Gulf of Mexico: Ocean and Coastal Acidification Research and Monitoring Gaps – Executive Summary

Jennifer Vreeland-Dawson
Janet J. Reimer, Emily R. Hall

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GULF OF MEXICO SOUTHEAST
COASTAL ACIDIFICATION NETWORKS' STAKEHOLDER FEEDBACK PROJECT

NOAA
SECOORA Southeast Coastal Ocean Observing Regional Association
GCOOS GULF OF MEXICO COASTAL OCEAN OBSERVING SYSTEM
OAP NOAA OCEAN ACIDIFICATION PROGRAM

Background

The Gulf of Mexico is home to highly diverse marine, coastal, and estuarine environments including ecosystems that contribute significantly to the U.S. Blue Economy. These systems contain several habitats and species including shellfish, coral reefs, and carbonate seafloor environments that are vulnerable to acidification. Gulf of Mexico seawater chemistry is highly complex but remains relatively under-observed with respect to acidification and poses critical knowledge, research, and monitoring gaps that limit our current understanding of environmental, ecological, and socioeconomic impacts. The habitat diversity over multiple climate zones makes international collaboration key to understanding the influence of acidification causes and changes in the Gulf of Mexico. In addition to the CO_2 from the atmosphere, acidification in the region is influenced by a complex interplay of processes and multiple stressors such as increasing water temperature, ocean circulation, river water, excess nutrient input, harmful algal blooms (HABs), low oxygen conditions, storms, and oil seeps and spills. Many industry stakeholders in the Gulf of Mexico are more concerned with low oxygen or harmful algal blooms than ocean and coastal acidification; however, these environmental stressors often interact, and little research has been conducted to evaluate these co-stressors. This document provides a brief summary of research and monitoring gaps identified in the 2022 Ocean Chemistry Coastal Community Vulnerability Assessment of the Interagency Working Group on Ocean Acidification as mandated by the 2020 Coordinated Ocean Observations and Research Act.

Social Vulnerability Gaps

The seafood industry in the Gulf of Mexico generated nearly $6 billion of income in 2019 and supported over 160,000 jobs. Recreational fishing activity, which generated over $1 billion in income in 2019 has supported over 40,000 jobs. **Figure 1** shows the number of jobs, gross sales, and employment income by state. Some of the most important species for commercial fisheries include blue crab, shrimp, oysters, tuna, red snapper, spiny lobster, menhaden, mullet, and grouper. Species of importance for recreational fisheries include Atlantic croaker, Gulf and Southern kingfish, sand and silver seatrout, sheepshead, red snapper, southern mackerel, and striped mullet. However, gaps remain in our understanding of ocean and coastal acidification chemistry, species and ecosystem impacts, and our ability to directly link species response to ocean and coastal acidification. These gaps make it difficult to estimate how commercial and recreational stocks will respond and the resulting economic impacts. There are also gaps in assessing how ocean and coastal acidification will affect marine resources that hold social or cultural values. Synthesis of socioeconomic data on potentially impacted species, ecosystems, industries, and resources is extremely limited in the region. Other key gaps of information also include:

- Economic and acidification data at smaller geographic scales;
- Understanding what increases sensitivity of communities to economic declines in fisheries that are driven by acidification;
- Development of social indicators specific to acidification to evaluate the vulnerability of coastal communities.

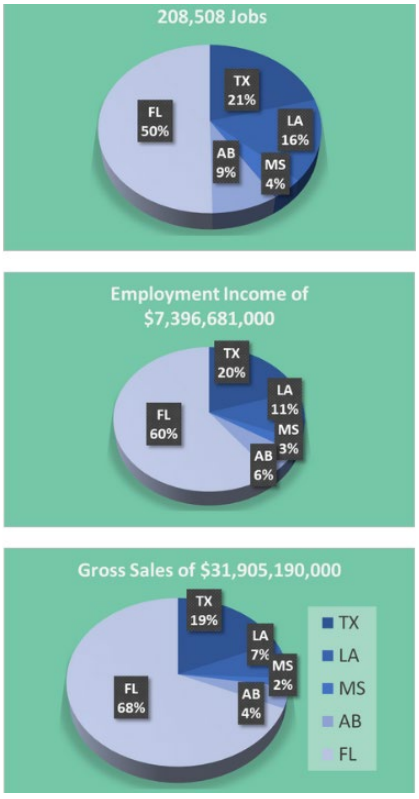

Figure 1. 2019 jobs and economic revenue from the recreational and commercial fishing industry in the Gulf of Mexico, including the west coast of Florida.

