Water Quality = Habitat Quality?

Frequency of Hypoxia at Artificial Reefs within the Mississippi Sound and Bight, Jun – Oct 2016

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Task 6: Water Quality

Just part of a much larger whole…

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
ENHANCE • PROTECT • CONSERVE

REEF FISH ASSESSMENT

for Mississippi Coastal and Nearshore Gulf Waters:

Restoration through Improved Data Collection and Management

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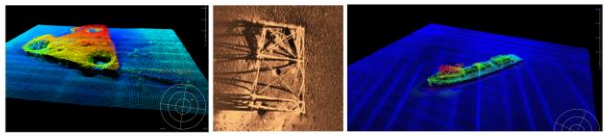
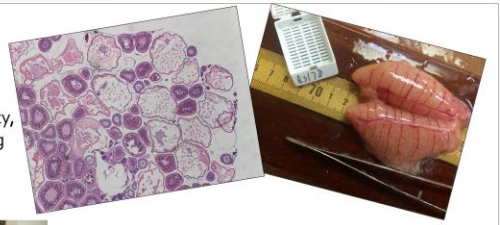
Remote Sensing Survey and Mapping

A remote sensing survey was conducted to acquire detailed multi-beam echo-sounder data to accurately map the positions and elevations of installed reef structures within the 21 artificial reef sites managed by the Mississippi Department of Marine Resources (MDMR).



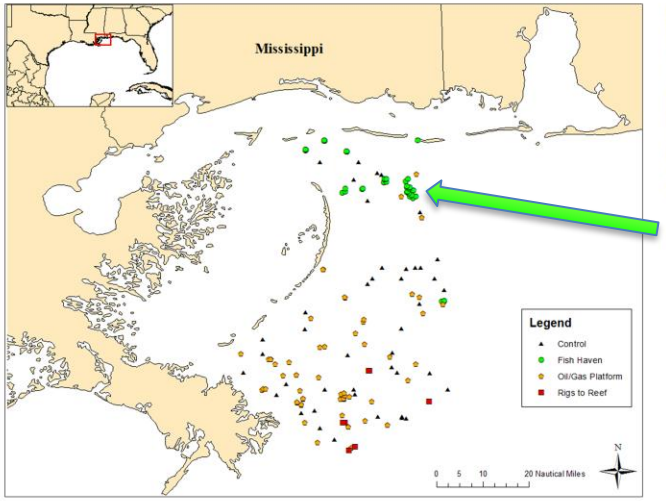
Reproduction

Gonads of target species are assessed to determine sex ratios, reproductive seasonality, size/age at maturity, fecundity, and spawning frequency.



Vertical Longline Field Work

Monthly vertical longline sampling was conducted April through October, in three depth strata (<20, 20-40, 50-100m) (see map right). Sampling protocols match those set forth by the Southeast Area Monitoring and Assessment Program (SEAMAP). Sampled sites include three replicate stations in one reef permit area in the shallowest depth zones and two Rigs to Reef sites in the deepest depth zone; three oil/gas platforms per depth zone; and two non-structure control sites. Three bandit reels are rigged with a 24 foot back bone outfitted with 10, 18 inch gangions. Each backbone is constructed with all 8/0, 12/0 or 15/0 circle hooks of zero offset. All lines are dropped to the bottom simultaneously and allowed to fish for five minutes prior to retrieval. Length and weight data are collected from all fish caught.



Trophic Ecology

Stomach and intestinal content of target species are assessed to determine feeding habits and ecology. Traditional macroscopic identification as well as genetic barcoding of unidentifiable prey techniques are used. Stable isotope analyses of muscle tissue is also implemented to better understand the trophic dynamics in the region.

Environmental Condition

Water quality and environmental samples were taken at all sample sites to assess surface, mid-water and bottom water temperature, salinity and dissolved oxygen conditions. Additionally, highly-resolved (0.25 m) vertical profiles of water temperature, salinity, density, dissolved oxygen and turbidity/clarity were obtained from select stations via CTD cast, along with surface and bottom water samples for laboratory quantitation of chlorophyll (via HPLC), dissolved inorganic nutrients (ammonium, nitrate, phosphate, and silica), dissolved and particulate carbon and nitrogen, and total suspended solids (wet, dry, and ash-free weights).

Age and Growth

Sagittae otoliths or spines are removed from target species, cut, mounted, and analyzed by microscope for ring counts to define fish biological age. These data are then used to determine age composition, life stage distributions, and age at length relationships for the population.

Thank You To Our Collaborators

NATIONAL FISH AND WILDLIFE FOUNDATION NFWF

MDEQ

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Fishery-Dependent Data Collection

Mississippi's Marine Recreational Information Program (MRIP) was expanded under this project to provide more precise and timely harvest and effort estimates. With the expansion, an offshore fishing endorsement was implemented; a phone app, web portal, and hotline were developed to enhance angler reporting and data validation; and an observer program was developed for the recreational for hire sector to assess landings discards and associated reporting biases.

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Artificial Reefs

Does Water Quality = Habitat Quality?

