Gulf Science Update and Summary of Hypoxia Zone in 2018

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Mississippi River Gulf of Mexico Watershed Nutrient Task Force

Hypoxia Task Force Meeting
Baton Rouge, LA, May 2019

Outline

- Hypoxia zone monitoring cruise, forecast and retrospective analysis
- Ongoing hypoxia impacts research, key publications and accomplishments and gulf wide monitoring and coordination efforts
- Outlook for upcoming season

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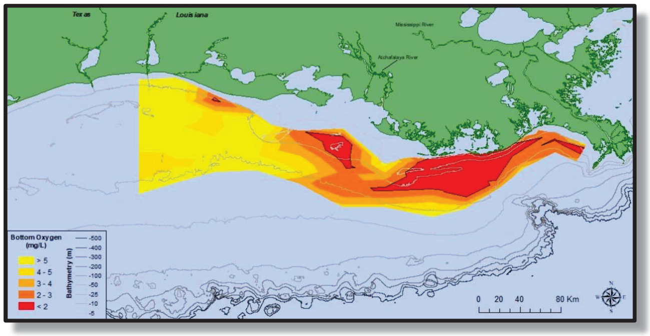
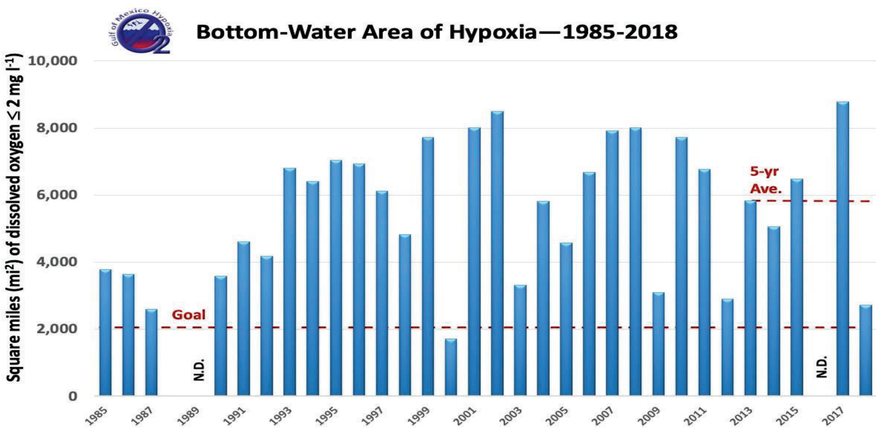
2018 Hypoxic Zone Monitoring Results



Mid-summer extent of hypoxic zone – metric to assess progress toward HTF Coastal Goal

Measured Size= 2,780 square miles

5-year average = 5,770 square miles



Long-term monitoring data set

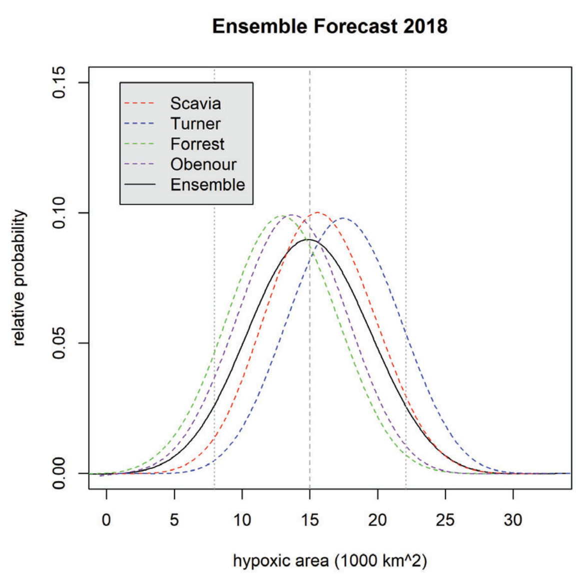
From Nancy Rabalais (LSU/LUMCON)

JOINT NEWS RELEASE
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
U.S. GEOLOGICAL SURVEY

