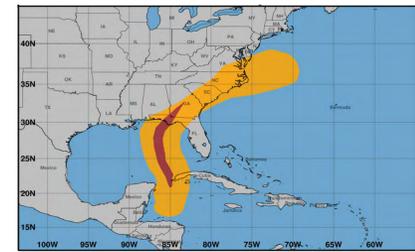




Assessment of Artificial Reefs Impacted by Hurricane Michael

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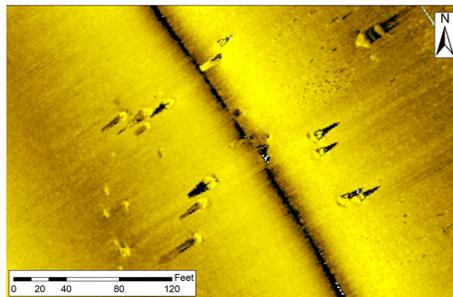
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Abstract

Hurricane Michael impacts to artificial reef material were assessed in two permitted areas within the path of the hurricane using pre- and post-storm side scan sonar mapping and diver observations. No movement was observed within either permitted area for four of the five types of artificial reef structures (concrete culverts, dome-shaped modules, modules on pilings, and ledge and disk modules), although significant sand movement resulted in some of those becoming uncovered or buried. Analysis of the 8 ft tall concrete tetrahedrons in the shallow (<30 ft) Bell Shoals permitted area found that 66% of all tetrahedrons moved further than 150 ft from their original location (mean distance moved of 873 ft). The long-term effect of the new reef configuration on local fish communities is unknown, but we expect the change in forage area and available ledge space to alter fish behavior and species diversity.

Survey Methods



Sidescan sonar

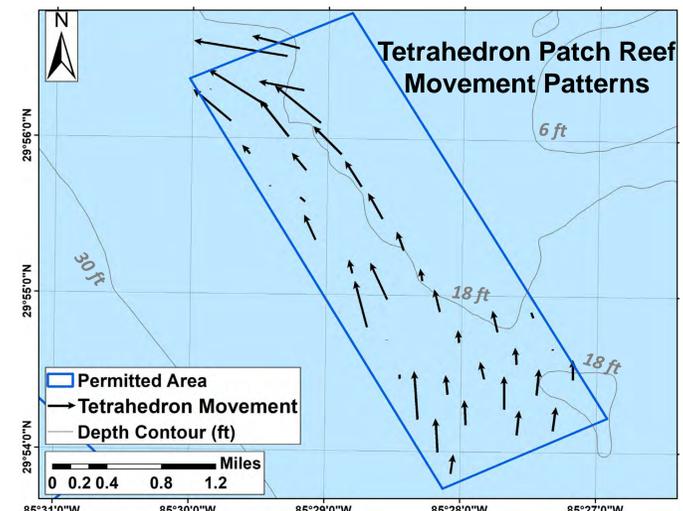
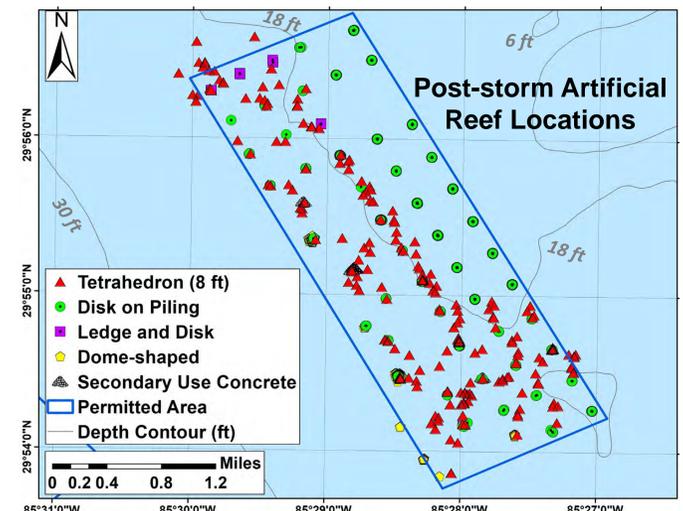
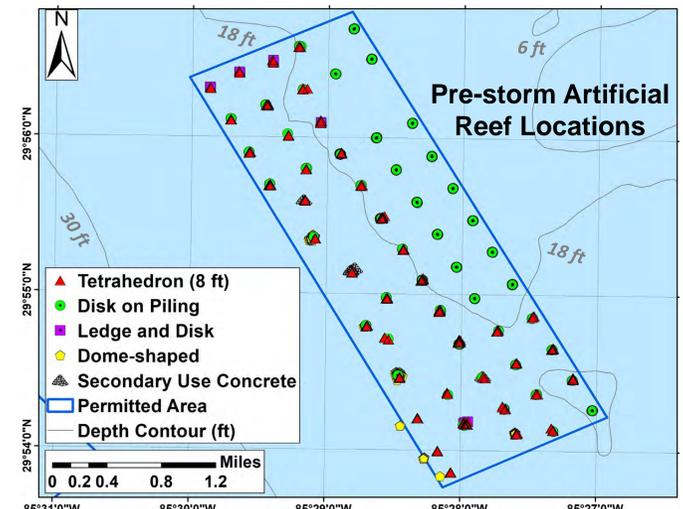
- Pre-storm imagery (Sept 2017)
- Post-storm imagery (Dec 2018)



