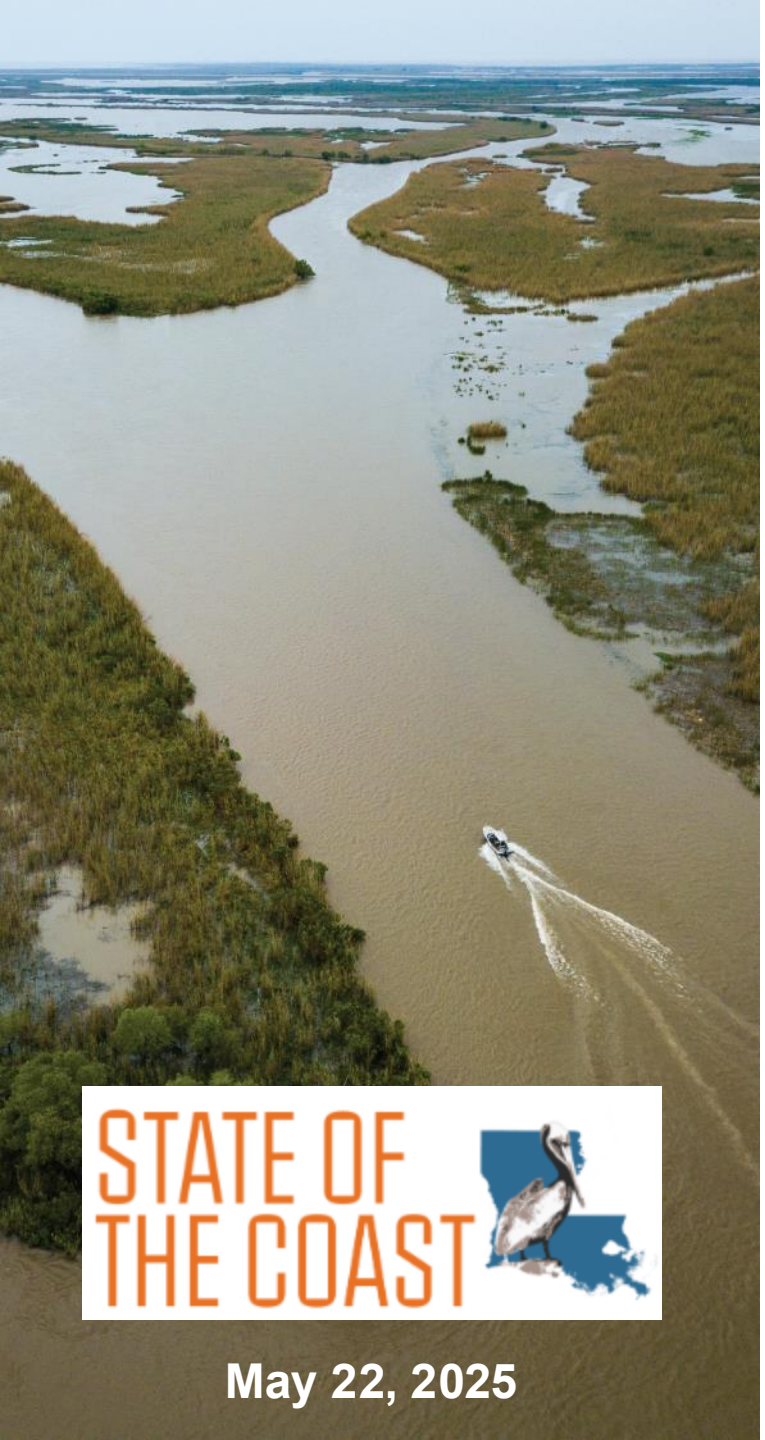

THE WATER INSTITUTE

ASSESSING FISH AND WATER COLUMN INVERTEBRATE ABUNDANCES IN NATURAL AND RESTORED MARSHES ACROSS BARATARIA AND TERREBONNE BASINS TO DEVELOP REFERENCE RANGES AND RESTORATION TARGET VALUES