-- June 7, 2018 –

Average Sized Dead Zone Forecast for Gulf of Mexico

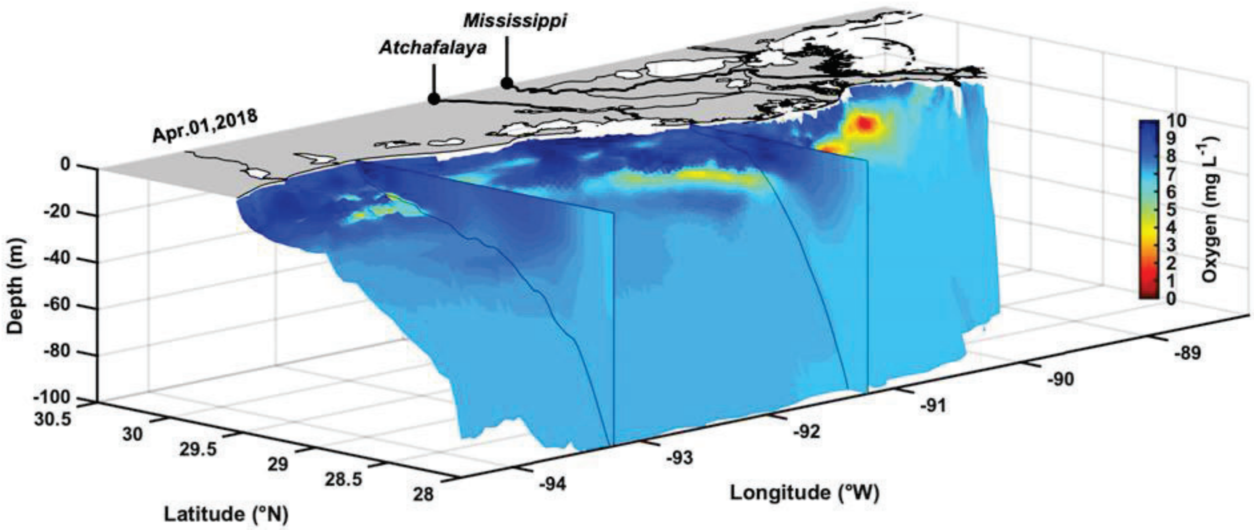
NOAA scientists are forecasting that this summer's Gulf of Mexico hypoxic zone or 'dead zone' – an area of low to no oxygen that can kill fish and other marine life – will be approximately 5,780 square miles [14,970 square kilometers], approximately the size of Connecticut