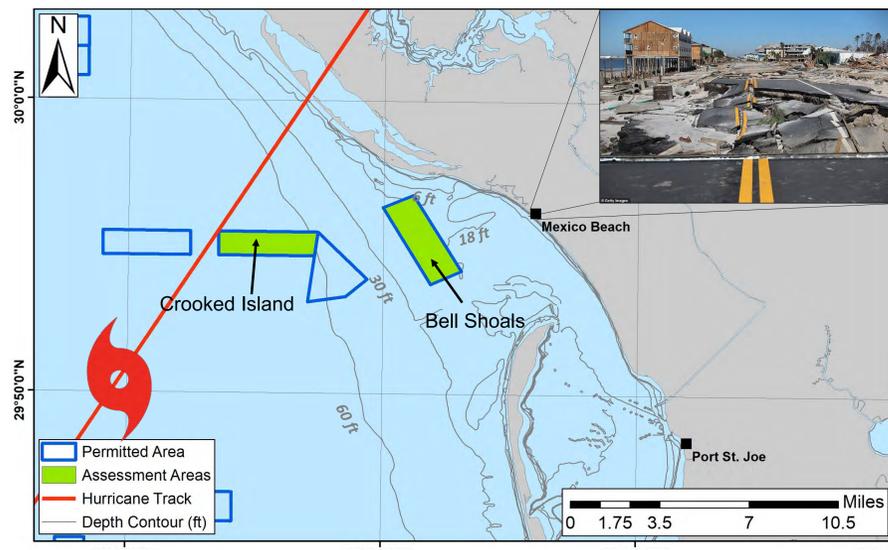
Dive Surveys

- 9 dives by FWC
- 21 dives by MBARA

Artificial Reef Movement



Study Site



Map of the two artificial reef permitted areas in Bay County assessed in relation to the path of Hurricane Michael

Bell Shoals Artificial Reef Permitted Area

- 4.55 mi² area and ~2 miles offshore
- Depth ranges from 15 to 25 ft
- 524 individual artificial reefs deployed from 1997-2018

Crooked Island Artificial Reef Permitted Area

- 3.6 mi² and ~5.5 miles offshore
- Depth ranges from 65 to 75 ft
- 93 individual artificial reefs deployed from 2015-2018

Disturbance Event

- Hurricane Michael (Category 5 Hurricane)
- Hurricane force winds extended 30 miles from eyewall
- 155 mph sustained wind speed with 10 ft storm surge

Results

Artificial reef materials identified in sidescan imagery and diving within Bell Shoals

Material Type	Identified Material (Sidescan)	Pre-storm	Post-storm	Dive Observations
Disk on Piling		177 modules	177 modules	Damaged (2)
Ledge and Disk		11 modules	9 modules	Buried (9)
Tetrahedron (8 ft)		260 modules	230 modules	Damaged (5), Buried (7)
Dome		70 modules	83 modules	Uncovered (13)
Secondary-use Concrete		1,077 ft ²	6,205 ft ²	Uncovered (5,128 ft ²)

Crooked Island

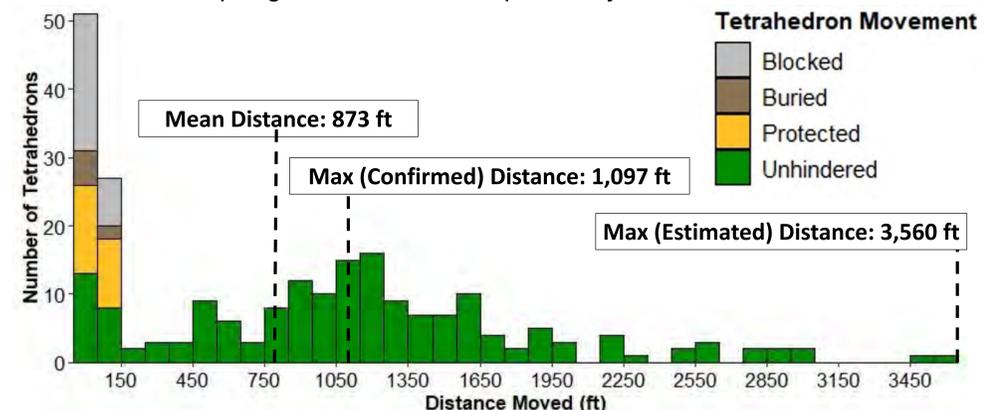
- No material movement/damage observed in this site

Bell Shoals (Tetrahedrons)

- Out of the five material types, only the tetrahedrons (8 ft tall) moved
- Unique memorial reef exact calculations of movement: 956', 1,067', and 1,097'
- The 30 missing 8 ft tetrahedrons are mostly from the shallowest areas (<20')
- Majority (85%) of the 150 displaced tetrahedrons were toppled in same direction

Bell Shoals (Other Material)

- Sand movement uncovered dome-shaped modules and concrete material
- Every ledge and disk module was buried at least 3 ft in sand
- The disk on pilings were the least impacted by the storm



Material Types Assessed



Disk on Piling



Ledge and Disk



Tetrahedron



Dome-shaped



Secondary-use Concrete

Conclusions

- Majority of the artificial material was unimpacted, and the displaced material will still provide habitat
- Reef design shifting from distinct to more dispersed patch reefs will likely influence fish assemblages and behavior
- Dispersed reefs will influence fishing effort, as there are now a greater number of patch reefs without coordinates

Visit our interactive map to see Hurricane Michael impacts to artificial reefs in Bell Shoals: <http://arcg.is/11yWDT>