Offshore Artificial Reef Sites

Artificial Reef Site

NOT FOR NAVIGATION

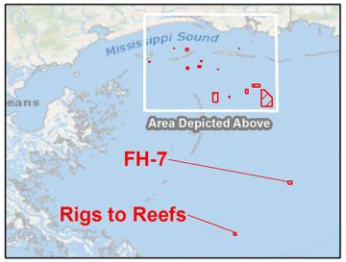
Nautical Miles

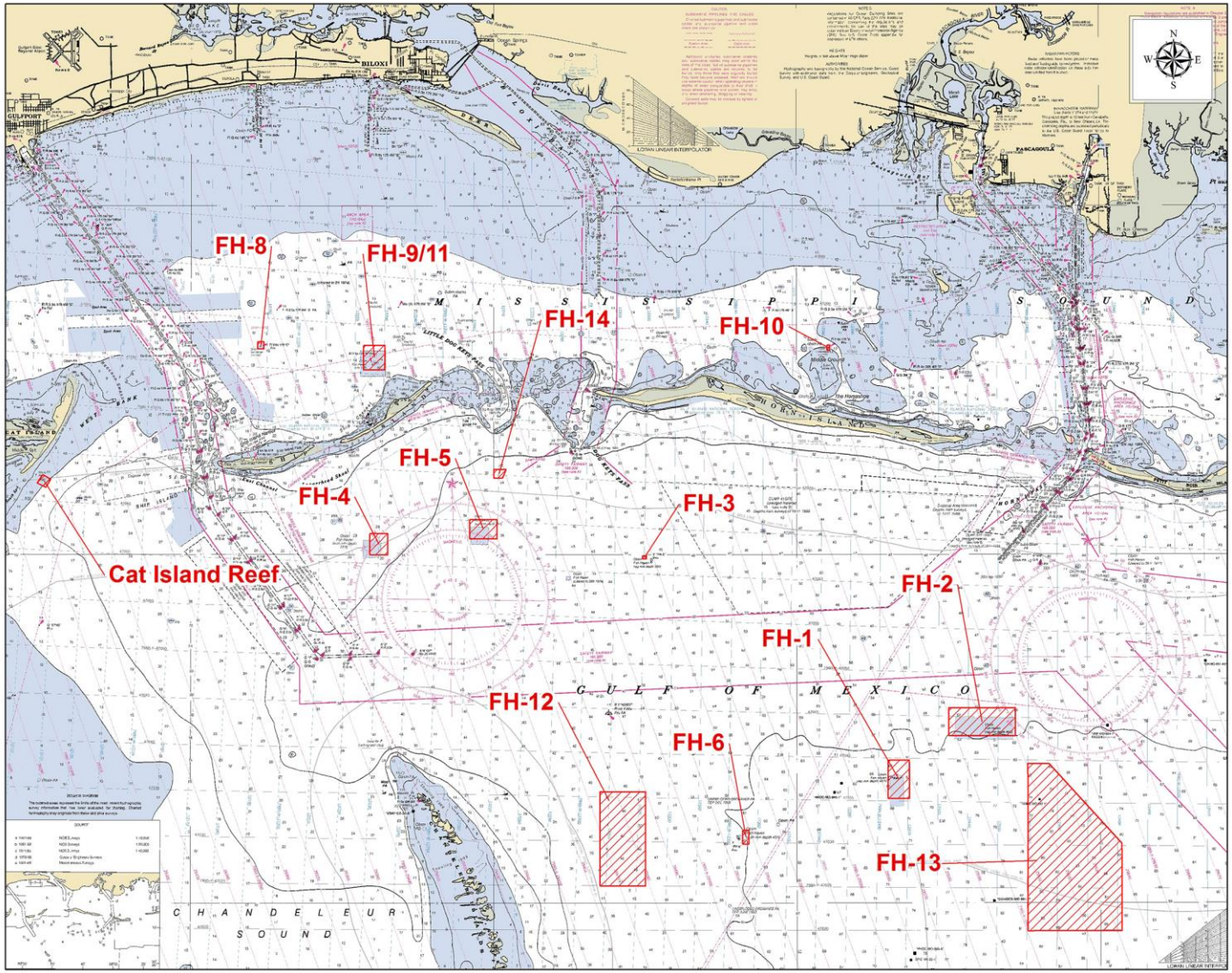
0 1 2 4 6 8

Based on NOAA Nautical Chart 11737
Mississippi Sound + Appr (Dauphin Island to Cat Island)

--FOR PLANNING PURPOSES ONLY--

Reef Center Points		
Fish Haven	Longitude	Latitude
FH-1	-88 36.648	30 03.552
FH-2	-88 33.9	30 05.202
FH-3	-88 45.03	30 09.918
FH-4	-88 53.802	30 10.302
FH-5	-88 50.352	30 10.728
FH-6	-88 41.7	30 01.902
FH-7	-88 24.102	29 37.098
FH-8	-88 57.702	30 16.002
FH-9/11	-89 04.854	30 12.102
FH-10	-88 38.952	30 15.93
FH-12	-88 45.75	30 01.848
FH-13	-88 30.852	30 01.188
FH-14	-88 49.8	30 12.318
Cat Island Reef	-88 53.952	30 15.648





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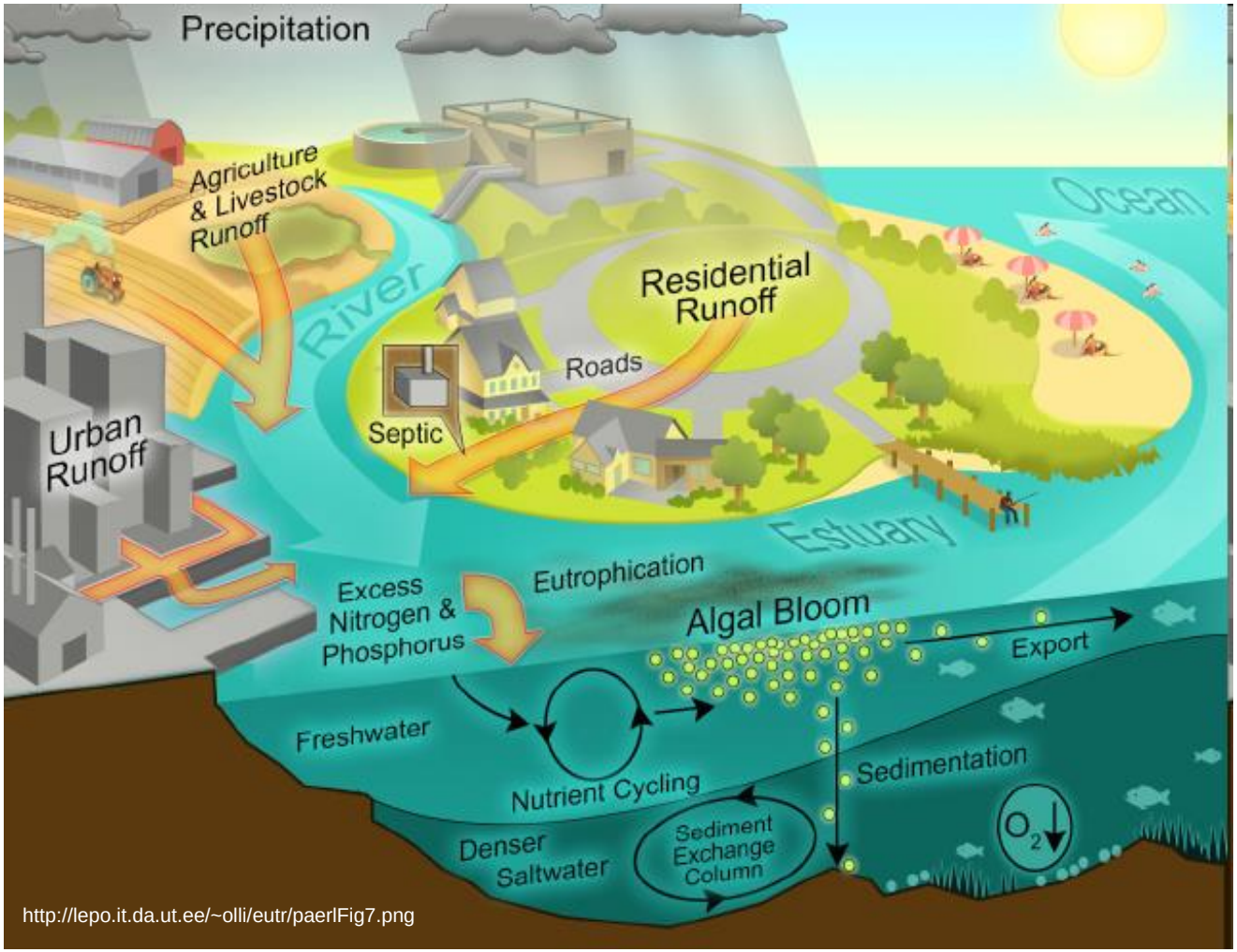
Frequency/Intensity of Hypoxia