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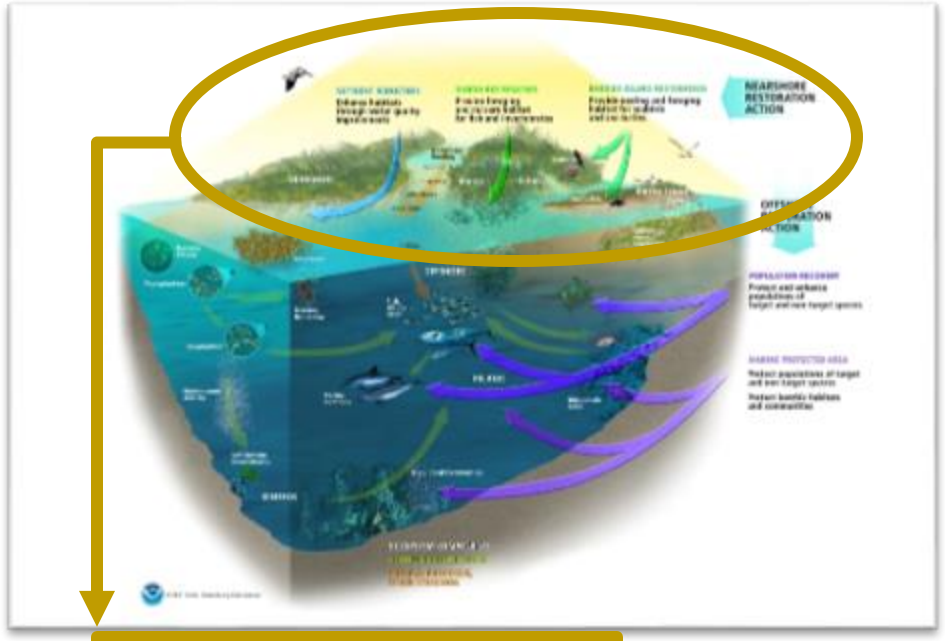
- **LSU**: Steve Midway
- **The Water Institute**: Erin Kiskaddon, Shawn Doyle, Harris Bienn, Jean Cowan, Tim Carruthers, Emelia Marshall

Funded by:

- Louisiana Trustee Implementation Group (LA TIG). DIVER Portal Project ID#: 299

HABITAT RESTORATION = MORE NEKTON



The large and continuous release of oil resulted in impacts to many species throughout the water column (see text box above that summarizes key aspects of the injury assessment that informed restoration planning). The restoration will need to address injuries to the species at different life stages and across their geographic ranges. In accordance with the ecosystem approach to restoration, the Trustees will implement a portfolio of restoration approaches for the water column injury that is three-fold:

1. Coastal and nearshore habitat restoration, discussed and implemented under the Wetlands, Coastal, and Nearshore Habitats Restoration Type (Section 5.5.2), SAV Restoration Type (Section 5.5.8) and Oysters Restoration Type (Section 5.5.9).
2. Offshore habitat restoration, discussed and implemented under the Mesophotic and Deep Benthic Communities Restoration Type (Section 5.5.13).
3. Mortality reduction, accomplished by addressing known sources of mortality to fish and invertebrates by reducing bycatch and fisheries interactions discussed and implemented under this Restoration Type (Section 5.5.6).

5.5 Alternative A: Comprehensive Integrated Ecosystem Restoration (Preferred Alternative)

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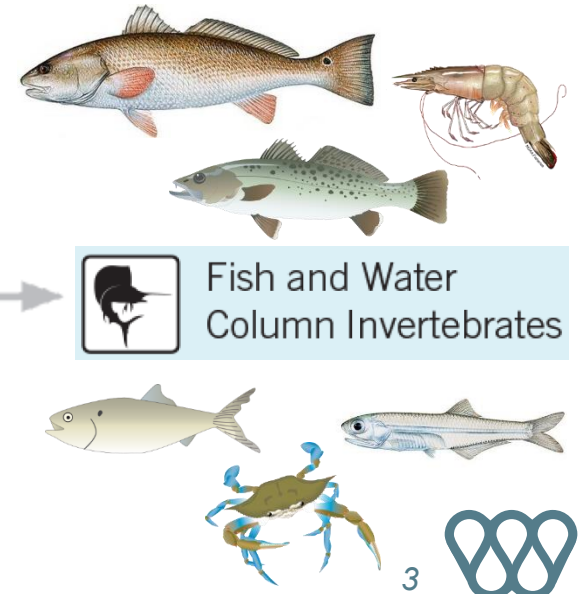
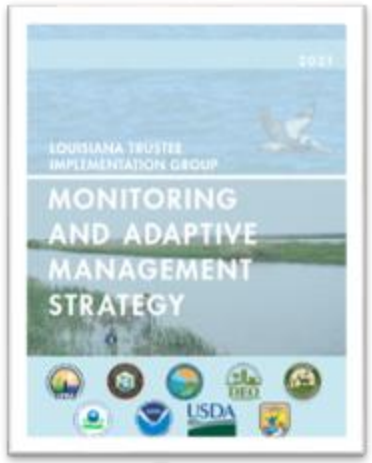
- Wetlands, Coastal, and Nearshore Habitats
- Submerged Aquatic Vegetation
- Oysters
- Mesophotic and Deep Benthic Communities

→ Fish and Water Column Invertebrates



HABITAT RESTORATION = MORE NEKTON(?)

