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RESEARCH INSTITUTE
FOR GULF OF MEXICO STUDIES



The Effects of Reopening Cedar Bayou on Estuarine-Dependent Species

**Center for Sportfish Science and Conservation
The Harte Research Institute for Gulf of Mexico Studies**

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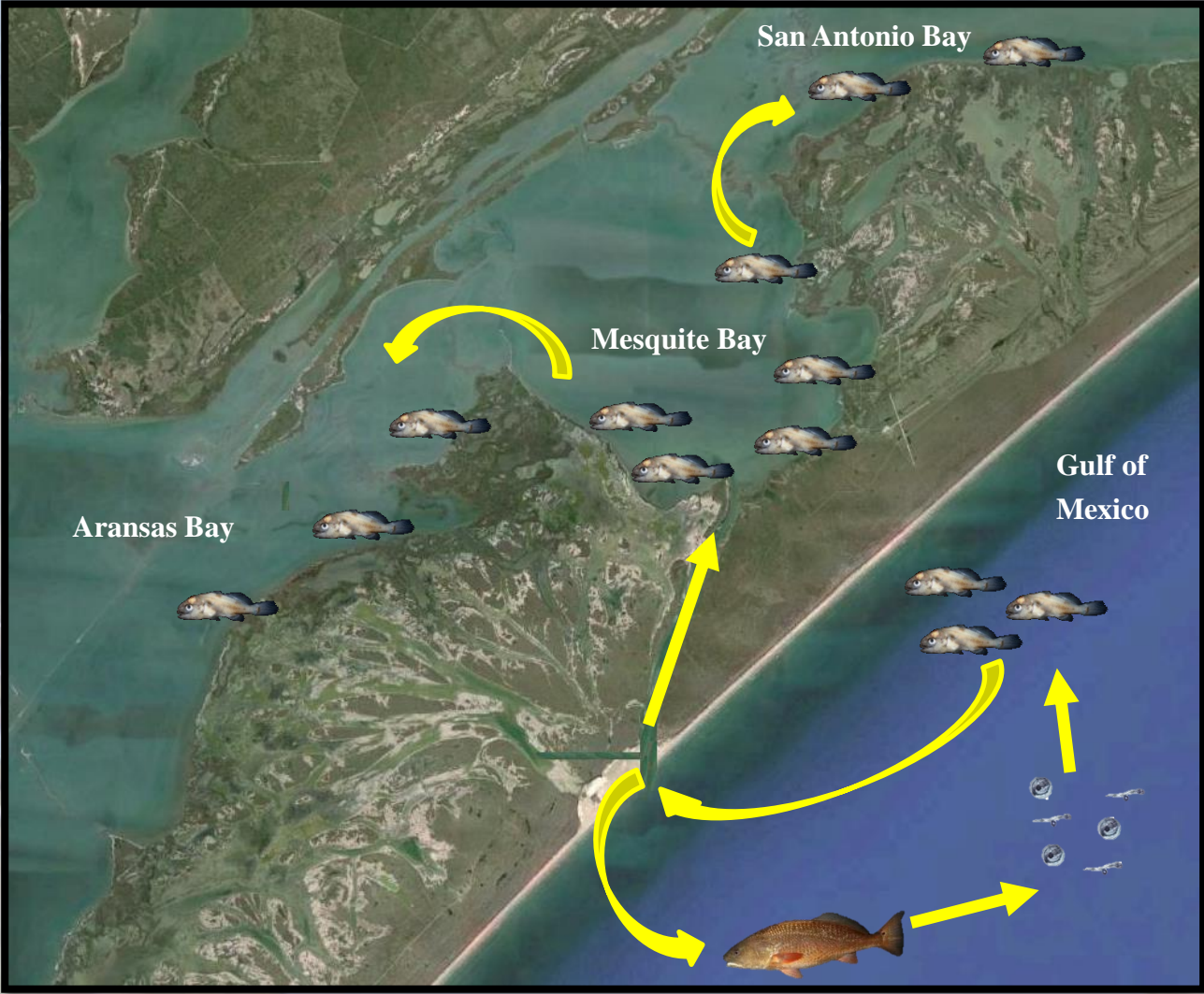
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Tidal inlets increase connectivity between gulf and estuarine ecosystems.



Red Drum (*Sciaenops ocellatus*) Example



Cedar Bayou is a natural tidal inlet that connects Texas estuaries to the Gulf of Mexico.



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat

Google earth

Cedar Bayou is isolated from other inlets.

Pass Cavallo
(36 miles North)

You Are
Here

Cedar Bayou

With Cedar Bayou
closed, Mesquite Bay's
seagrass nurseries are
inaccessible to offshore
nekton.

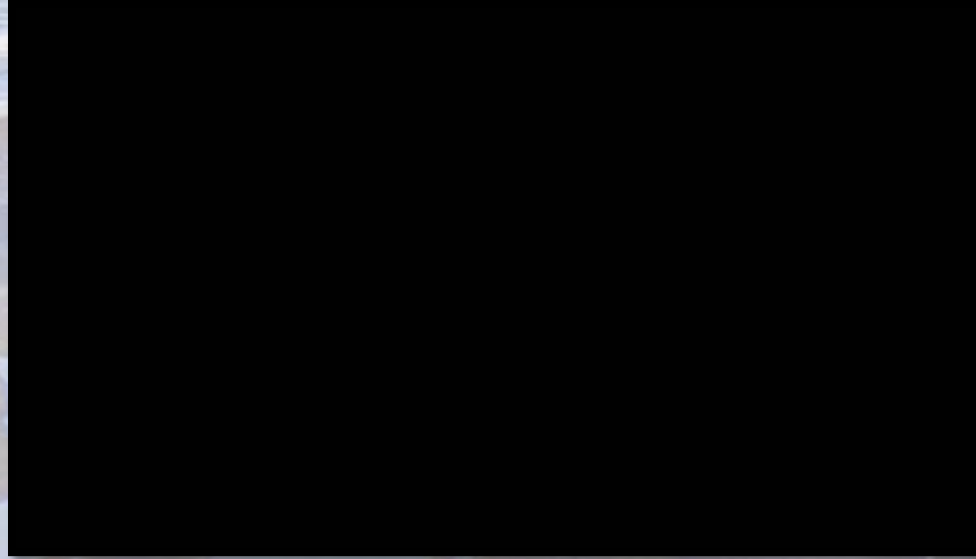
Aransas Pass
(20 miles South)



Oil from Ixtoc I spill began moving towards Matagorda Island in 1979.