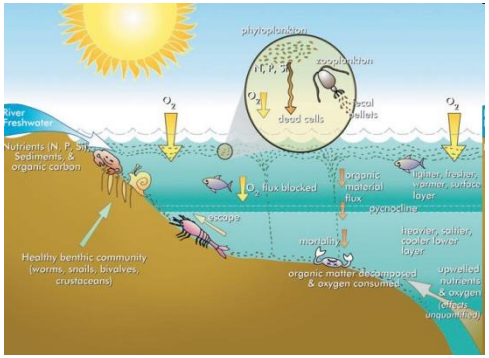
Stressors from the top-down…



http://lepo.it.da.ut.ee/~olli/eutr/paerlFig7.png

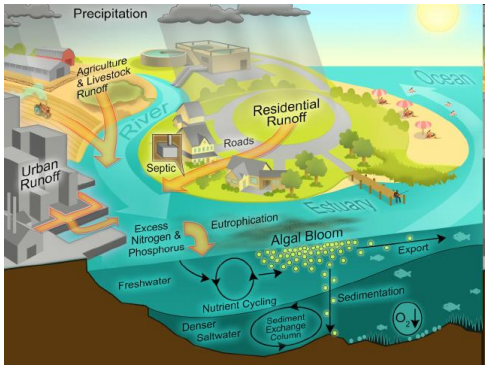
Top-down Stressors:

- O_2 Solubility
- O_2 Piston Velocity
- Thermal and/or Salinity Stratification
- Eutrophication
- Organic Load
- Sinking Detritus



Frequency/Intensity of Hypoxia

…and stressors from the bottom-up



http://www.epa.gov/owow_keep/msbasin/images/eutro_550w.jpg

Bottom-up Stressors:

- Limited Vertical Mixing
- Disphotic Bottom Water
- Bacterial Respiration of Detritus
- Mortality Event Feedback

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Continuous WQ Monitoring

On-reef Logger Deployments

Offshore Artificial Reef Sites

Based on NOAA Nautical Chart
Mississippi Sound + Appr (Dauphin Island to Cat Island)

--FOR PLANNING PURPOSES ONLY--

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FH-8	-88 57.702	
FH-9/11	-89 04.854	
FH-10	-88 38.952	
FH-12	-88 45.75	
FH-13	-88 30.852	
FH-14	-88 49.8	
Cat Island Reef	-88 53.952	

Mississippi Department of Marine Resources
Artificial Reef Habitat Mapping Program
Fish Havens Feature Report

February 2016

Artificial Reef Mapping Program
Rigs to Reefs Site FH1

DAVID EVANS AND ASSOCIATES INC. MARINE SERVICES

Feature FH01-30

Position (NAD83)	30° 03.27466' N	088° 36.48875' W
Clearance (MLLW)	15.57 m	51.1 ft

Prepared for:

Mississippi Department of Marine Resources
1141 Bayview Avenue
Biloxi, MS 39530

Prepared by:

David Evans and Associates, Inc.
14231 Seaway Rd, Suite 4002
Gulfport, MS 39503

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Logger Deployment

Dive support courtesy of MGFB

Join this group to see the discussion, post and comment. + Join Group

MEMBERS 1,232 Members

DESCRIPTION

Website: http://www.mgfb.org/

Mississippi Gulf Fishing Banks, Inc. is a non-profit organization dedicated to developing and monitoring fishing reefs off the Mississippi Gulf Coast. The foremost intent of the Fishing Banks is to improve Mississippi's fishing and diving. Members come from all walks of life including sport fishermen, charter boat skippers, commercial fishermen, or just the average "Joe" interested in Mississippi's offshore fishing. All are invited to participate. The annual dues are only ten dollars each. The members meet at 7:00 P.M. at the Biloxi Yacht Club. The group was funded by Harrison and Jackson Counties along with federal funds that become available on a matching basis, but recent budget cuts have left the group without any funding and are currently operating on reserves and fund raising.

Members (1,232) See All

Reef Center Points		
Fish Haven	Longitude	Latitude
FH-1	-88 36.648	
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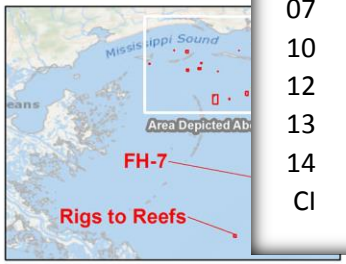

FH	NAME	YLAT	XLON	ZDEP (ft)	ZDEP (m)
01	"Ole Faithful" Shrimp Boat	30.054578	-88.608146	69.5	21.2
02	"St. Elmo" Shrimp Boat	30.080324	-88.554626	62.0	18.9
03	Unnamed Chevron Vessel	30.165612	-88.750057	45.5	13.9
04	"Ship Island C" Barge	30.170440	-88.898543	31.8	9.7
06	"B Site" Reef Balls	30.034411	-88.694896	60.5	18.4
07	"Jumbo" Barge	29.614597	-88.410028	134.9	41.1
10	CableOne Antennae	30.264883	-88.649242	16.0	4.9
12	"Frank Taylor" Shrimp Boat	30.048114	-88.758024	45.7	13.9
13	"Barataria Bay" Pogy Boat	29.993423	-88.505826	89.3	27.2
14	"My Wife II" Shrimp Boat	30.206700	-88.830733	34.0	10.4
CI	Unnamed Shrimp Boat	30.202517	-89.081833	12.0	3.7

Logger Package

Temperature, Conductivity, and Dissolved O_2

Continuous logging @ 15 min intervals

HOBO U24-002C

- Temperature (0.01° C resolution)
- Conductivity (2 µS/cm resolution)
- Salinity (calculated using PSS-1978)

- Calibrated pre- and post-deployment

  (12,880 µS/cm & 53,000 µS/cm standards)