Louisiana Trustee Implementation Group (LA TIG) needs ***reference range*** and ***restoration target*** values to **quantify marsh habitat restoration benefits** to fisheries species and their prey



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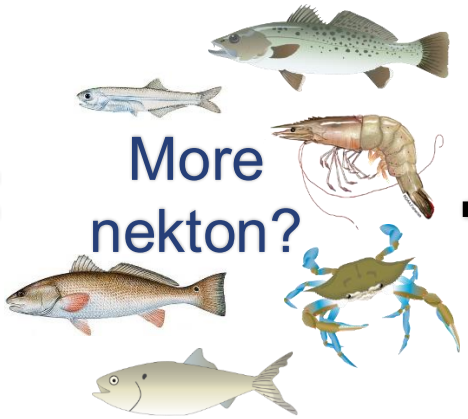
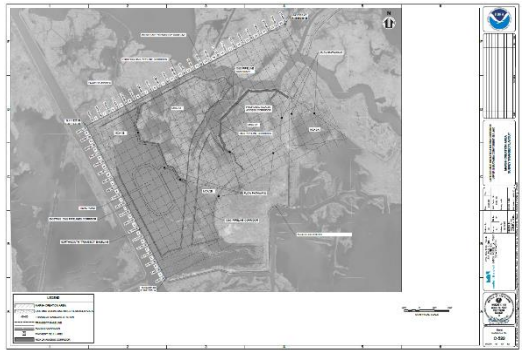


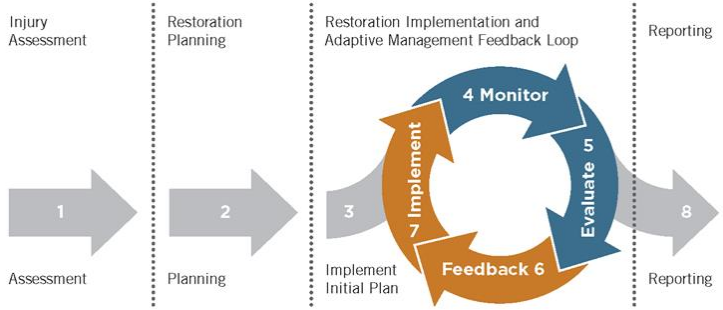
Planning and design of future marsh restoration projects



Assist with creating, tracking, and assessing achievement High Level and Fundamental Objectives

S.M.A.R.T. Objectives

SMART Objectives are intended to assist resources managers to create, track, and assess achievement of short- and long-term goals. Specific to the LA TIG MAM process, development of SMART objectives was guided by resource experts and restoration practitioners. Here, the SMART acronym is defined as: specific about what restoration effort will achieve; provide a measurable target for restoration success; targets have been identified by resource experts as achievable; measures are relevant to ecosystem objectives; a program-appropriate timeline is identified for quantifying progress.



ESTABLISHING THE 'NEKTON PROJECT'

Resolution LA-2022-017

LOUISIANA RESTORATION AREA TRUSTEE IMPLEMENTATION GROUP
of the
DEEPWATER HORIZON TRUSTEE COUNCIL

In re: Oil Spill by the Oil Rig "Deepwater Horizon" in the Gulf of Mexico
on April 20, 2010,
Civil Action Nos. 10-4536; 10-04182; 10-03059; 13-4677; 13-158; 13-00123 (ED. La.)
MDL No. 2179

Resolution # LA-2022-017

Resolution to Approve the "Monitoring the Effects of Coastal Wetland Restoration on Fish and Invertebrates" Monitoring and Adaptive Management (MAM) Activity Implementation Plan (MAIP) and to Approve and Allocate Funds to Implement this MAIP

In 2023, Louisiana Trustees allocated $5.3 M for a 6-year Monitoring and Adaptive Management (MAM) Activity:

- **Monitoring the Effects of Coastal Wetland Restoration on Fish and Invertebrates PID 299** (aka the 'Nekton project')

Goals:

- **Support development** of multiple **LA MAM Strategy Restoration** and **Cross-Restoration Type SMART Objectives**
- **Contribute to LA TIG Programmatic MAM Needs:** relative effectiveness different restoration approaches
- I**nform planning, design, and implementation** of future DWH restoration projects to maximize habitat benefits for associated fish and invertebrates

Tasks:

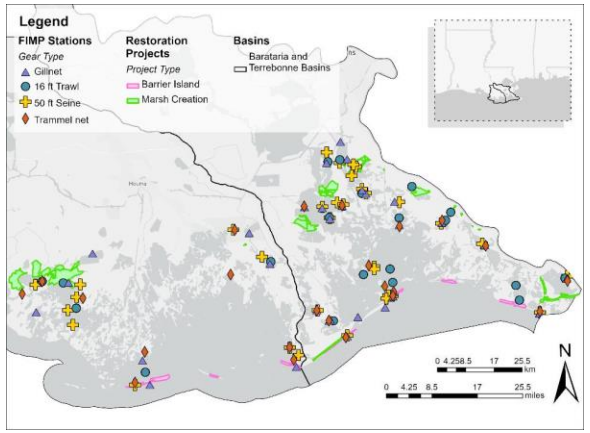
1) Review and analyze existing monitoring data; develop fixed-area monitoring plan

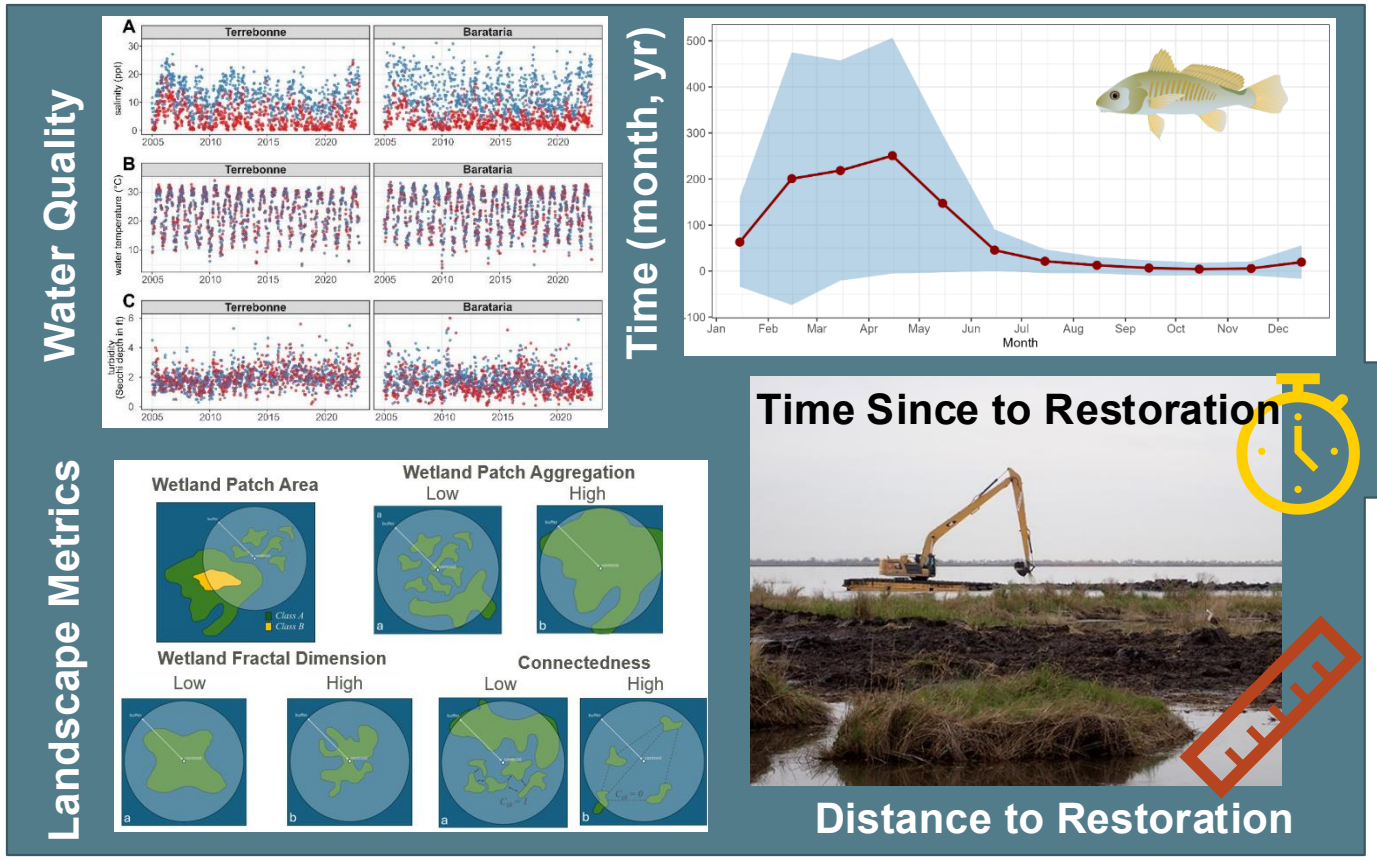
2) Conduct 3 years of fixed-area monitoring data

3) Analyze Task 2 fixed-area monitoring data; develop draft ***reference ranges*** and ***restoration targets***