On September 25, 2014, the most comprehensive dredging project of Cedar Bayou was completed.



Before Dredging



After Dredging

We want to quantify any changes to nekton densities that result from opening Cedar Bayou.

But Why?



Importance

Red Drum



- Ecology
- TX Economics
 - 15,000+ jobs
 - \$952 million/yr (NMFS, 2011)

Blue Crab

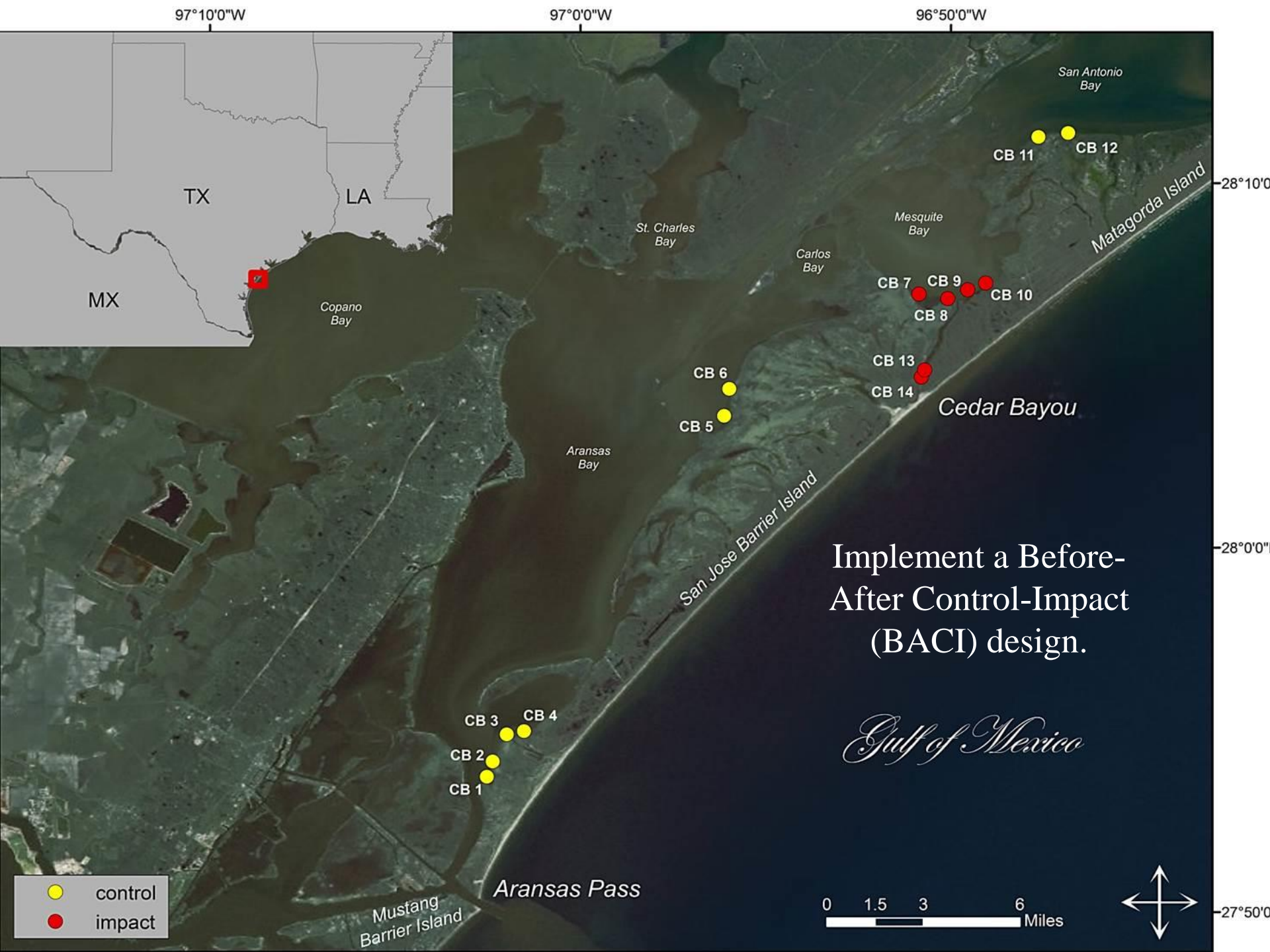


- Primary food source of Whooping Cranes
- Commercial & recreational fishery
- Numbers declining