HOBO U26-001

- Temperature (0.01° C resolution)
- Dissolved O_2 (0.02 mg/L resolution)

- Calibrated pre- and post-deployment

  (100% & 0% Saturation)

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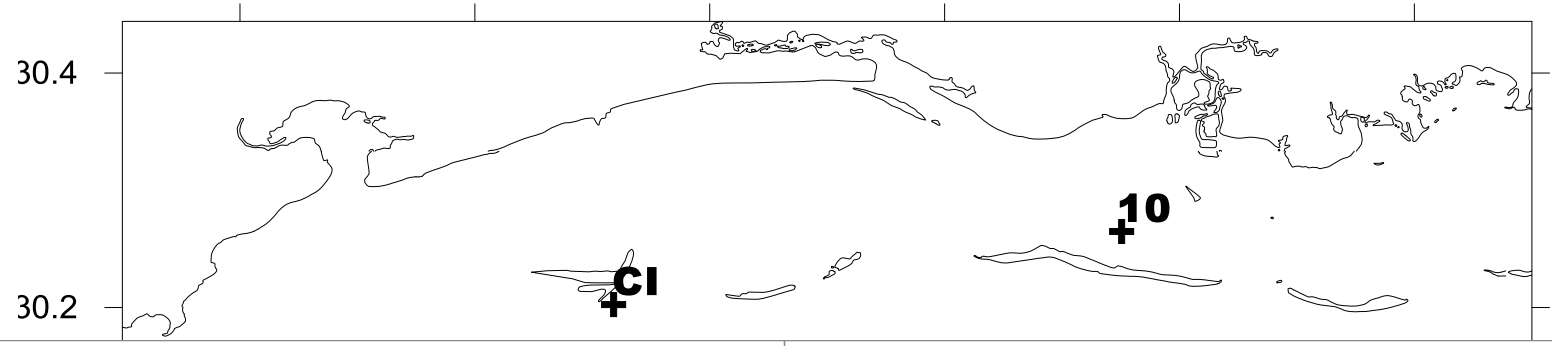
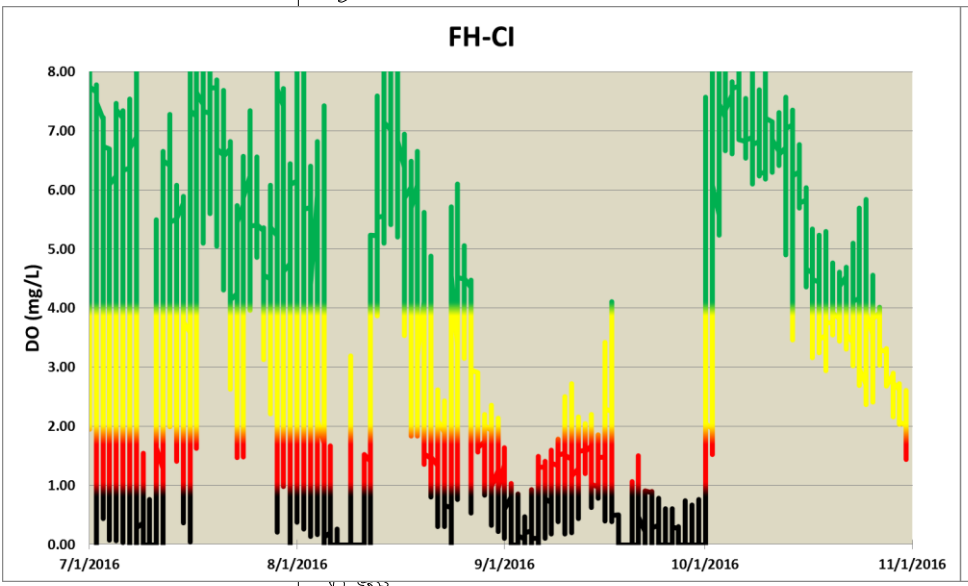
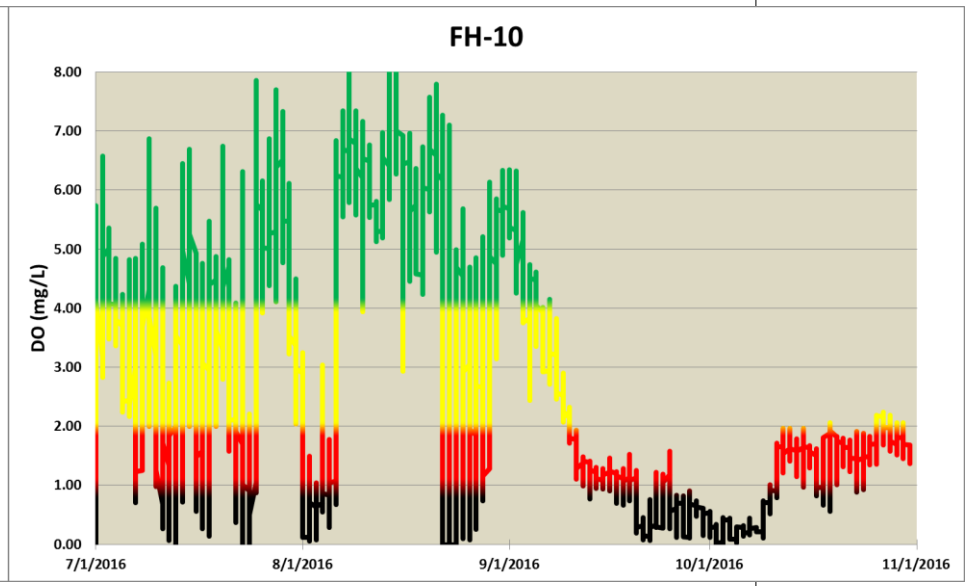
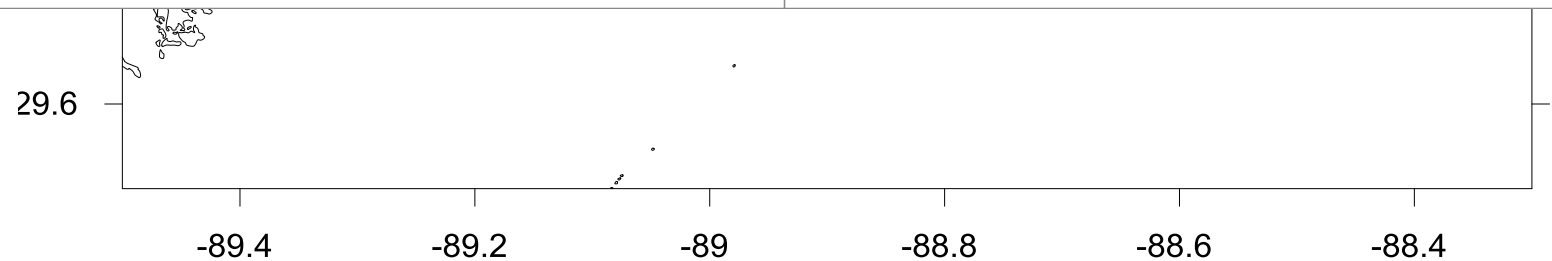
Hypoxia Data