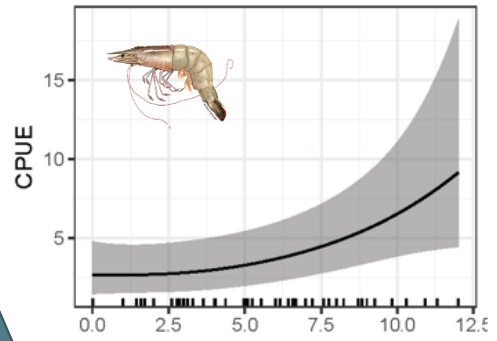
TASK 1: ANALYZE EXISTING DATA

- **17 years of existing LDWF FIMP data** (2005-2022),144 stations within 10 km of **21 selected restoration sites** 0 to >15 years post-build
- **Sites** in **intermediate/brackish** and **saline wetlands** within Terrebonne and Barataria Basins

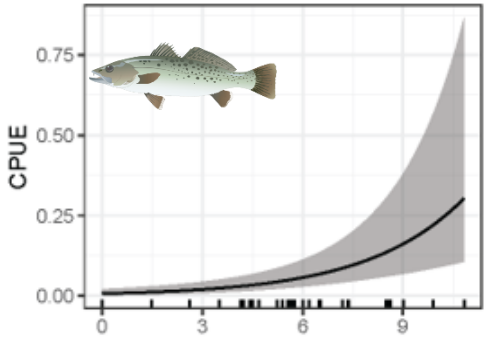


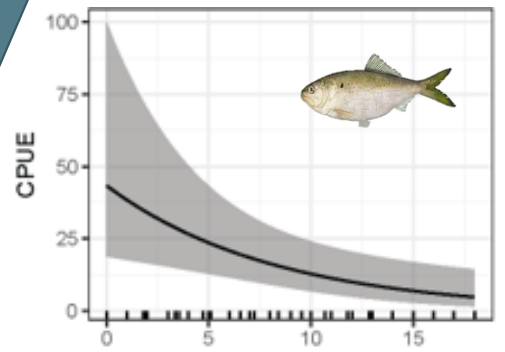


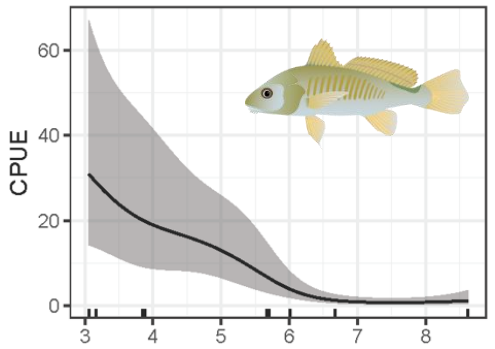
Average Time (Years) Post-Restoration



Average Distance (km) from Restoration





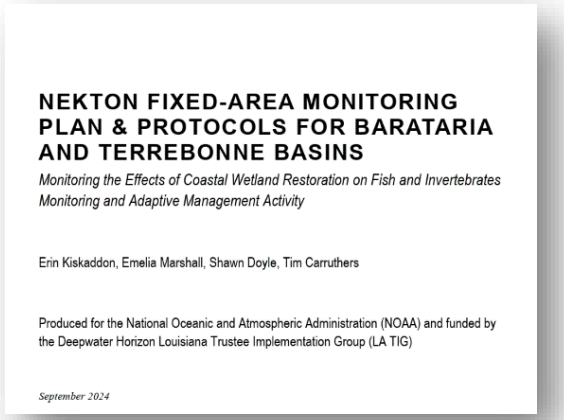


Kiskaddon et al., *in prep*

TASK 1: DEVELOP SAMPLING PROTOCOL

- Focused on **3 marsh sub-habitats**: marsh interior, marsh edge, open water adjacent to marsh edge
- Sampling across **fresh**, **intermediate/brackish**, and **saline** zones of Terrebonne and Barataria Basins **seasonally** (4x annually) for 3 years
- Fixed-area gear: **drop sampler**


Figure 1. Drop Samplers


NEKTON FIXED-AREA MONITORING PLAN & PROTOCOLS FOR BARATARIA AND TERREBONNE BASINS

Monitoring the Effects of Coastal Wetland Restoration on Fish and Invertebrates Monitoring and Adaptive Management Activity

Erin Kiskaddon, Emelia Marshall, Shawn Doyle, Tim Carruthers

Produced for the National Oceanic and Atmospheric Administration (NOAA) and funded by the Deepwater Horizon Louisiana Trustee Implementation Group (LA TIG)