Whooping Crane



- Critically endangered
- Eat Blue Crabs
- Large eco-tourist industry

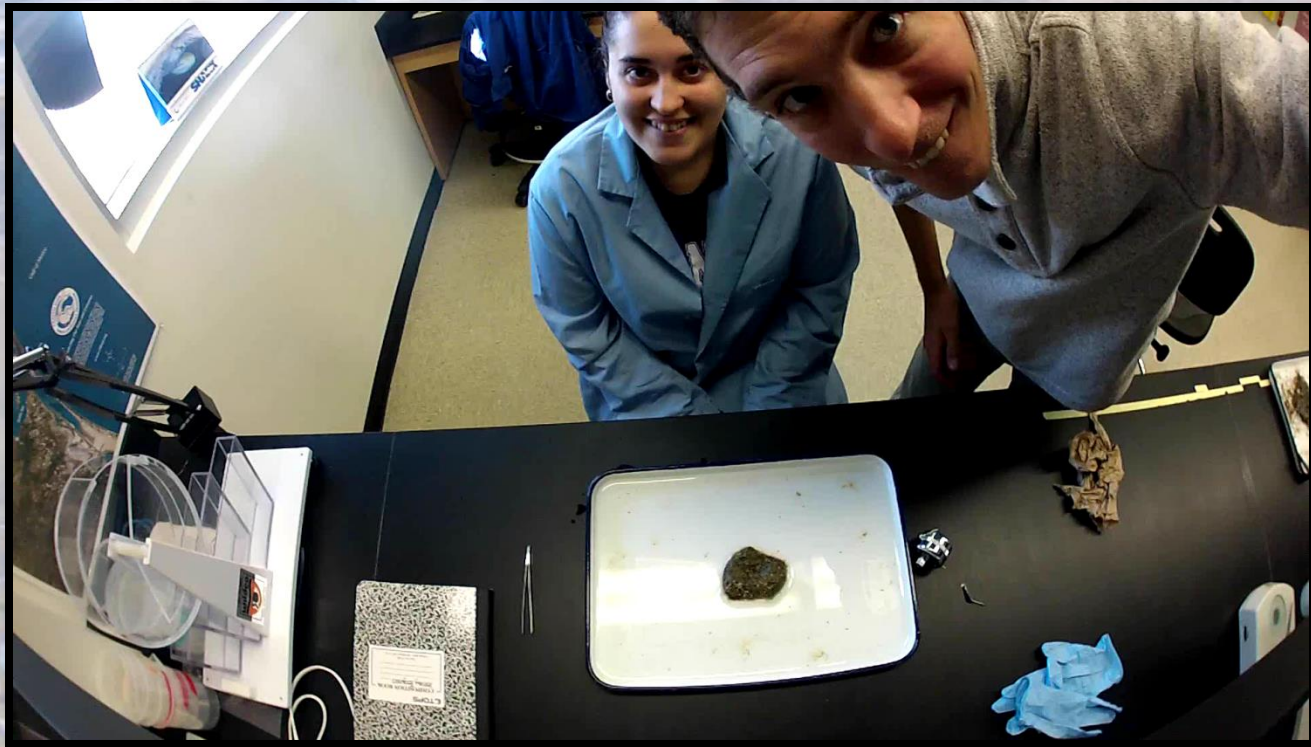


Three tows are taken at each control/impact site using an epibenthic sled.

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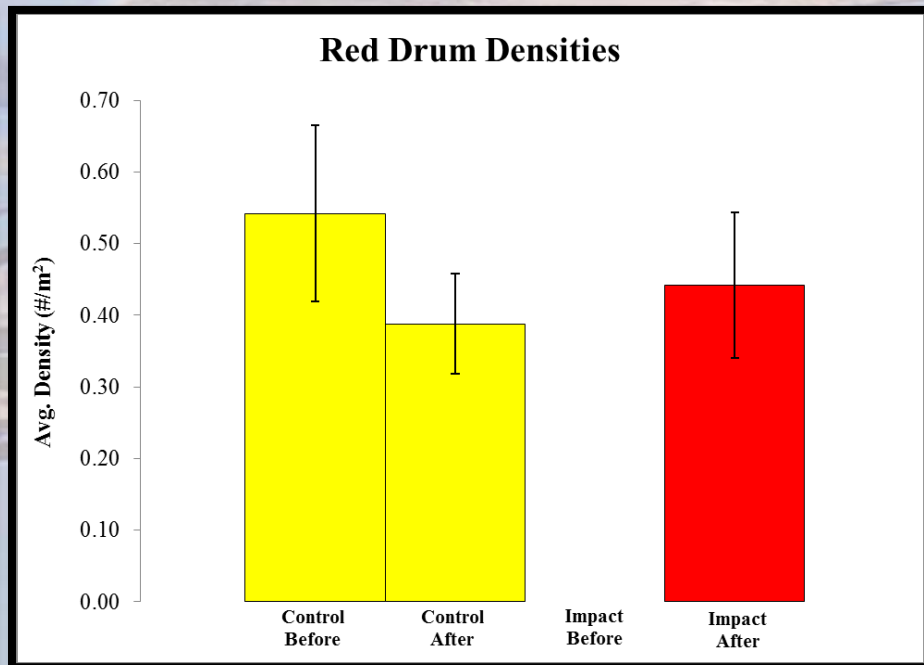


Each sample is taken to the lab for sorting and species identification.