3.5 – 5.0 m Fish Havens









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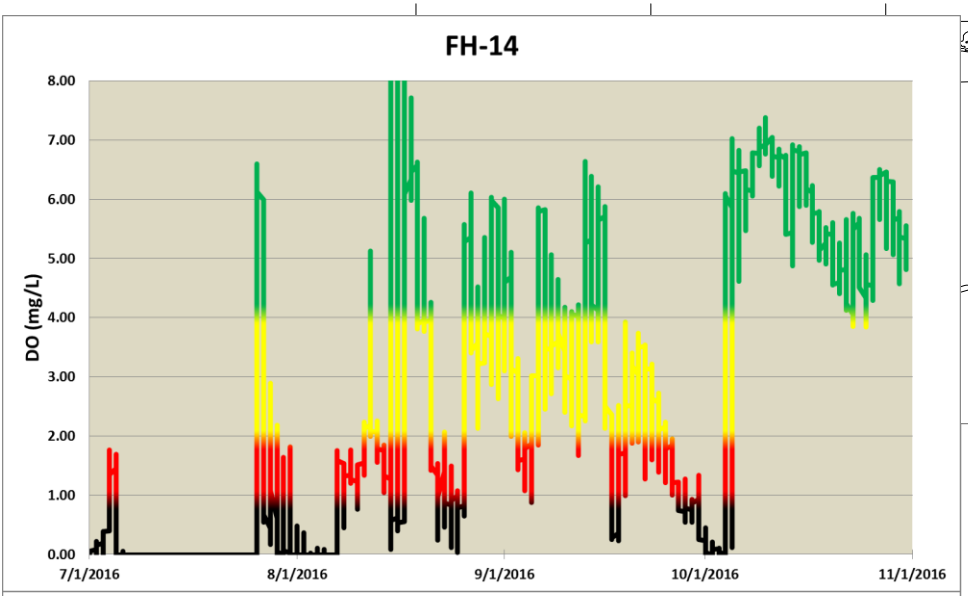
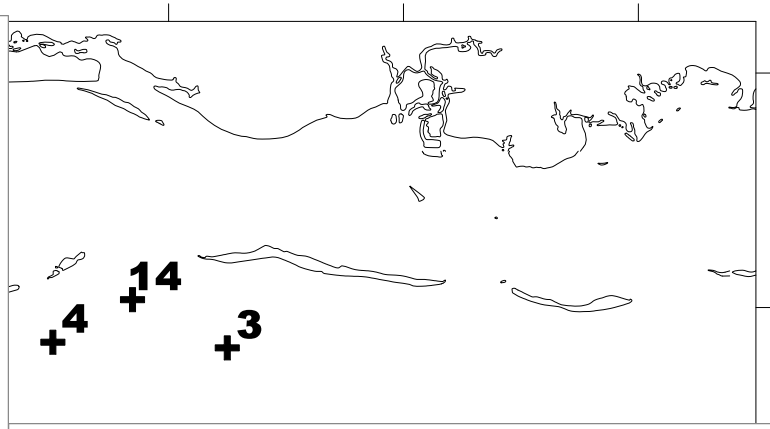
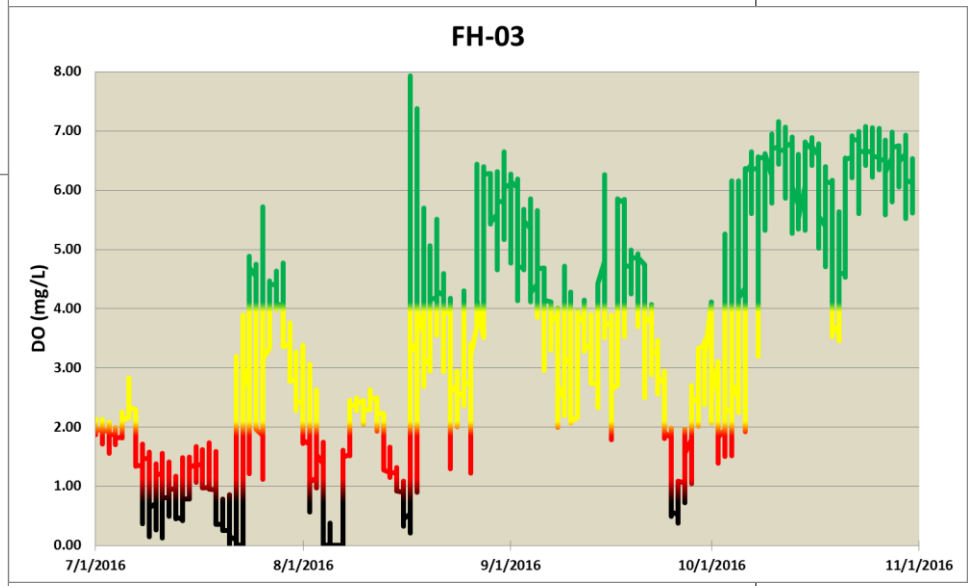
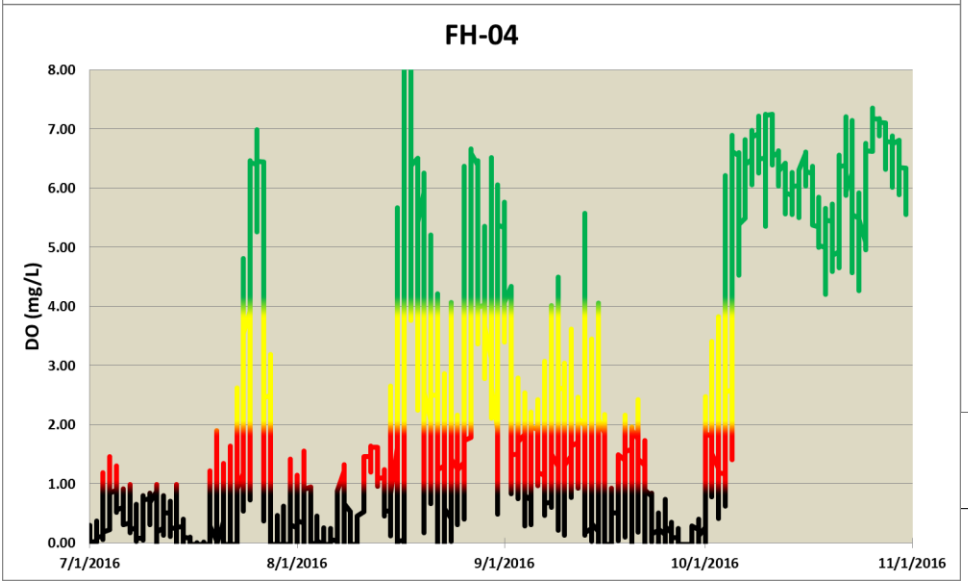
Hypoxia Data

