Did the dredging of Summer Haven River impact nearby oyster reefs?

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Introduction

The Summer Haven River, located south of the Matanzas Inlet, runs north-south between the Intracoastal Waterway and the Atlantic Ocean, bisecting the barrier island. In 2008, multiple storms caused a dune breach and sand filled in the northern half of the river (Figure 1). In 2016, a dredging project was approved to restore the flow to the river. In response to the dredge project, the GTMNERR initiated an oyster monitoring project to assess any impacts the reefs may face. Oyster reefs provide numerous ecosystem services including habitat, coastal protection, and water filtration; and they are good indicators of water quality. Negative impacts to reefs can result in cascading effects to the ecosystem.

Figure 1 Summer Haven River pre- (left) and post (right) dune breach

Methods

Six reefs were selected for monitoring (Figure 2), two in the southern end of Summer Haven River (SH), two in Dolphin Creek (DC), and two adjacent to Whitney Lab (WL). Reefs were monitored using standard Oyster Condition Assessment protocols (Walters et al. 2016, unpublished). Initial monitoring began in winter 2016, prior to the start of the dredging, and has continued twice annually since (winter/summer).

Data was analyzed using a Before/After Control/Impact (BACI) design, using the initial winter monitoring as time zero (before, winter 2016) and the most recent winter monitoring as time one (after, winter 2018). Reefs located in Summer Haven River were categorized as Impact reefs, while reefs in Dolphin Creek and Whitney were Controls. Data were analyzed using Wilcoxon Rank-Sum tests (α=0.1).

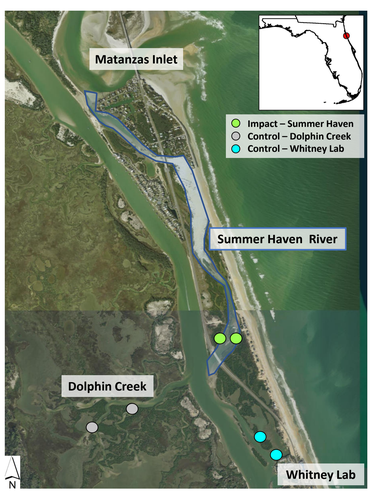

Figure 2 Map of monitoring site

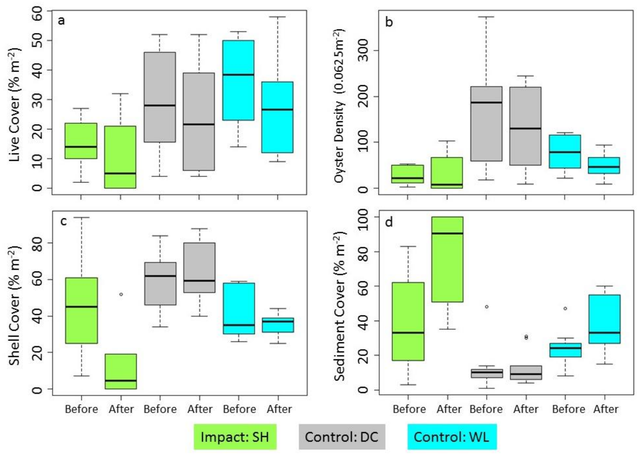

Figure 3 Boxplots (black bar = median) of a) live cover, b) oyster density, c) shell cover, and d) sediment cover for reefs grouped by treatment + site (Impact reefs = Summer Haven (SH), green; Control reefs = Dolphin Creek (DC), gray and Whitney Lab (WL), blue) and time (Before = pre dredge, After = post dredge).

Results

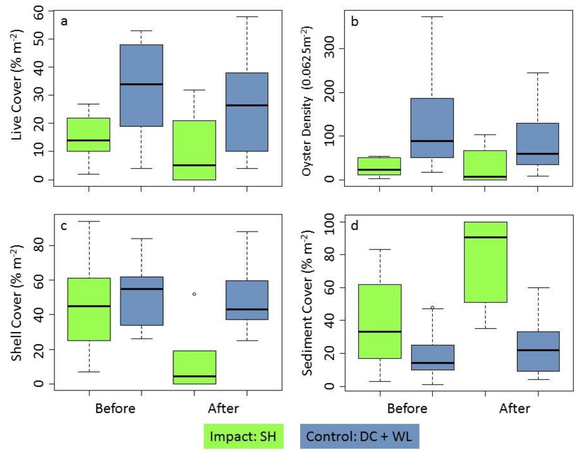

Figure 4 Boxplots (black bar = median) of a) live cover, b) oyster density, c) shell cover, and d) sediment cover for reefs grouped by treatment (Impact reefs = Summer Haven (SH), green; Control reefs = Dolphin Creek (DC) and Whitney Lab (WL), blue) and time (Before = pre dredge, After = post dredge).