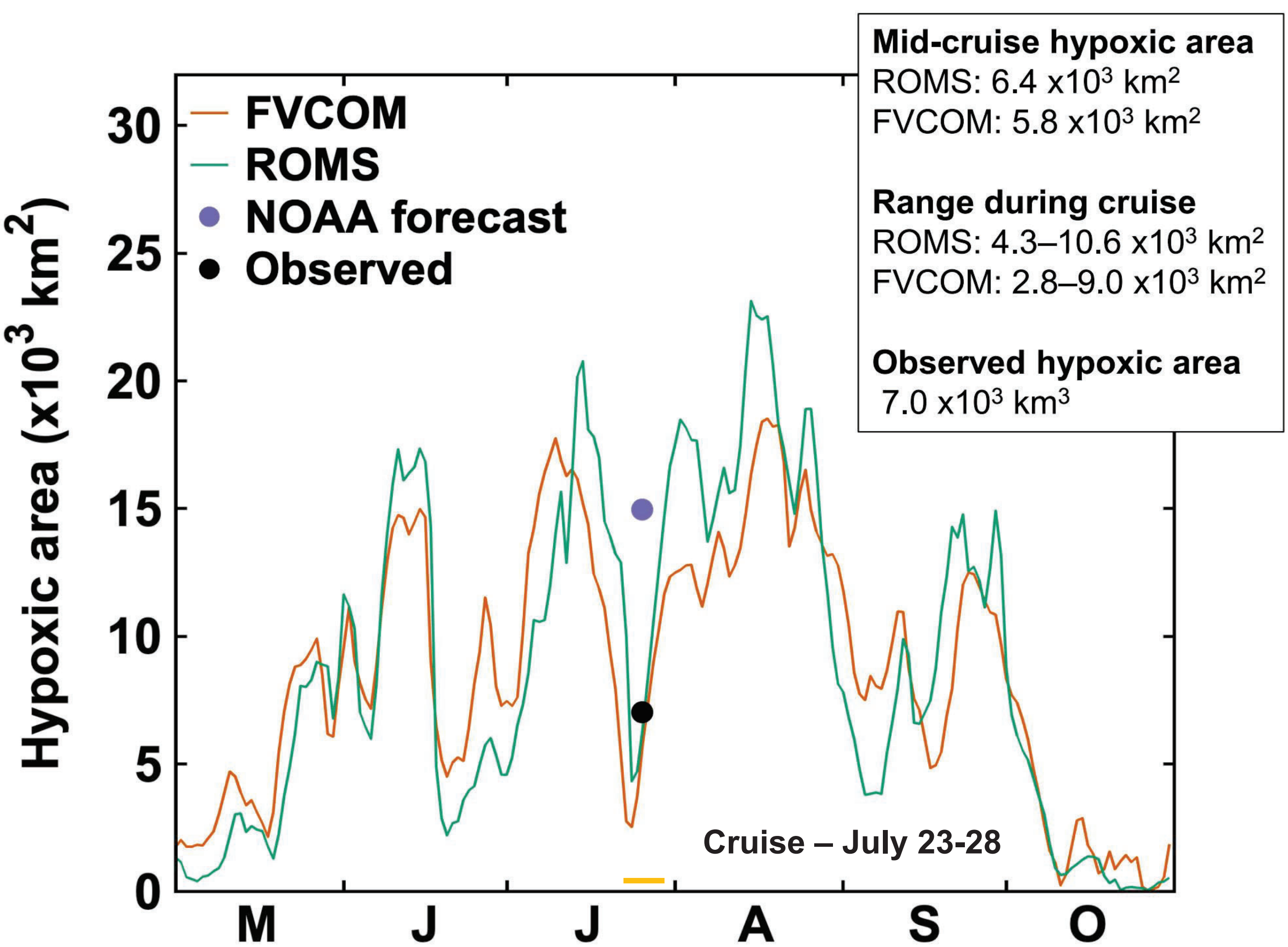


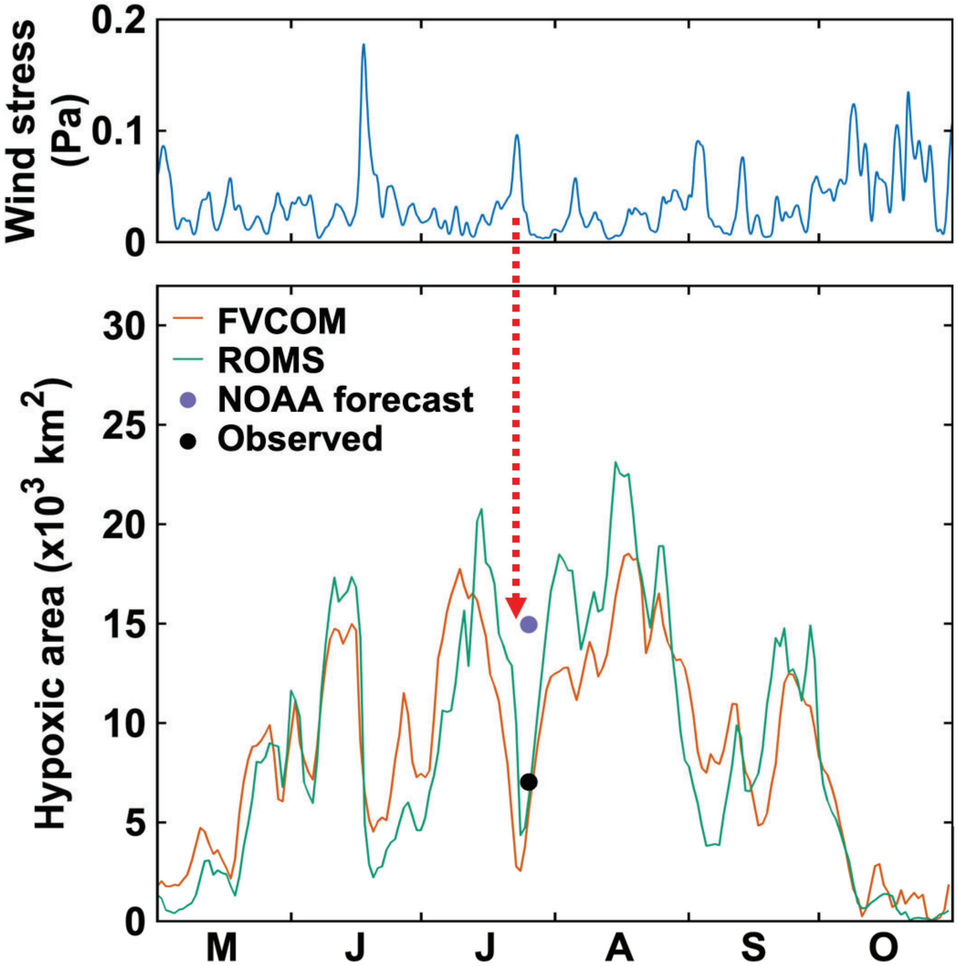
Models that simulate the 3-D Zone have added value