10.0 – 14.0 m Fish Havens









-88.8 -88.6 -88.4

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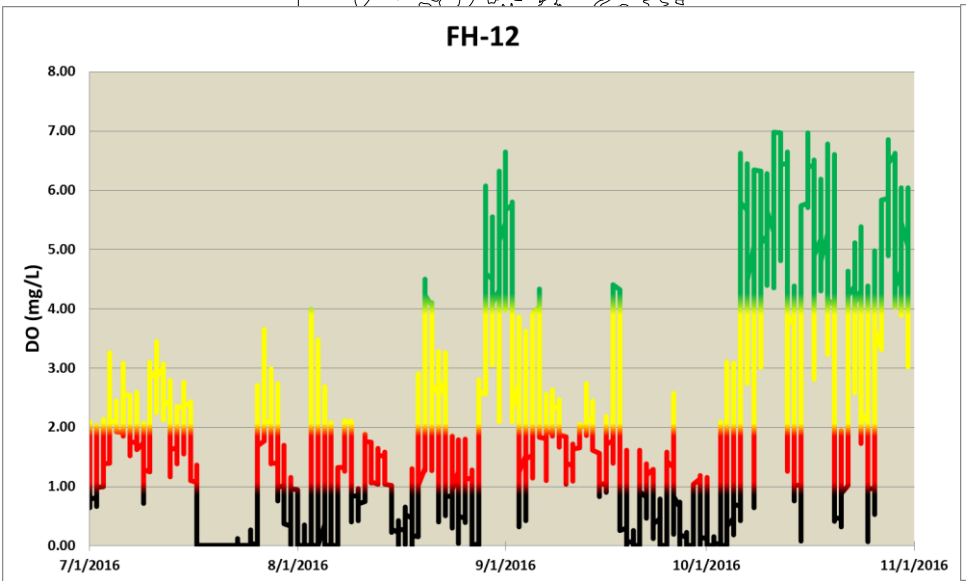
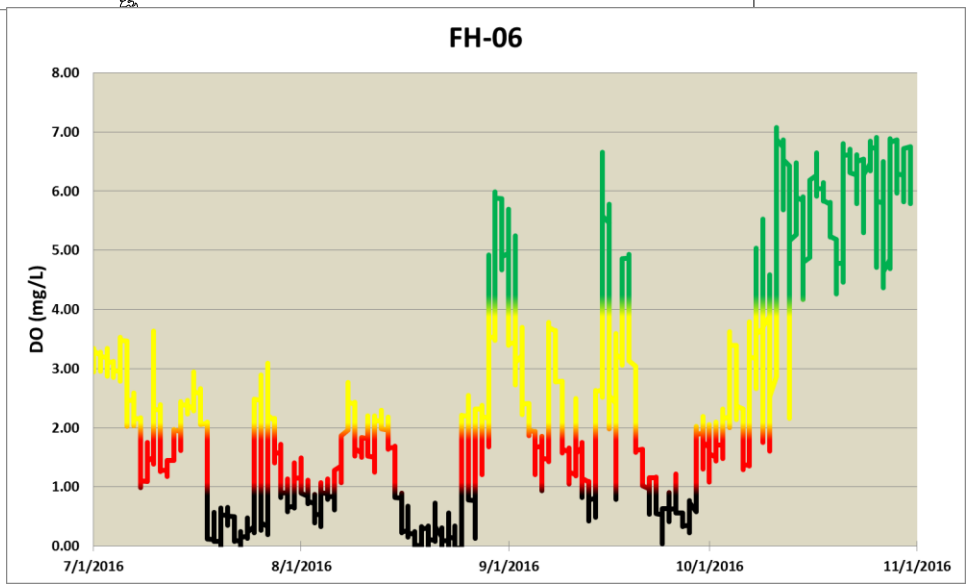
Hypoxia Data