September 2024

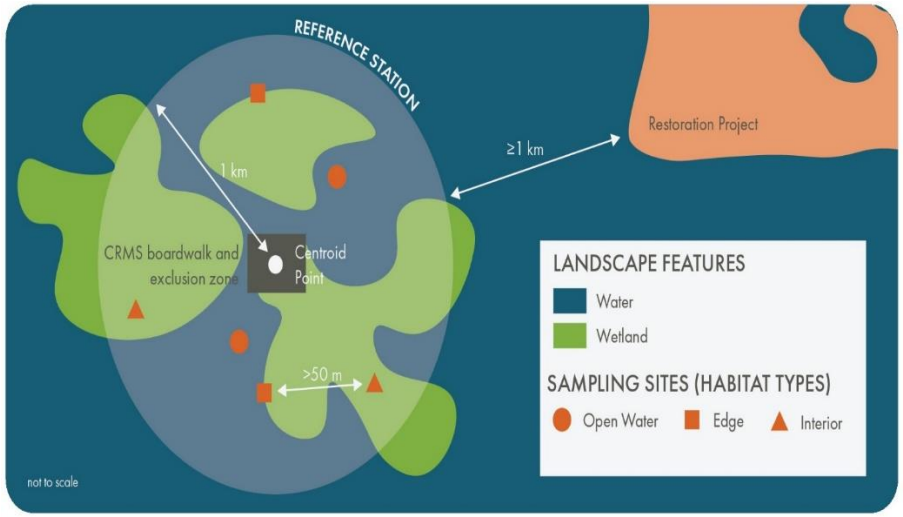
Target Taxa

- **Grass Shrimps**
- **Mud Crabs**
- **Brown Shrimp**
- **White Shrimp**
- **Lesser Blue Crab**
- **Blue Crab**
- **Cyprinodont Guild** (killifishes)
- **Goby Guild**
- **Species Richness**
- **Shannon Diversity**

Anticipate Juveniles of Other Species: spotted seatrout, red drum, spot, croaker, etc.

TASK 1: SAMPLING REFERENCE STATIONS

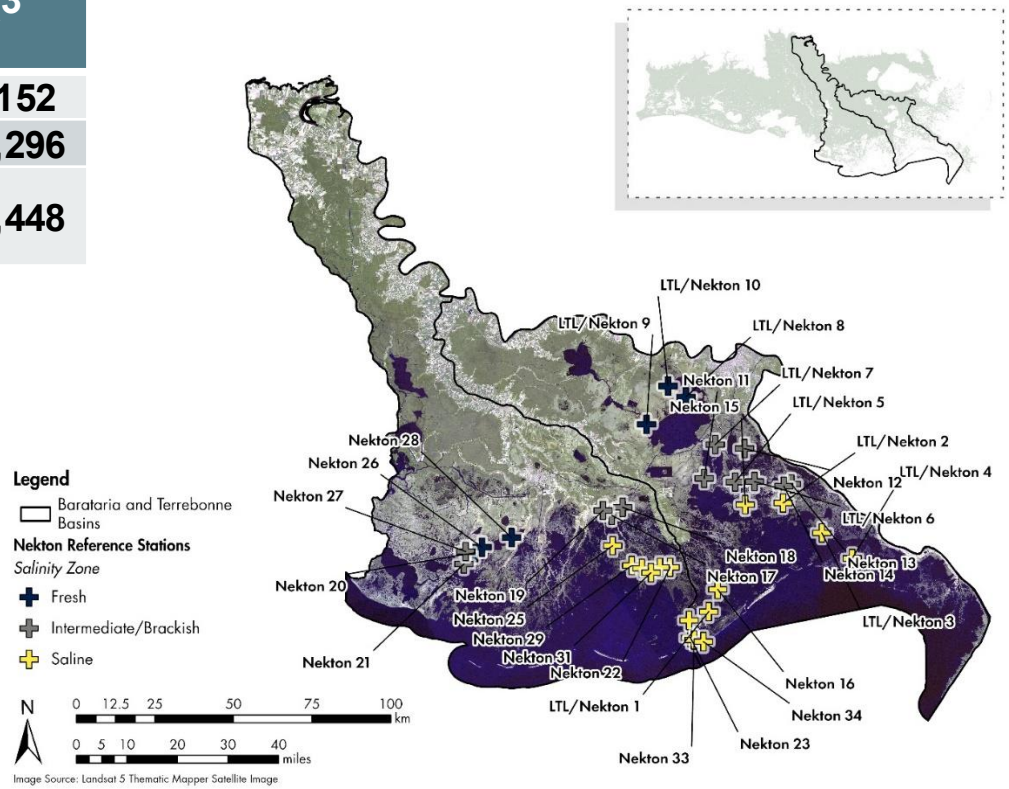
Basin	Stations Per Zone per Seasonal Effort			Total Stations	Samples per Zone per Seasonal Effort			Total Samples Per Effort | Year | Project (3 years)
	F	I/B	S		F	I/B	S	
BA	3	7	6	16	18	42	36	96 | 384 | 1,152
TB	3	5	10	18	18	30	60	108 | 432 | 1,296
Combined Total	6	12	16	34	36	72	96	204 | 816 | 2,448