Before vs After (Figure 3, Table 1)

- Shell coverage decreased on Summer Haven reefs
- Sediment coverage increased on Summer Haven and Whitney reefs
- One of the Summer Haven reefs was lost during dredging (Figure 5)
- Oyster densities were not significantly different

Control vs Impact (Figure 4, Table 2)

- Oyster density and live coverage were higher on control reefs before dredging
- Sediment coverage was higher on impact reefs before dredging
- Oyster density, live and shell coverage was higher on control reefs after dredging
- Sediment cover was higher on impact reefs than on control reefs before and after dredging

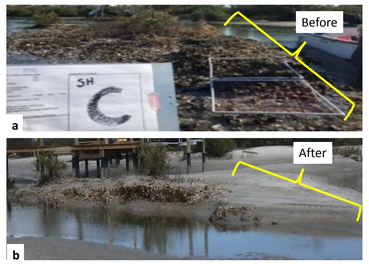

Figure 5 Summer Haven reef lost during dredging a) pre-dredge b) post-dredge

Before vs After		Δ x̄	*p*
SH	Oyster Density	3.3	0.3807
	Live Cover	-4.2	0.195
	Shell Cover	-33.9	0.005398
	Sediment Cover	38.6	0.01331
DC	Oyster Density	-26.7	0.549
	Live Cover	-5.1	0.5725
	Shell Cover	4.4	0.6723
	Sediment Cover	0.3	0.9718
WL	Oyster Density	-24.6	0.1506
	Live Cover	-8.0	0.2897
	Shell Cover	-5.3	0.9095
	Sediment Cover	12.1	0.05363

Table 1 Wilcoxon Rank Sum Test results for Before (pre dredge) vs. After (post dredge) comparisons by site (SH = Summer Haven, DC = Dolphin Creek, WL = Whitney Lab). Difference in means (Δ x̄) = After – Before. Highlighted values are significant using α=0.1.

Control vs Impact		Δ x̄	*p*
Before	Oyster Density	-89.9	0.001041
	Live Cover	-17.3	0.005978
	Shell Cover	-4.9	0.4852
	Sediment Cover	21.1	0.02793
After	Oyster Density	-59.0	0.01724
	Live Cover	-15.2	0.01436
	Shell Cover	-37.9	< 0.001
	Sediment Cover	53.3	< 0.001

Table 2 Wilcoxon Rank Sum Test results for Control (Dolphin Creek and Whitney) vs. Impact (Summer Haven) reef comparisons for before (pre) and after (post) dredge.). Difference in means (Δ x̄) = Impact – Control. Highlighted values are significant using α=0.1.

Discussion

- Increased sediment at both SH and WL reefs may, in part, be due to over wash from Hurricane Irma, both sites are located adjacent to sand dunes, while DC is across the Intracoastal Waterway
- Changes in shell and sediment cover in Summer Haven may be attributed to the loss of the one reef, particularly in the control/impact assessment
- Lack of change in oyster density in SH post-dredging despite loss of reef could be indication of low recruitment in the region or sample size too small to detect change.
- Significant differences between control and impact sites before dredging indicate natural site differences, making impact assessment difficult
- Impacts to oyster density and sedimentation on reefs may be affected by flow restoration over time

Figure 6 Closing dune breach

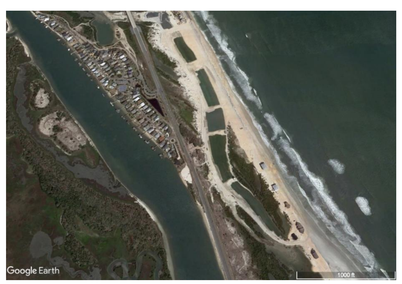

Figure 7 Middle of Summer Haven River during dredge (March 2017)

Figure 8 Summer Haven River post-dredging (March 2018)

Conclusions

- The only direct impact of dredging observed was the loss of one reef in Summer Haven River
- Potential hurricane impacts may be confounding before/after results
- Variations among impact/control sites and small sample sizes may be masking dredge effects
- Continued monitoring is warranted to determine if restored flow will affect reefs in the region

Acknowledgments

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