Exposure Gaps

Ocean and coastal acidification have been documented across much of the Gulf of Mexico, although conditions are highly variable and long-term sustained data are limited. Modeling approaches paired with the limited available data is a valuable strategy for filling monitoring gaps in the Gulf of Mexico. However,

sustained and additional monitoring is needed to track the progression and understand the causes of acidification across the region due to the diversity of environments and high degree of habitat and tidal, daily, seasonal, and yearly variability in carbonate chemistry. Due to limited observational data, impacts of acidification on coastal and seafloor habitats and species are poorly understood. Seasonal changes have not been well defined in the Gulf due to limited collection of data during winter and fall seasons. Targeted subsurface observations are critical for supporting research to understand vulnerable seafloor communities that are already exposed to more acidic waters, such as deep, cold-water coral habitats. A rigorous synthesis of existing historical and modern data relevant to acidification observations and research has not been conducted in the Gulf of Mexico. Other key gaps in information also include:

- Examining when acidification conditions occur and how long they persist to aid decision making for monitoring areas of interest;
- Informing habitat restoration and acidification reduction strategies;
- Improving ocean biogeochemical models that can also inform sampling and monitoring strategies;
- Modeling past and future changes in acidification.

Biological Response Gaps

The Gulf of Mexico is home to a range of marine habitats including salt marshes, seagrass and shellfish beds, mangroves, oyster reefs, and coral reefs that host economically, ecologically, and recreationally important marine species that are vulnerable to acidification. However, studies on impacts of acidification to Gulf species have been limited and mostly focused on a few economically important shellfish species (including Eastern oysters, Bay scallops, Hard clams, Queen conch, Gulf shrimp, and Florida stone crab). While the Gulf of Mexico has over 1,443 finfish species, studies of acidification-impacts on fish are also limited to only a few species. **Figure 2** shows which species have been studied and of those species have been commercially evaluated and impacted by acidification. The cascading indirect impacts of ocean and coastal acidification across the marine food web is not yet known. Little is known of how co-stressors interact with each other and with acidification, including impacts of these co-stressors to coastal and marine species and harmful algal blooms. Estuarine, coastal, and open marine habitats in the Gulf of Mexico provide a variety of ecosystem services that support food security, recreation, tourism, industry, and coastal hazards protection. Additional knowledge gaps include:

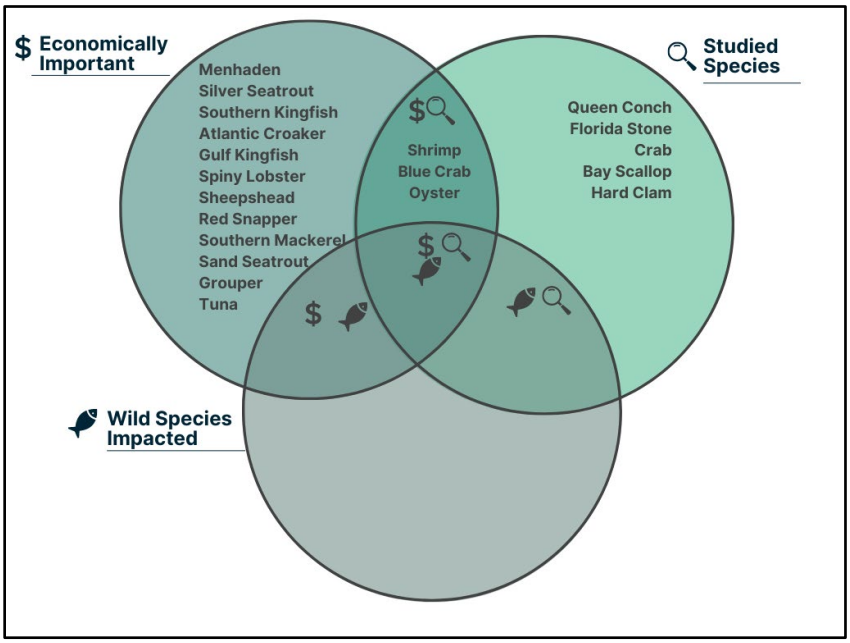

Figure 2. Of the economically important species, very few have been studied and it is not yet known if any of these species are impacted in the wild.

- Assessing the impacts of acidification on chemical erosion of the seafloor, elevation loss, relative sea level rise, and coastal hazards;
- Identifying resistant ecosystems and species;
- Conducting research to develop acidification reduction strategies;
- Monitoring trickle-down effects of multi-stressor impacts on marine species to ecosystem function and services.