Ecosystem Shifts and Climate Change: Mangrove Recruitment on Oyster Reefs

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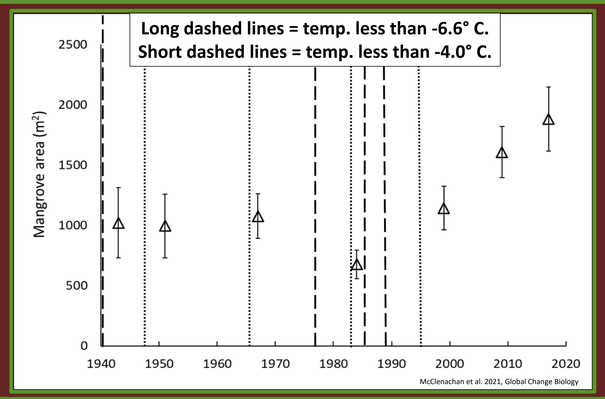
Abstract:

Mangrove cover has increased by 198% on intertidal oyster reefs in Mosquito Lagoon (ML) , FL since 1984 as a direct result of tropicalization. Site visits found large numbers of small red mangroves (*Rhizophora mangle*) on these patch reefs, suggesting increases in mangrove abundance post-1984 were the result of increased *R. mangle* recruitment and survival. In August 2020, we began monthly tracking of all propagule recruitment on 15 reefs in ML. 1681 propagules were followed for 16 months to understand retention and growth. Overall, 90.6% of propagules were red mangroves (13.2% survival) , black mangroves accounted for 9.3% (< 1% survival), while only 1 unsuccessful white propagule was observed. Survival increased if propagules arrived after fall high-water season ended, were within 0.3 m of an adult mangrove stand, and if the base of the propagule was buried in sediment. The lack of extreme freeze events could lead to an ecosystem shift from intertidal oyster reefs to mangrove islands within decades in Mosquito Lagoon.

Mangrove Area on Oyster Reefs from 1943-2017 Showing Freeze Events Since 1940



Mean (± S.E.) mangrove area on oyster reefs. Temperatures less than -6.6° C are lethal to black mangroves, while < -4.0° C is lethal to red mangroves. Since 1984, mangrove cover has increased by 198% on intertidal oyster reefs in Mosquito Lagoon.

Tracking of All Mangrove Propagules on 15 Reefs 16 months, 1681 propagules

Using GLM and categorical decision tree modeling, the variables that INCREASED chances of propagule survival by 88% were: ≤ 0.3 m from adult mangrove stand, being buried upright in the sediment, and landing on reef between January and March after annual high-water season ended. Variables that did NOT INCREASE survival were: live oyster density, shell heights, distance to reef edge, distance to single pioneer red mangroves, and propagule length.

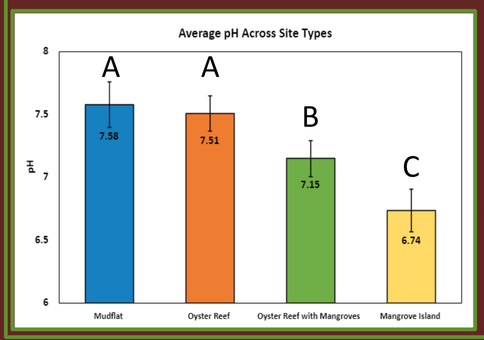
Mangrove Survival by Species (Overall: 12.0%)

Mangroves	Survival: NO	Survival: YES	% Survived
Black	156	1	0.6%
Red	1322	201	13.2%
White	1	0	0%

Mangrove Survival by Reef Type (Overall: 12.0%)

Reef Type	Survival: NO	Survival: YES	% Survived
Oysters only	270	9	3.2%
Oysters + mangroves	1208	193	16.0%

Why do we care? We care because red mangroves acidify surrounding sediments and this reduction in pH could dissolve oyster shells.



Mean (± S.D.) pH of 4 site types in Mosquito Lagoon. Replicate pore-water samples were collected from each site type monthly for 7 months. The pH of oyster reef + mangroves was intermediate between the pH of mangrove stand and oyster reef with no mangroves (ANOVA: $p < 0.001$ + Tukey tests).

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