- Models can predict the future zone conditions
- Models can be used to estimate area, volume, and duration
- Models can recreate (hindcast) the zone to explain what happened

FVCOM



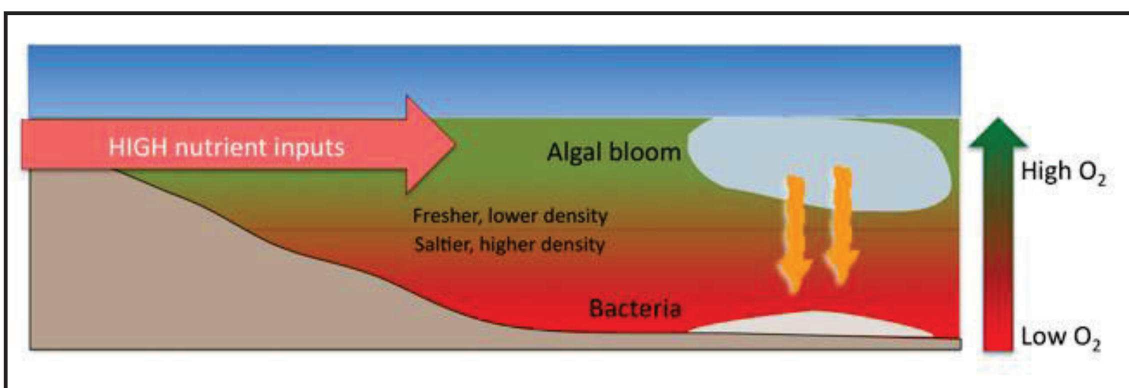




Strong wind events coincide with large decreases in hypoxic area that are only temporary.

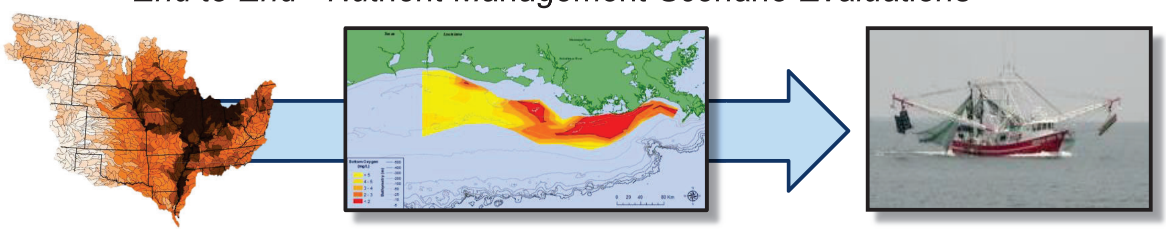
Small zones do not always reflect nutrient reductions

- **High nutrient inputs and calm conditions leading to water stratification are both needed for hypoxic zone formation.**



The 5-year average helps deal with a dynamic zone

- **We average across years (snapshots) to have a more robust measure.**
- **The annual cruise offers the only monitoring based metric available, but with newer models we can ask important questions about the metric and consider additional metrics:**
    - *When is the zone the largest and how often does the cruise capture it?*
    - *How long is the zone present (seasonal duration)?*
    - *What is the volume?*
    - *How might diversions affect hypoxia?*
    - *"End to End" Nutrient Management Scenario Evaluations*



Quantifying the ecological impacts of hypoxia

Synthesis of long-term datasets and modeling of data to support fisheries and hypoxia management in the NGOM

Scientific PI: Dan Obenour (NCSU); Kevin Craig (NOAA NMFS)

Linking models to connect nutrient pollution and impacts of diversions on hypoxia and the subsequent impacts on living resource

Scientific PI: Kenny Rose (UMCES), Dubravko Justic (LSU); Kevin Craig (NOAA NMFS)

User-Driven Tools to Predict and Assess Effects of Reduced Nutrients and Hypoxia on Living Resources in the GOM

Scientific PI: Kim de Mutsert (George Mason U); App. PI: Matt Campbell (NOAA NMFS)