↑→

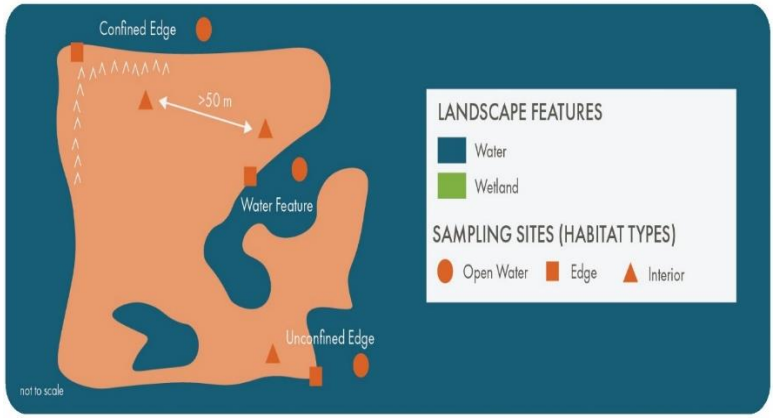
Identified **34** **reference** stations

← Within each station, target 6 sites: **2x for each marsh sub-habitat**: open water, edge, interior



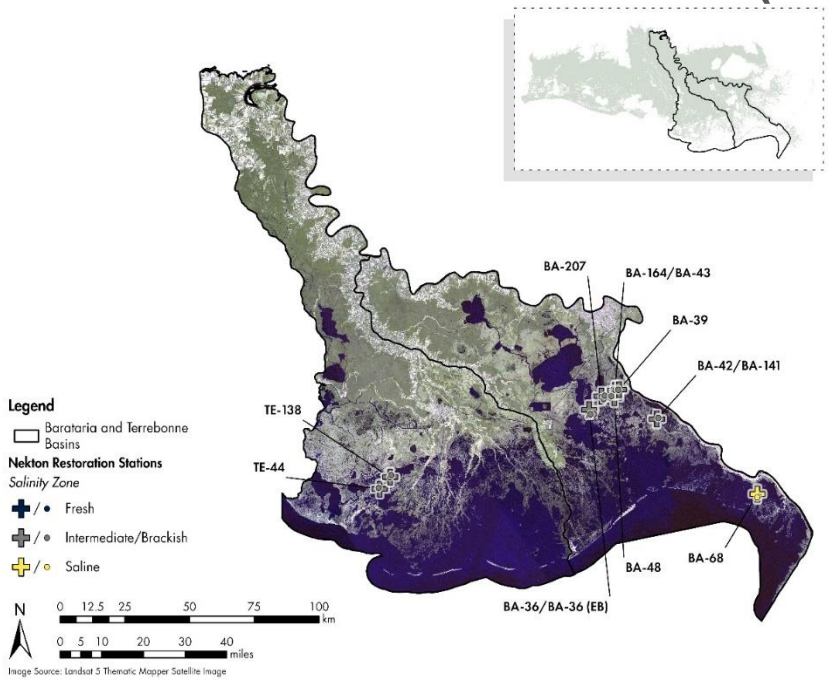
TASK 1: SAMPLING RESTORATION STATIONS

Salinity Zone	Age Category	Barataria Stations	Terrebonne Stations	Total Stations
F	N/A	0	0	0
I/B	0-5	1	1	2
	6-10	3	0	3
	11-15	2	1	3
S	0-5	0	0	0
	6-10	1	0	1
	11-15	0	0	0



← Within each station, target 9 sites: **3x for each marsh sub-habitat** (open water, edge, interior), **1x for each project feature (CE, UE, WF)**

Salinity Zone	Project Feature	Barataria Samples per Effort	Terrebonne Samples per Effort	Total Samples per Effort | Samples per Year | Total Samples per Project
F	N/A	0	0	0 | 0 | 0
I/B	CE	24	9	33 | 132 | 396
	UE	12	0	12 | 48 | 144
	WF	21	6	27 | 108 | 324
S	CE	3	0	3 | 12 | 36
	UE	0	0	0 | 0 | 0
	WF	6	0	6 | 24 | 72



↑ → Identified **9 restoration stations**

TASK 2: IMPLEMENTING THE PLAN

- Spring 2025 Event:
  - Tranche 1 - 14 straight field days, 218 samples
  - Tranche 2 - ongoing, 2 of 6 field days complete