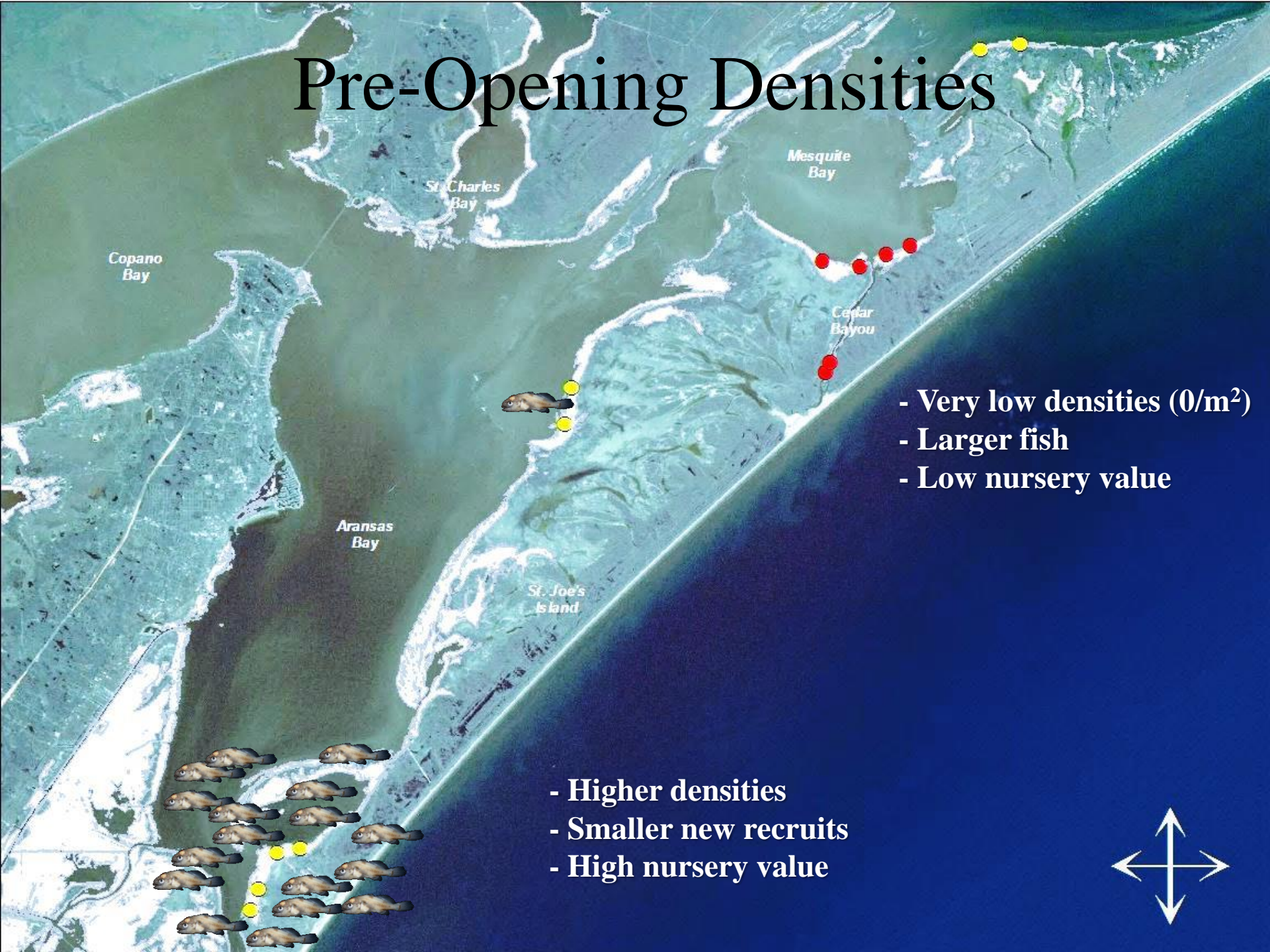
252 Samples Per Sampling Year

Post-Opening Results (Red Drum)



Before Control \neq Before Impact ($p = 0.001$; 95% CI)
After Control = After Impact ($p = 0.821$; 95% CI)