Brown Shrimp

Atlantic Croaker

Gulf Menhaden

Red Snapper

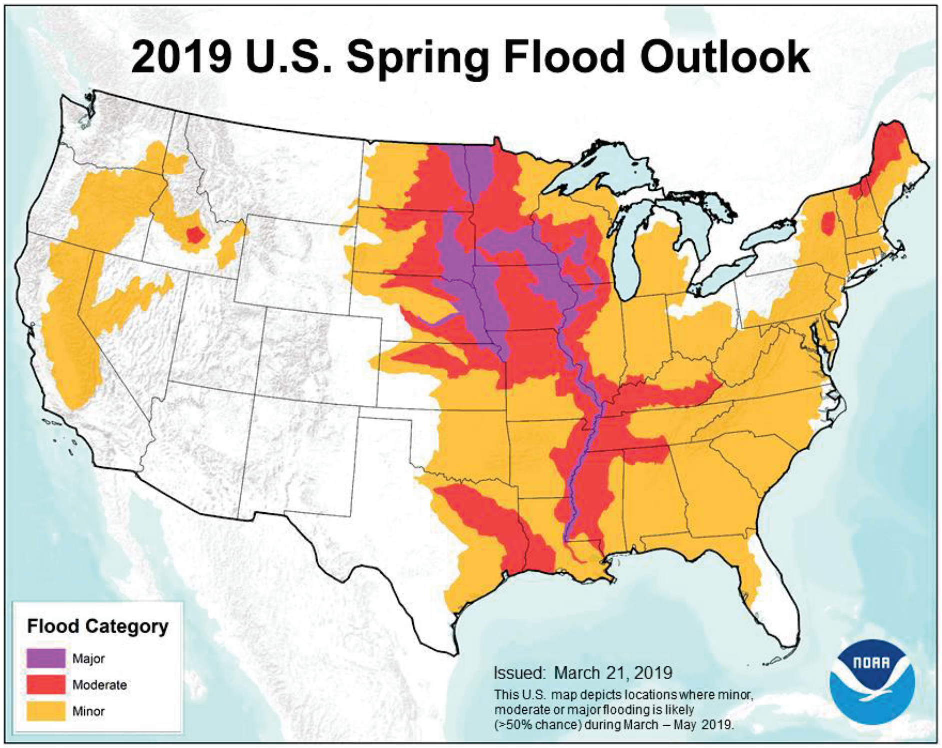
Recent Hypoxia Research Efforts and Publications

Several publications have come out with implications for hypoxic zone monitoring, forecasting, economic impacts and management targets.

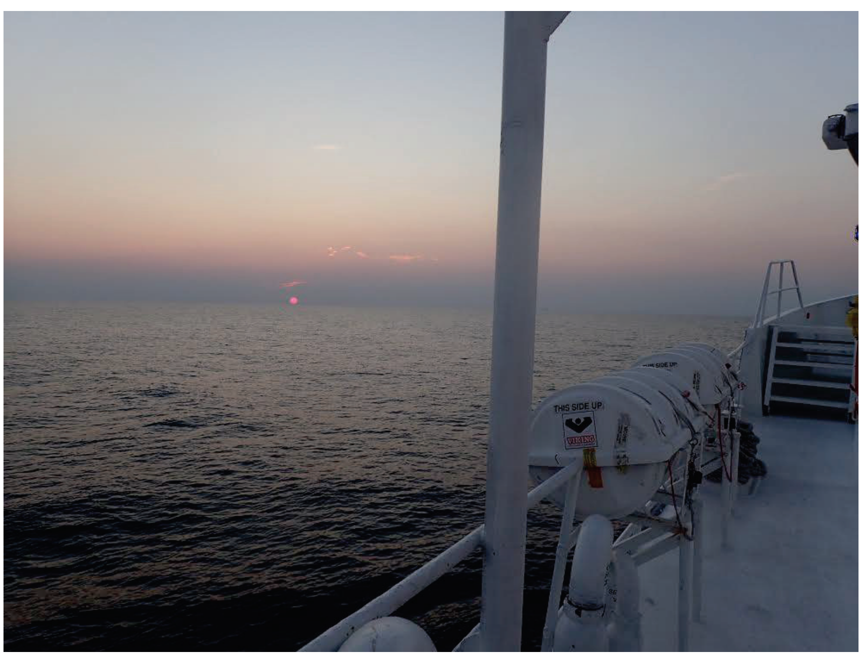
- Adding phosphorus reduction targets lowers the amount of nitrogen reductions required to meet the Task Force goal (Fennel and Laurent, 2018) over reducing nitrogen only (Scavia et al., 2017)
- A summer-wide average of zone size may be a better metric for measuring hypoxia (Matli et al., 2018)
- Hypoxic volume is more responsive than hypoxic area to nutrient load reductions (Scavia et al., 2018)
- Shrimpers are having to travel further to avoid hypoxic waters and the value of shrimp is affected (Smith et. al 2017; Purcell et al., 2017)

