**Oyster Mortality Simulation Analysis**

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**Project Description:** The aim of this project was to determine the effect of oyster density and structural orientation on mortality. Oyster density and structural complexity are correlated with positive outcomes for oyster reef restoration and enhancement of associated faunal communities. It is therefore important to understand the interactions between density and structural effects on mortality in a natural setting in order to better inform oyster reef restoration decision-making. We designed a two-level factorial field experiment using divided plastic sampling trays (Baggett et al. 2014) stocked with oysters at high or low densities and either in an upright orientation or lying flat. The former orientation was used to simulate typical oyster reef structural complexity, with oysters growing, typically upright, on other oysters; the latter simulated surviving oysters on a degraded reef with reduced structural complexity. This project would demonstrate natural oyster mortality on healthy vs adjacent degraded reef structures by using both orientations at identical densities on opposite sides of the same sampling tray. This project was carried out on natural oyster reefs in the Suwannee Sound estuary at Cedar Key, FL.

|  |  |
| --- | --- |
| High Density  Structured | High Density Unstructured |
|  |  |

High density sampling tray

|  |  |
| --- | --- |
| Low Density  Structured | Low Density Unstructured |
|  |  |

Low density sampling tray

**Power Analysis:** Prior to beginning full experimentation, we conducted a pilot study to test equipment efficacy and to provide initial data on mortality under each of the four treatment scenarios (high density + structured; high density + unstructured; low density + structured; low density + unstructured). The oyster\_sim script includes a basic generalized linear model assessing the effect of each treatment on mortality in the pilot study data (PilotDataFull.csv). The script also includes a power analysis simulation to determine the necessary sample size for a full-scale field study. Treatment effect sizes in the simulation are based on existing literature on oyster natural mortality at high and low densities and on healthy or degraded reefs.

**Pilot Study Data**

tray\_id Identifier assigned to each specific sampling tray deployed in the field

substrate Mechanism within tray to maintain structural orientation; pilot study initially tested effective substrate materials; foam substrate used initially, then deemed ineffective and switched to rubber matting

date\_placed Date tray was placed in the field with live oysters

date\_checked Date tray was retrieved and live/dead oysters counted, recorded

location Identifier assigned to specific natural oyster reef where tray was placed

structure S = structured (vertical orientation); U = unstructured (lying flat)

density Density at deployment: H (high), M (medium – discarded), L (low)

treatment Two-factor combination treatment code

oysters\_start Number of live oysters initially present upon treatment start, based on density

live Number live and still in initial location at tray retrieval

dead Number dead at tray retrieval

total Live + dead oysters at tray retrieval

loose Number of oysters loose within tray (i.e. number for which we were unable to determine original structure treatment within the tray; also accounts for oysters which may have entered the tray space since deployment); not included in analysis