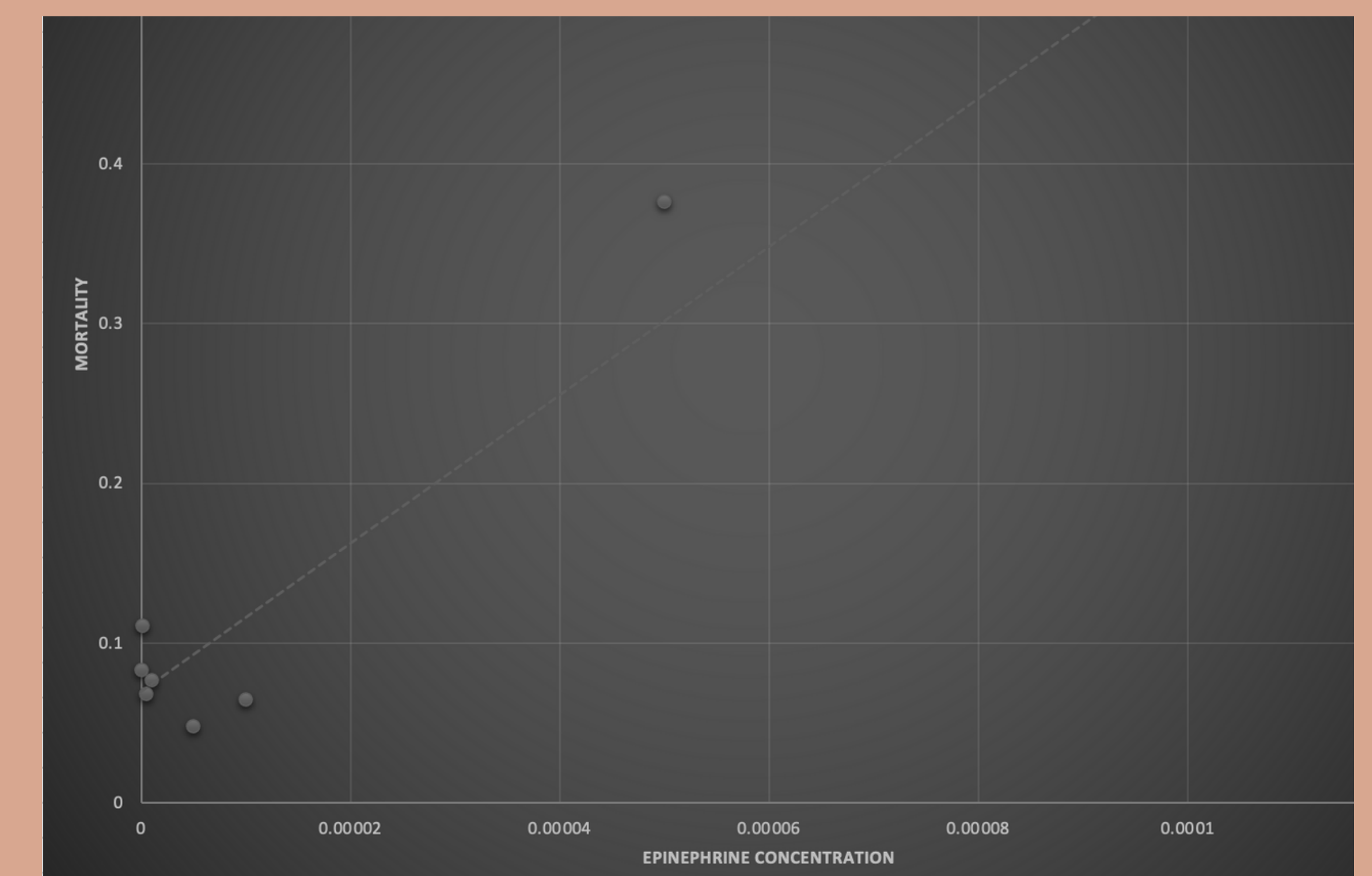
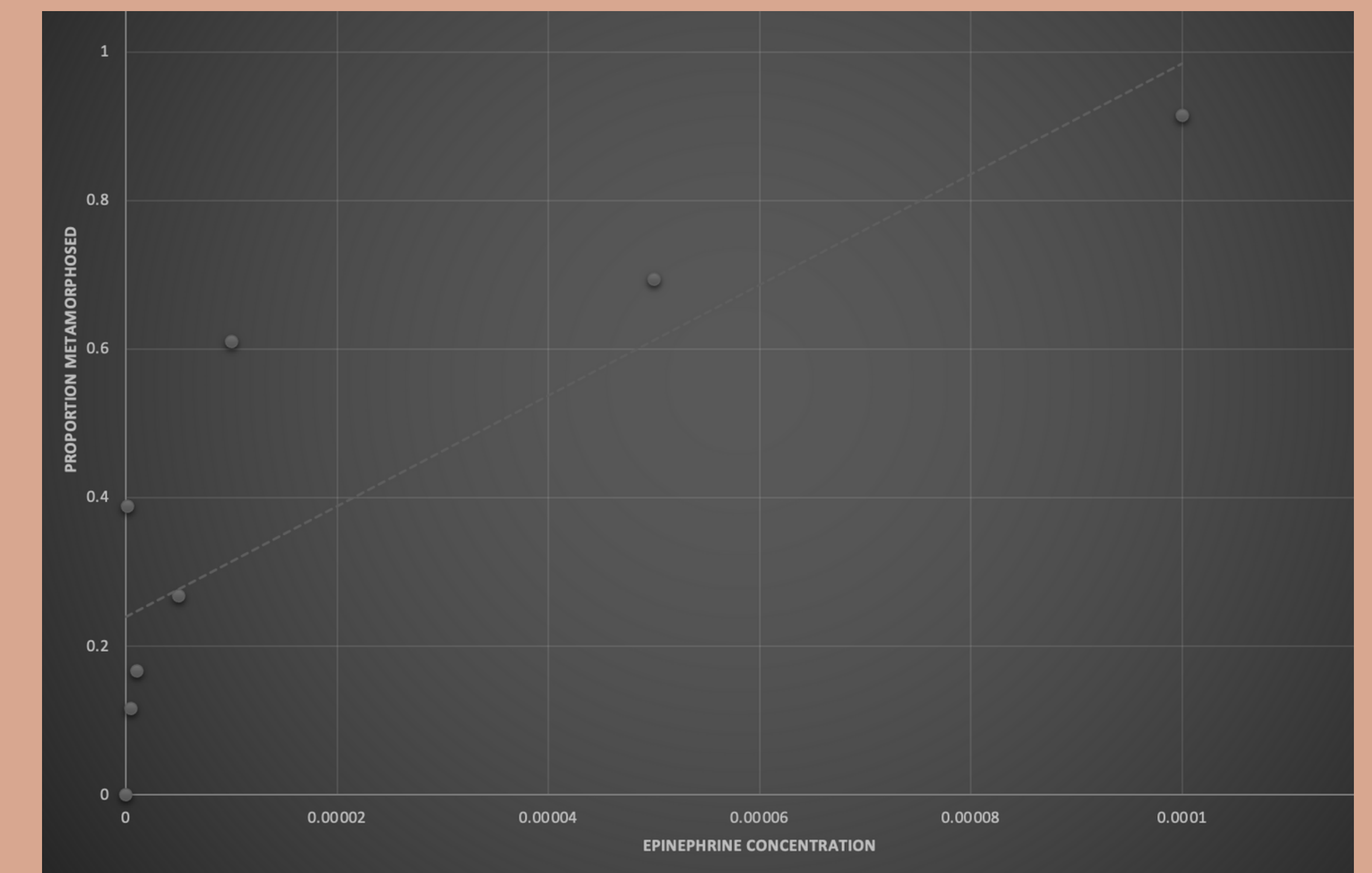
Figure 2: Metamorphosis in oysters