Cooperative Hypoxia Assessment and Monitoring Program (CHAMP)

Outlook for the 2019 Hypoxia Season



Thank you



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Additional Slides

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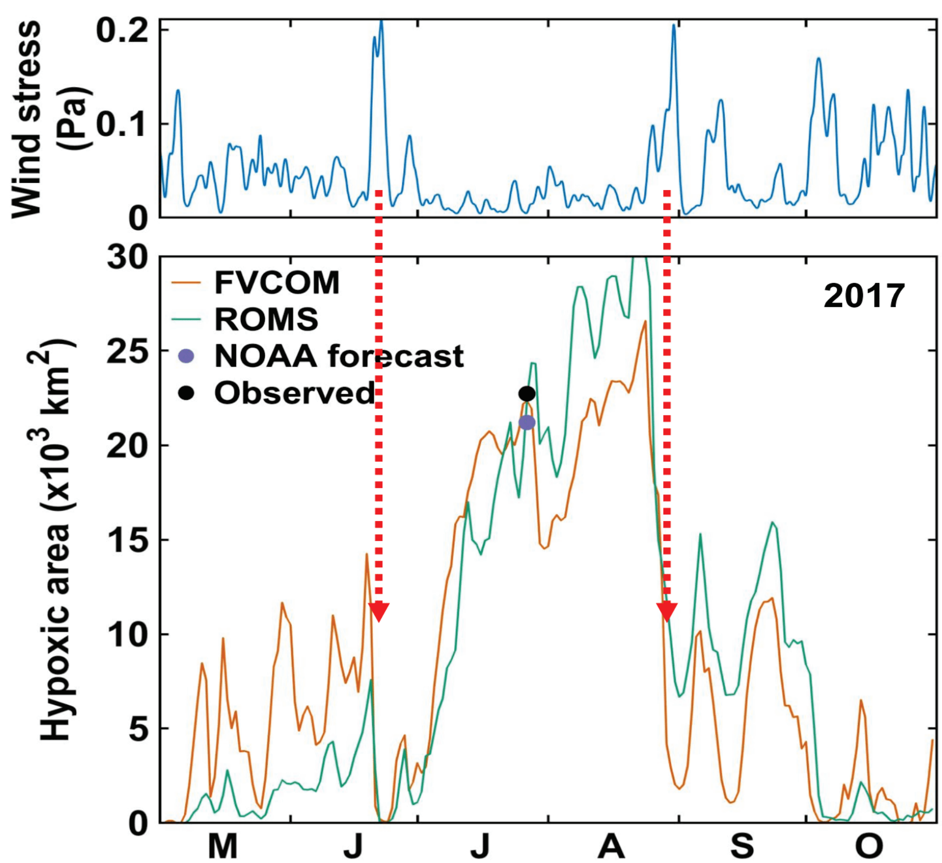
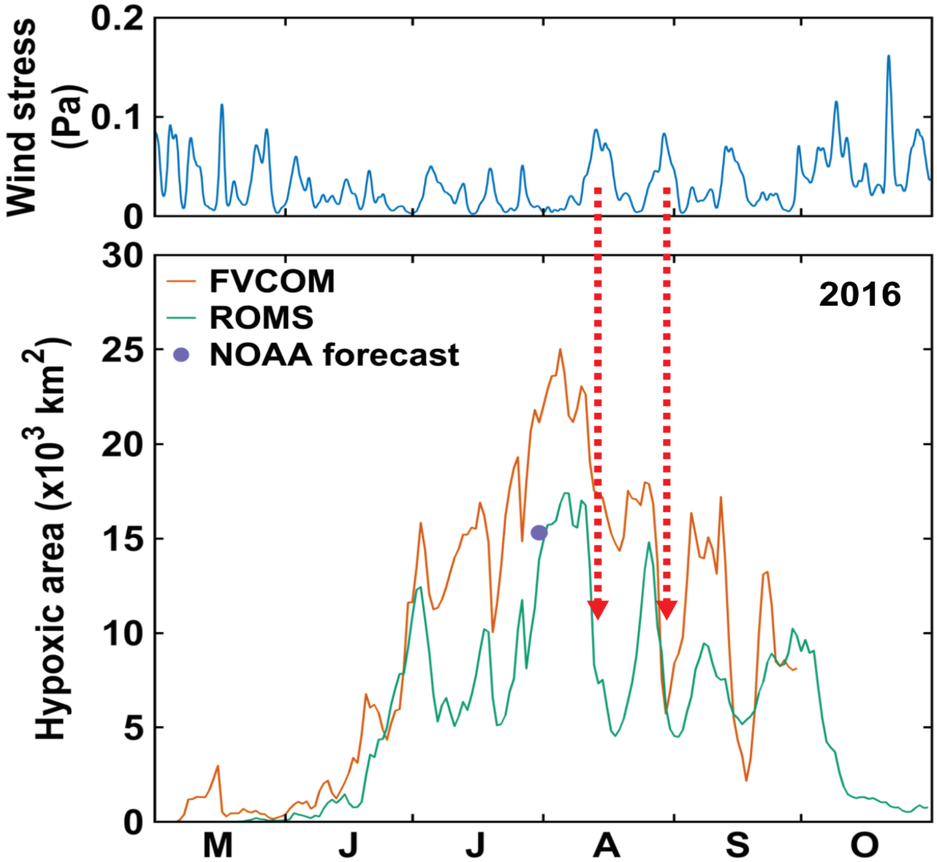
Retrospective – 2017 Season