14.0 – 18.5 m Fish Havens





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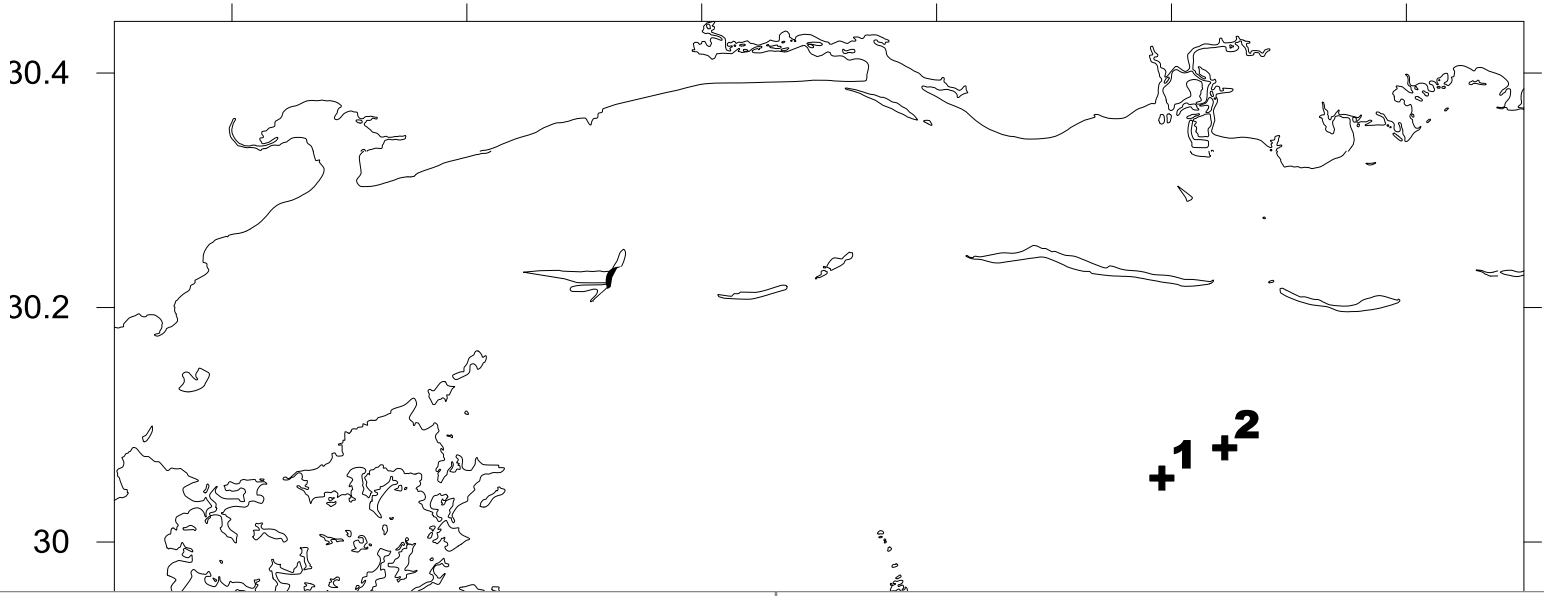
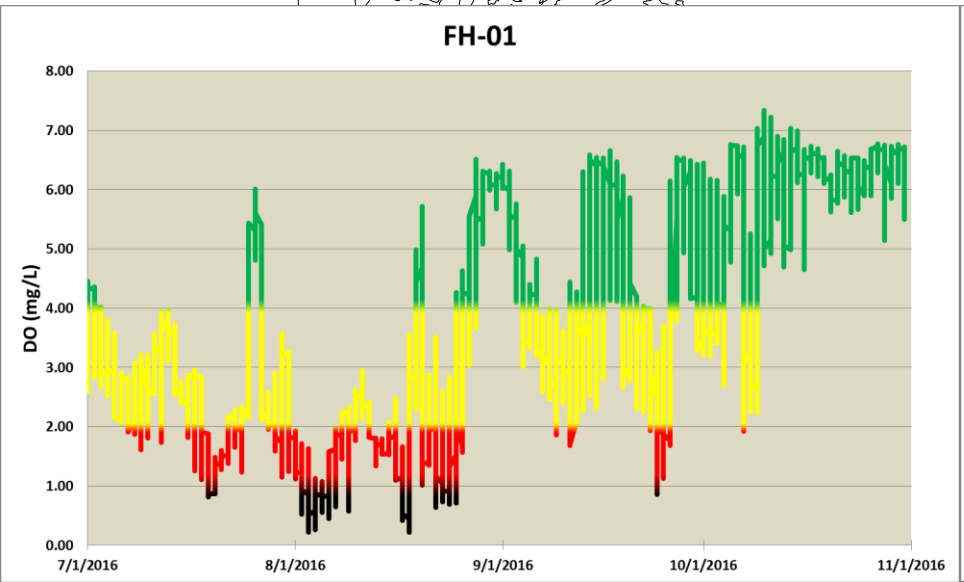
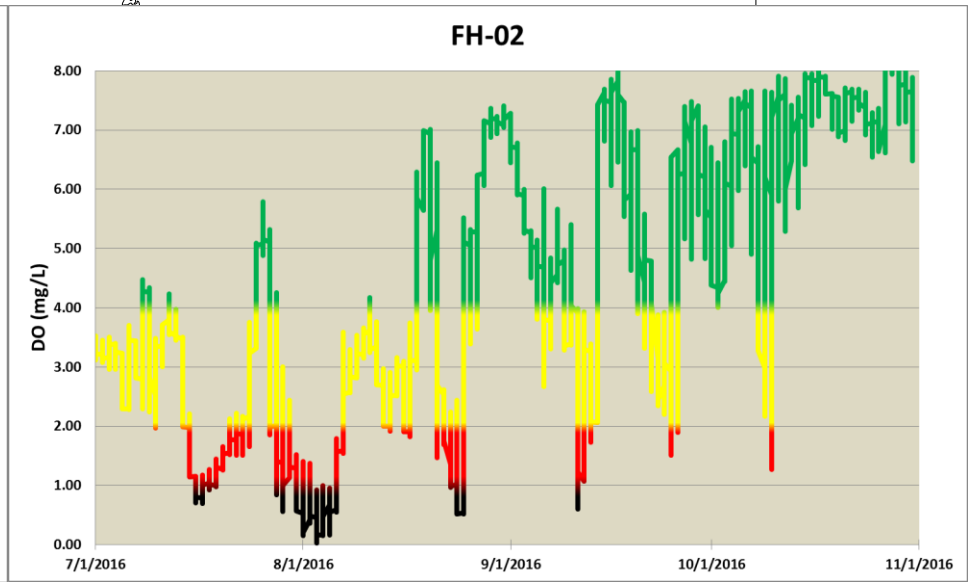
Hypoxia Data

18.5 – 21.0 m Fish Havens







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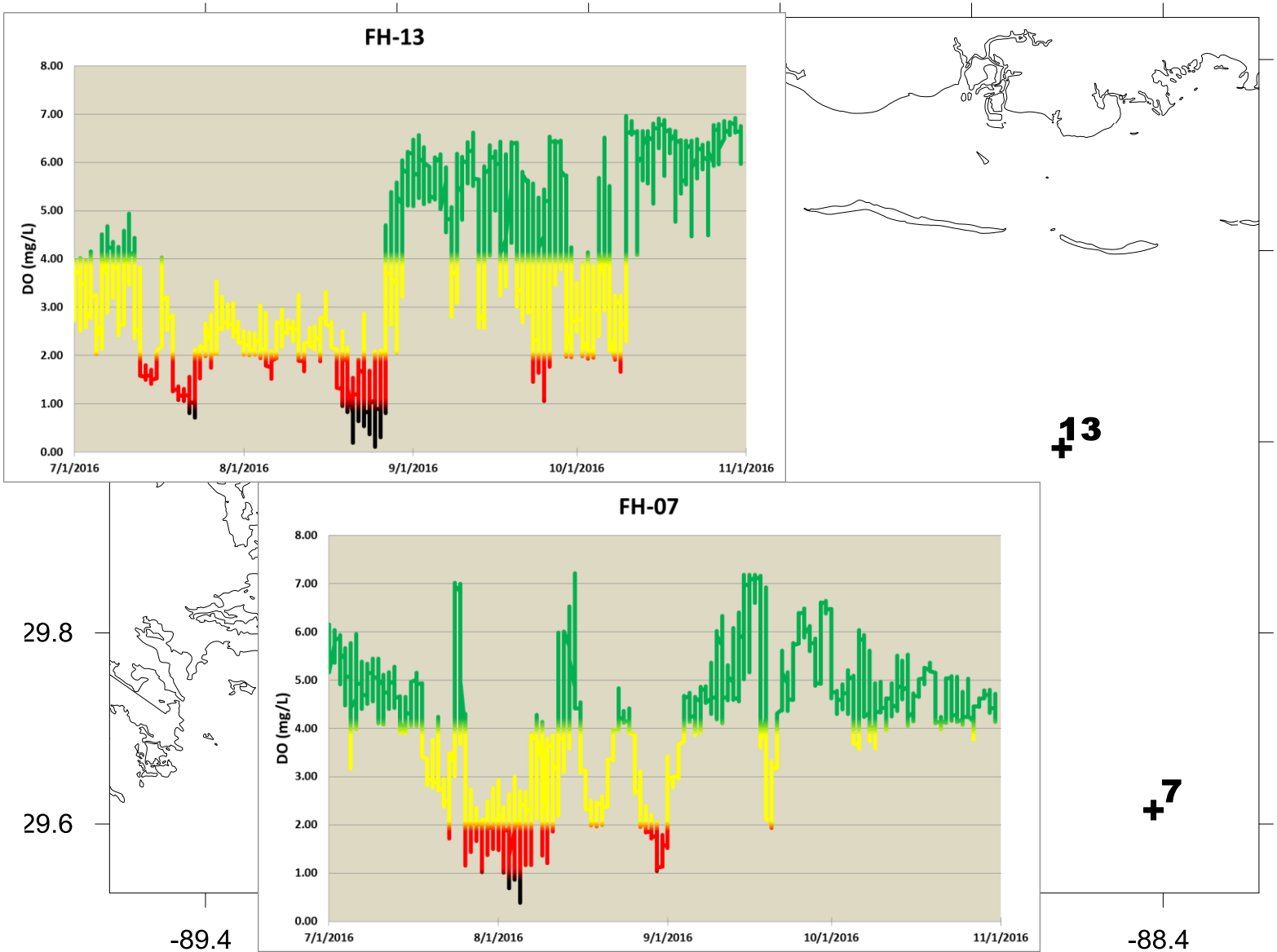
Hypoxia Data