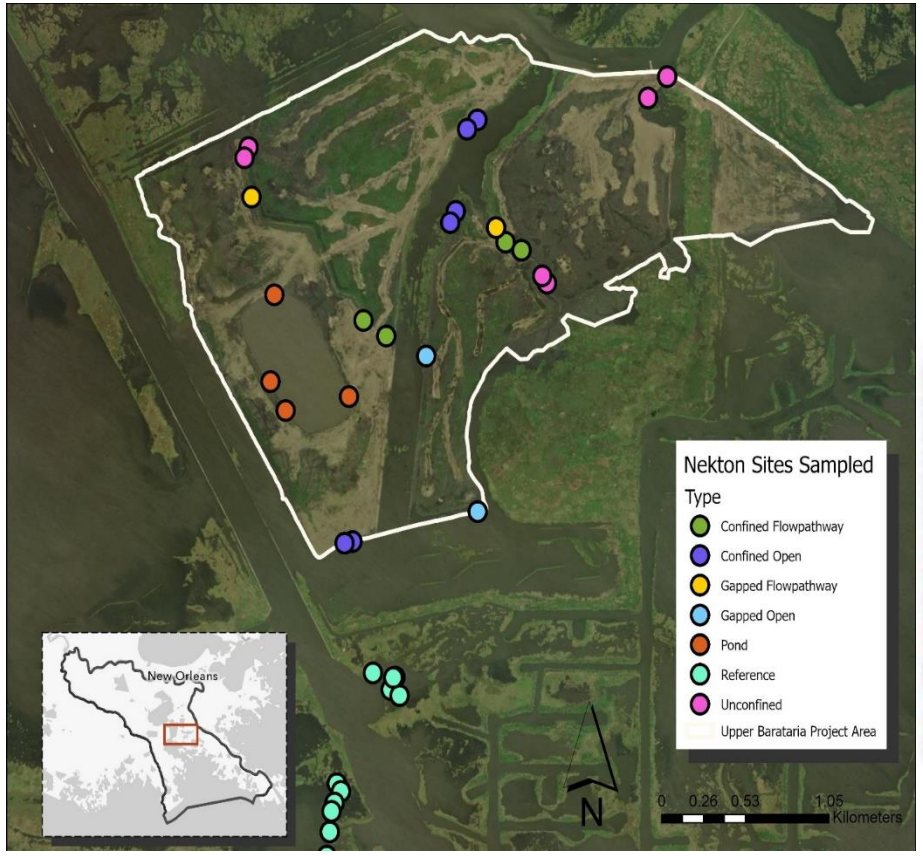
NEKTON PROJECT TIMELINE

Task #	Project Year	Activity Description	Completion (*Anticipated*)
Task 1	1, 2	Task 1 Finalized	Fall 2024
Task 2	**2, 3, 4, 5**	**Implement 3 years of seasonal fixed-area sampling; sample processing and species identification carry over into year 4**	**Ongoing (*Summer 2028)***
Task 3	**3, 4, 5**	**3.1) Initial analyses Task 2 fixed-area data-set**	***Fall 2025, Fall 2026, Fall 2027***
	6	**3.2) Finalize fixed-area analysis; final MAM project report**	***Fall 2028-Spring 2029***
	6	**3.3) Revisit FIMP analysis**	***Winter 2029***
	6	**3.4) Identify *reference ranges* and *restoration targets*; Development SMART Objectives**	***Spring 2029***
	6	**3.5) Final MAM Activity Report**	***Summer 2029***

ASSESSING RESTORATION OUTCOMES

Large Scale Marsh Creation – Upper Barataria Component (PID 124, BA-207)

- 1,183 acres completed 2023, included multiple habitat-focused features: unconfined edges, pond, flow pathways, and dike gaps



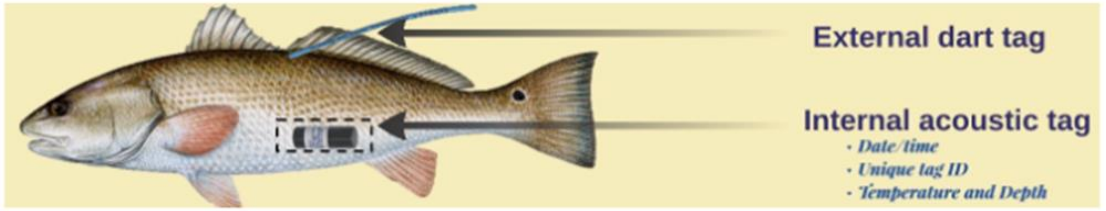


Diagram of redfish with an acoustic transmitter. Image credit: Ashley Ferguson, LDWF

THANK YOU

Emelia Marshall and Erin Kiskaddon

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