Pre-Opening Densities

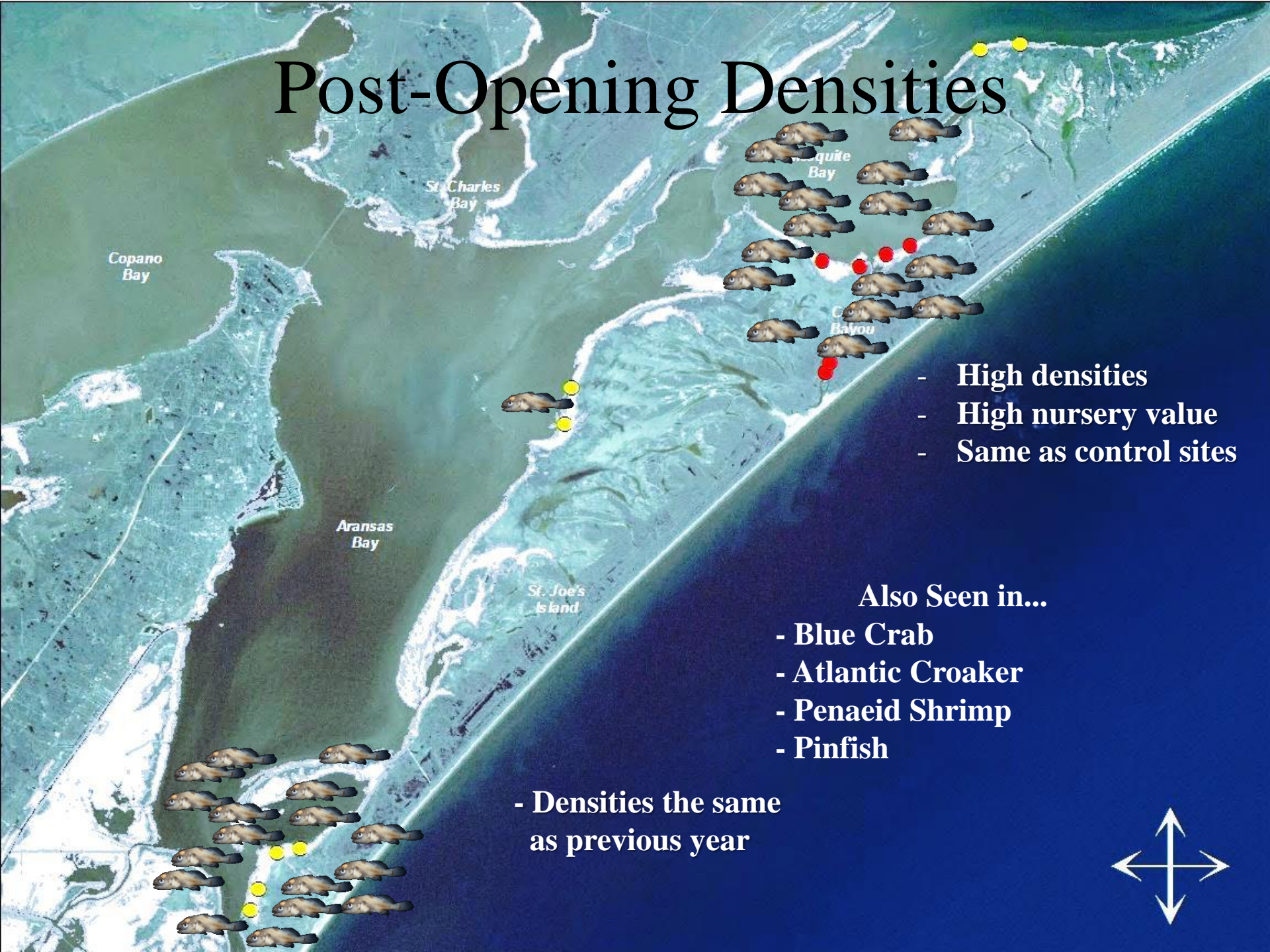


- Very low densities ($0/m^2$)
- Larger fish
- Low nursery value

- Higher densities
- Smaller new recruits
- High nursery value



Post-Opening Densities



- High densities
- High nursery value
- Same as control sites

Also Seen in...

- Blue Crab
- Atlantic Croaker
- Penaeid Shrimp
- Pinfish

- Densities the same as previous year



Red Drum Acoustic Telemetry

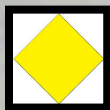
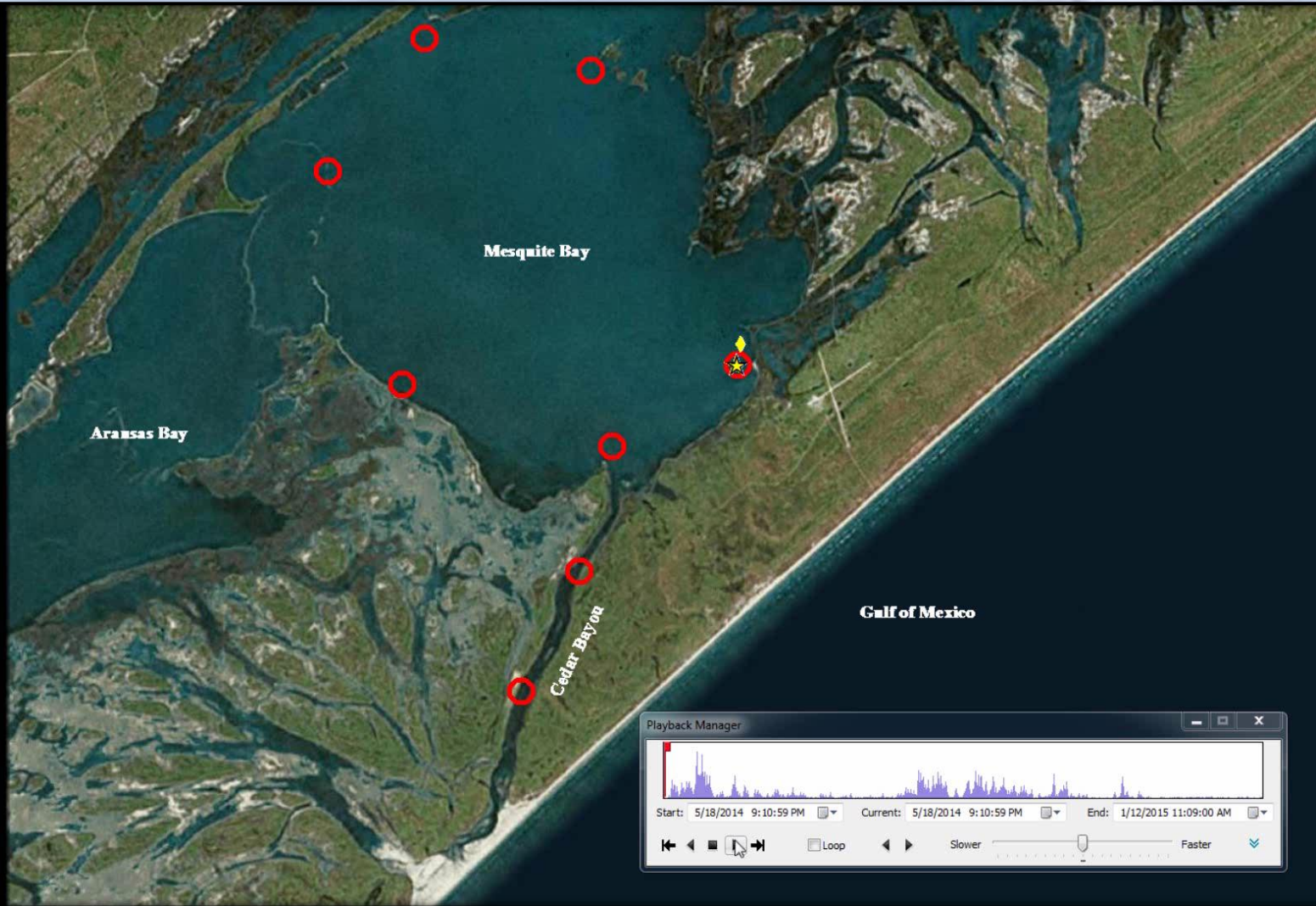
- How will opening Cedar Bayou influence Red Drum spawning movements and residency times in Mesquite Bay?