Data, Results and Discussion:

- Data analysis revealed a strong correlation between increasing concentration of epinephrine solution and increasing rates of metamorphosis. However, it also had a strong correlation with increasing mortality rates.
- The 0.00005 concentration solution yielded a 69% metamorphosis rate with a 37.6% mortality rate, while a concentration of 0.0001 yielded 91% metamorphosis but had a much higher mortality rate of 50%. In higher concentrations, surviving oysters had significantly higher metamorphosis rates.
- Higher levels of concentration showed more success in metamorphosis, but had the trade-off as mortality rates began increasing rapidly. The best concentration for maximizing metamorphosis and minimizing mortality in this experiment was 0.00005.
- Chart with 3 trials including concentration and proportions metamorphosized and dead. (Proportion metamorphosized taken from only group still living)

| EPI_Conc | C1 met | C1 mort | C2 met | C2 mort | C3 met | avg met | avg mort |
|-----------|--------|---------|--------|---------|--------|---------|----------|
| 0 | 0.096 | 0.038 | 0 | 0.074 | 0 | 0 | 0.083 |
| 0.0000001 | 0.091 | 0.061 | 1 | 0.105 | 0.67 | 0.387 | 0.111 |
| 0.0000005 | 0.158 | 0.083 | 0.125 | 0.059 | 0.133 | 0.116 | 0.068 |
| 0.000001 | 0.303 | 0 | 0.091 | 0.154 | 0.25 | 0.166 | 0.077 |
| 0.000005 | 0.689 | 0.057 | 0.214 | 0 | 0.286 | 0.267 | 0.048 |
| 0.00001 | 0.333 | 0.064 | 0.5 | 0.081 | 0.641 | 0.61 | 0.065 |
| 0.00005 | 0.944 | 0.5 | 0.875 | 0.429 | 0.875 | 0.694 | 0.376 |
| 0.0001 | | 0.538 | 0.8 | 0.444 | 1 | 0.915 | 0.504 |



Next Steps:

- The use of epinephrine to induce metamorphosis could be utilized to induce metamorphosis in groups of oysters spawned inside hatcheries to be used for further research or released into the Gulf of Mexico for restoration efforts.
- More data and concentrations could be used to further specify the best concentration of epinephrine solution to maximize metamorphosis rates and minimize mortality rates.

References:

“Oyster Reef Restoration.” Florida Department of Environmental Protection, floridadep.gov/rcp/rcp/content/oyster-reef-restoration. Accessed 12 Feb. 2024.

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