27.0 – 41.0 m Fish Havens



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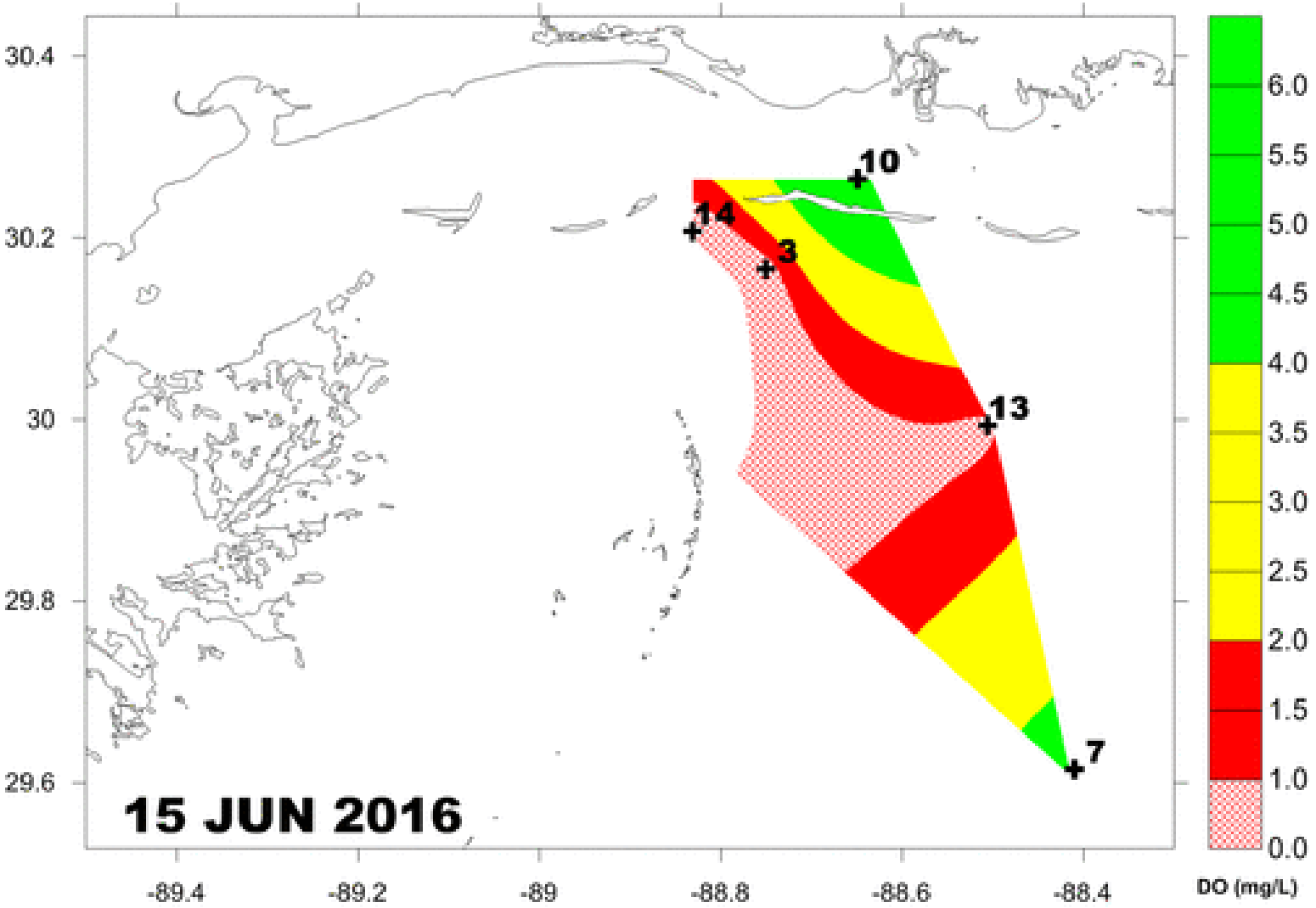
Hypoxia Data

Spatio-temporal patterns of hypoxia in 2016



Conclusions

- Nearshore reefs (10 & CI) witnessed the onset of significant hypoxia in September, while the opposite occurs (*i.e.* hypoxia season ends) for offshore reefs in September.

- Reefs located in 10-18 m (3, 4, 6, 12, 14) in the western Bight experienced significant, persistent hypoxia which would likely prevent invertebrate colonization / reef habitat stabilization.

- Reefs located in 19-47 m (1, 2, 7, 13) in the eastern Bight were somewhat more protected from hypoxia events and therefore represent a more favorable location for reef creation and long-term habitat success.

- Companion WQ data (CTD casts, TSS, chl-a, nutrients, POC) are still being analyzed as part of a larger effort to assess the genesis of these recurrent WQ issues…

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Acknowledgements

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