Red Drum Acoustic Telemetry



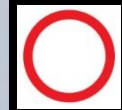
Red Drum Acoustic Telemetry



Release Event

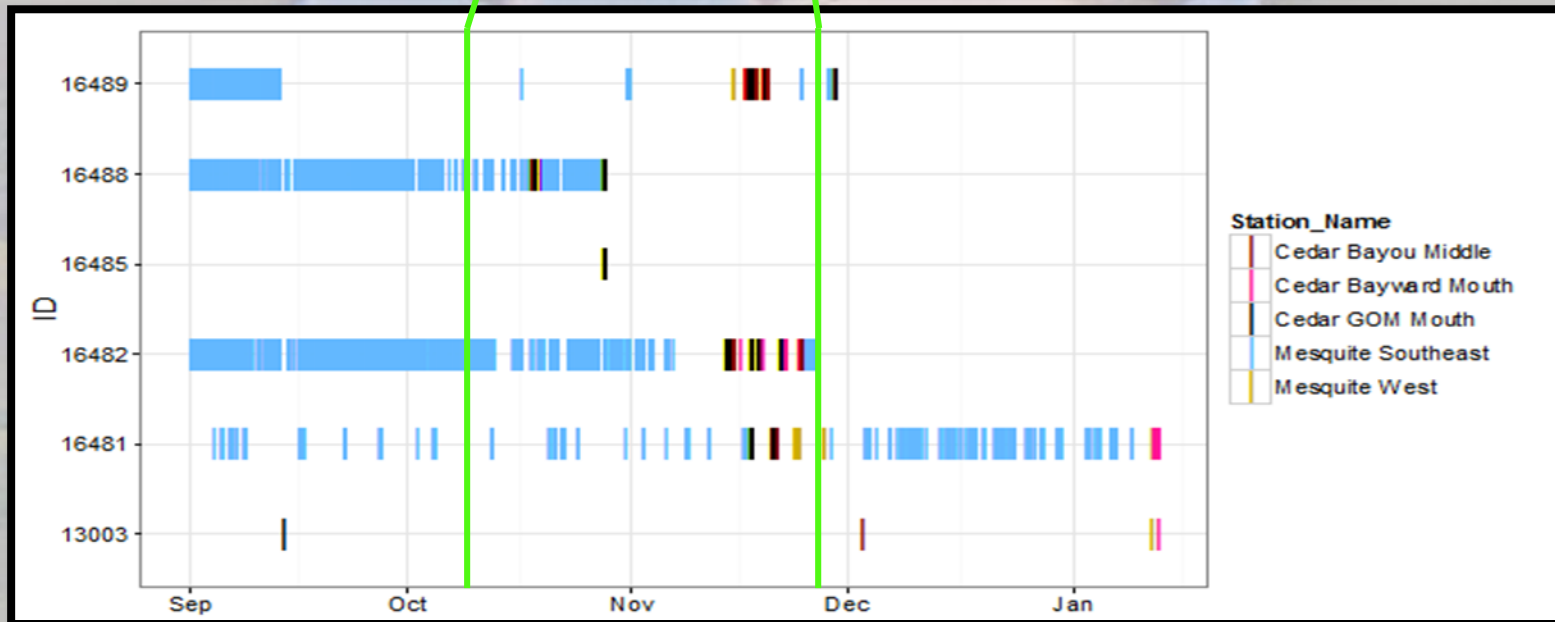
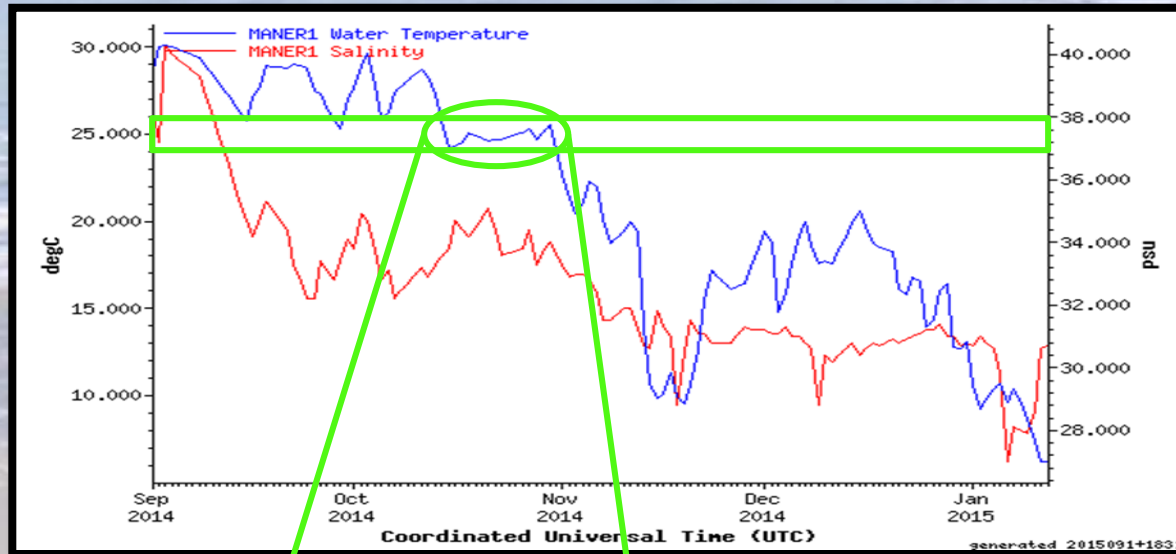


Detection Event



Receiver Location

Acoustic Telemetry Results



Moving Forward

- Continue sampling and determine how other species respond?
- Use Cedar Bayou project as example for future projects.