In 2017 there were no strong wind events between mid July and the end of August. But strong winds in late June and late August coincided again with large decreases in hypoxic area.

Retrospective – 2016 Season



In 2016 a series of smaller wind events throughout the summer led to reoccurring temporary reductions in hypoxic area.

Recent Hypoxia Research Efforts and Publications

Several publications have come out with implications for hypoxic zone monitoring, forecasting, economic impacts and management targets.

Nutrient Reduction Targets

- Fennel, K. and Laurent A. 2018. **N and P as ultimate and proximate limiting nutrients in the northern Gulf of Mexico: implications for hypoxia reductions strategies**. Biogeosciences, 15: 3121-3131. https://doi.org/10.5194/bg-15-3121-2018
- Scavia, D., J. Dubravko, D.R. Obenour, K. Craig, L. Wang. 2018. **Hypoxic volume is more responsive than hypoxic area to nutrient load reductions in the northern Gulf of Mexico – and it matters to fish and fisheries.** Env. Res. Lett. https://doi.org/10.1088/1748-9326/aaf938.

Fisheries Impacts

- Smith MD, Oglend A, Kirkpatrick AJ, Asche F, Bennear LS, Craig JK, Nance JM. **Seafood prices reveal impacts of a major ecological disturbance.** Proceedings of the National Academy of Sciences. 2017; Jan 30:201617948. 10.1073/pnas.1617948114.
- Purcell KM, Craig JK, Nance JM, Smith MD, Bennear LS (2017) **Fleet behavior is responsive to a large-scale environmental disturbance: Hypoxia effects on the spatial dynamics of the northern Gulf of Mexico shrimp fishery.** PLoS ONE. 12(8): e0183032. https://doi.org/10.1371/journal.pone.0183032

Monitoring and Modeling

- Scavia D., I. Bertani, D. R. Obenour, R. E. Turner, D. R. Forrest, A. Katin. 2017. **Ensemble modeling and Gulf of Mexico hypoxia.** Proceedings of the National Academy of Sciences, 114 (33) 8823-8828; DOI: 10.1073/pnas.1705293114
- V. Rohith Reddy Matli, Shiqi Fang, Joseph Guinness, Nancy. N. Rabalais, J. Kevin Craig, and Daniel R. Obenour (2018). Space-Time Geostatistical Assessment of Hypoxia in the Northern Gulf of Mexico. Environmental Science & Technology 2018 52 (21), 12484-12493, DOI: 10.1021/acs.est.8b03474

Climate Effects

- Laurent, A., Fennel, K., Ko, D. S.,Lehrter, J. (2018). **Climate change projected to exacerbate impacts of coastal eutrophication in the northern Gulf of Mexico.** Journal of Geophysical Research: Oceans, 123, 3408–3426. https://doi.org/10.1002/2017JC013583