Sponsors and Collaborators



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HENRY HILDEBRAND MEMORIAL GRANT

THE AMERICAN FISHERIES SOCIETY - TEXAS

Questions?



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	FALL	Impact Pre-Opening					Impact Post-Opening						
		Total Catch	RA (%)	Mean Density (#/m ²)	SE	Mean Length (mm)	SE	Total Catch	RA (%)	Mean Density (#/m ²)	SE	Mean Length (mm)	SE
Total Fish		99					715						
Atlantic Croaker	<i>Micropogonias undulatus</i>	2	2.0	0.008	(0.008)	9.35	(1.250)	24	3.4	0.100	(0.042)	10.55	(0.554)
Bay Whiff	<i>Citharichthys spilopterus</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	9	1.3	0.038	(0.016)	20.32	(2.854)
Blackcheek Tonguefish	<i>Symphurus plagiosa</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	28	3.9	0.117	(0.045)	25.44	(1.823)
Blackwing Searobin	<i>Prionotus rubio</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	1	0.1	0.004	(0.004)	23.80	(0.000)
Darter Goby	<i>Gobionellus boleosoma</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	71	9.9	0.296	(0.073)	14.58	(0.759)
Dwarf Seahorse	<i>Hippocampus zosterae</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	3	0.4	0.013	(0.007)	11.03	(2.446)
Feather Blenny	<i>Hypsoblennius hentz</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	1	0.1	0.004	(0.004)	16.20	(0.000)
Gobiosoma sp.	<i>Gobiosoma sp.</i>	73	73.7	0.304	(0.083)	14.84	(0.564)	313	43.8	1.304	(0.440)	15.94	(0.308)
Pinfish	<i>Lagodon rhomboides</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	22	3.1	0.092	(0.037)	9.98	(0.253)
Pipefish	<i>Syngnathus sp.</i>	23	23.2	0.096	(0.019)	41.37	(4.811)	134	18.7	0.558	(0.106)	49.36	(2.432)
Red Drum	<i>Sciaenops ocellatus</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	106	14.8	0.442	(0.102)	9.74	(0.444)
Sharptail Goby	<i>Gobionellus oceanicus</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	1	0.1	0.004	(0.004)	12.50	(0.000)
Spotted Seatrout	<i>Cynoscion nebulosus</i>	1	1.0	0.004	(0.004)	13.30	(0.000)	2	0.3	0.008	(0.006)	58.70	(35.500)
Total Crustaceans		905					6963						
Arrow Shrimp	<i>Tozeuma carolinense</i>	356	39.3	1.483	(0.468)	24.70	(0.390)	593	8.5	2.471	(0.657)	22.50	(0.357)
Blue Crab	<i>Callinectes sapidus</i>	5	0.6	0.021	(0.008)	9.20	(2.770)	176	2.5	0.733	(0.160)	4.46	(0.296)
Brown / Pink Shrimp	<i>Farfantepenaeus sp.</i>	16	1.8	0.067	(0.020)	34.05	(2.416)	309	4.4	1.288	(0.349)	27.24	(0.752)
Grass Shrimp	<i>Palaemonetes sp.</i>	116	12.8	0.483	(0.200)	16.47	(0.245)	1476	21.2	6.150	(1.853)	14.24	(0.245)
Mud Crab (<i>Xanthids</i>)	<i>Xanthids</i>	0	0.0	0.000	(0.000)	0.00	(0.000)	14	0.2	0.058	(0.046)	2.51	(0.220)
Penaeid	<i>Penaeidae sp.</i>	34	3.8	0.142	(0.047)	9.82	(0.386)	1058	15.2	4.408	(0.831)	12.39	(0.230)
White Shrimp	<i>Litopenaeus setiferus</i>	9	1.0	0.038	(0.019)	41.41	(2.111)	5	0.1	0.021	(0.017)	32.28	(2.112)
Unidentified Hippolytidae	<i>Hippolytidae sp.</i>	369	40.8	1.538	(0.315)	8.83	(0.177)	3332	47.9	13.883	(2.246)	9.28	(0.173)
	WINTER												
Total Fish		106					166						
Atlantic Croaker	<i>Micropogonias undulatus</i>	5	4.72	0.021	(0.008)	20.08	(4.538)	39	23.49	0.163	(0.047)	21.86	(0.949)
Bay Whiff	<i>Citharichthys spilopterus</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	15	9.04	0.063	(0.015)	13.11	(0.477)
Blackcheek Tonguefish	<i>Symphurus plagiosa</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	1	0.60	0.004	(0.004)	25.90	(0.000)
Darter Goby	<i>Gobionellus boleosoma</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	11	6.63	0.046	(0.021)	15.50	(1.871)
Gobiosoma sp.	<i>Gobiosoma sp.</i>	4	3.77	0.017	(0.012)	18.38	(1.357)	16	9.64	0.067	(0.028)	21.11	(1.060)
Gulf Menhaden	<i>Brevoortia patronus</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	1	0.60	0.004	(0.004)	16.20	(0.000)
Pinfish	<i>Lagodon rhomboides</i>	10	9.43	0.042	(0.012)	14.81	(0.583)	20	12.05	0.083	(0.028)	16.71	(1.121)
Pipefish	<i>Syngnathus sp.</i>	8	7.55	0.033	(0.016)	61.01	(2.614)	8	4.82	0.033	(0.012)	64.81	(4.168)
Sheepshead Minnow	<i>Cyprinodon variegatus</i>	20	18.87	0.083	(0.052)	28.29	(1.379)	0	0.00	0.000	(0.000)	0.00	(0.000)
Shrimp Eel	<i>Ophichthus gomesii</i>	1	0.94	0.004	(0.004)	47.80	(0.000)	0	0.00	0.000	(0.000)	0.00	(0.000)
Southern Flounder	<i>Paralichthys lethostigma</i>	13	12.26	0.054	(0.019)	17.95	(1.780)	14	8.43	0.058	(0.015)	17.51	(1.844)
Spot Croaker	<i>Leiostomus xanthurus</i>	45	42.45	0.188	(0.051)	14.81	(0.342)	41	24.70	0.171	(0.044)	14.87	(0.456)
Total Crustaceans		239					656						
Arrow Shrimp	<i>Tozeuma carolinense</i>	57	23.85	0.238	(0.079)	27.34	(0.487)	80	12.20	0.333	(0.094)	26.20	(0.335)
Blue Crab	<i>Callinectes sapidus</i>	11	4.60	0.046	(0.021)	8.66	(0.937)	267	40.70	1.113	(0.149)	4.09	(0.202)
Brown / Pink Shrimp	<i>Farfantepenaeus sp.</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	4	0.61	0.017	(0.013)	26.23	(2.331)
Grass Shrimp	<i>Palaemonetes sp.</i>	65	27.20	0.271	(0.098)	17.46	(0.262)	35	5.34	0.146	(0.047)	17.70	(0.513)
Mud Crab (<i>Xanthids</i>)	<i>Xanthids</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	7	1.07	0.029	(0.013)	8.09	(1.473)
Penaeid	<i>Penaeidae sp.</i>	4	1.67	0.017	(0.010)	11.90	(0.699)	78	11.89	0.325	(0.089)	12.95	(0.363)
Snapping Shrimp	<i>Alpheus heterochaelis</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	1	0.15	0.004	(0.004)	11.70	(0.000)
Unidentified Hippolytidae	<i>Hippolytidae sp.</i>	102	42.68	0.425	(0.146)	10.50	(0.192)	184	28.05	0.767	(0.170)	11.68	(0.171)
	SPRING												
Total Fish		89					299						
Atlantic Croaker	<i>Micropogonias undulatus</i>	1	1.12	0.004	(0.004)	22.70	(0.000)	15	5.02	0.063	(0.046)	17.50	(1.511)
Bay Whiff	<i>Citharichthys spilopterus</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	1	0.33	0.004	(0.004)	11.60	(0.000)
Darter Goby	<i>Gobionellus boleosoma</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	25	8.36	0.104	(0.036)	13.16	(1.565)
Dwarf Seahorse	<i>Hippocampus zosterae</i>	1	1.12	0.004	(0.004)	22.40	(0.000)	2	0.67	0.008	(0.006)	15.55	(6.550)
Gobiosoma sp.	<i>Gobiosoma sp.</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	7	2.34	0.029	(0.019)	9.09	(2.328)
Gulf Menhaden	<i>Brevoortia patronus</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	6	2.01	0.025	(0.018)	21.07	(0.406)
Inland Silverside	<i>Menidia beryllina</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	14	4.68	0.058	(0.030)	9.93	(2.240)
Inshore Lizardfish	<i>Synodus foetens</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	2	0.67	0.008	(0.006)	40.50	(0.000)
Pigfish	<i>Orthopristis chrysoptera</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	56	18.73	0.233	(0.155)	10.94	(0.293)
Pinfish	<i>Lagodon rhomboides</i>	65	73.03	0.271	(0.164)	12.83	(0.088)	48	16.05	0.200	(0.048)	16.48	(4.453)
Pipefish	<i>Syngnathus sp.</i>	4	4.49	0.017	(0.010)	26.30	(14.304)	24	8.03	0.100	(0.020)	26.15	(4.547)
Silver Perch	<i>Bairdiella chrysoura</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	21	7.02	0.088	(0.041)	5.28	(0.263)
Southern Flounder	<i>Paralichthys lethostigma</i>	4	4.49	0.017	(0.010)	29.18	(2.098)	0	0.00	0.000	(0.000)	0.00	(0.000)
Spot Croaker	<i>Leiostomus xanthurus</i>	14	15.73	0.058	(0.024)	28.76	(1.822)	18	6.02	0.075	(0.050)	17.08	(0.674)
Spotted seatrout	<i>Cynoscion nebulosus</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	1	0.33	0.004	(0.004)	11.70	(0.000)
Unidentified Clupeiform	<i>Clupeiformes</i>	0	0.00	0.000	(0.000)	0.00	(0.000)	59	19.73	0.246	(0.106)	9.42	(0.351)
Total Crustaceans		154					2268						
Arrow Shrimp	<i>Tozeuma carolinense</i>	29	18.83	0.121	(0.056)	32.51	(0.665)	26	1.15	0.108	(0.030)	33.00	(0.803)
Blue Crab	<i>Callinectes sapidus</i>	15	9.74	0.063	(0.017)	9.54	(0.507)	12	0.53	0.050	(0.012)	12.18	(1.749)
Brown / Pink Shrimp	<i>Farfantepenaeus sp.</i>	2	1.30	0.008	(0.008)	28.65	(0.850)	329	14.51	1.371	(0.388)	24.20	(0.571)
Grass Shrimp	<i>Palaemonetes sp.</i>	5	3.25	0.021	(0.012)	18.54	(1.729)	30	1.32	0.125	(0.046)	19.39	(1.085)
Mud Crab (<i>Xanthids</i>)	<i>Xanthids</i>	1	0.65	0.004	(0.004)	12.10	(0.000)	2	0.09	0.008	(0.008)	8.30	(0.800)
Penaeid	<i>Penaeidae sp.</i>	78	50.65	0.325	(0.086)	13.34	(0.370)	1720	75.84	7.167	(1.629)	13.52	(0.155)
Unidentified Hippolytidae	<i>Hippolytidae sp.</i>	24	15.58	0.100	(0.050)	10.39	(0.379)	149	6.57	0.621	(0.142)	10.05	(0.370)