Southeast: Ocean and Coastal Acidification Research and Monitoring Gaps – Executive Summary

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GULF OF MEXICO
SOUTHEAST
COASTAL ACIDIFICATION NETWORKS' STAKEHOLDER FEEDBACK PROJECT

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

Background

The Southeast region, North Carolina, South Carolina, Georgia, the east coast of Florida, and the Florida Keys, spans subtropical to tropical climate zones and encompasses diverse ecosystems and environmental conditions. While much of the Southeast and Caribbean region has higher seawater temperature and salinity, which act to decrease acidity, and lower carbon dioxide levels than in other regions, many coastal areas are experiencing higher rates of acidification than in the open-ocean. The Southeast includes diverse habitats and ecosystems such as coral reefs, mangroves, seagrass beds, salt marshes, open water pelagic zones, and other carbonate dominated environments. Impacts of acidification to corals include decreased growth rates and other physiological effects, and dissolution of carbonate seafloor sediments. Coral reefs provide important coastal resistance to dangerous waves, support a large tourism industry, and provide social value for communities in the Southeast. The Southeast also has one of the largest recreational fishing industries and a growing aquaculture industry. At present, many stakeholders are less concerned about ocean and coastal acidification compared to other co-stressors, such as low oxygen events and harmful algal blooms. The Southeast represents a wide range of communities and cultures, and many have important ties to the marine environment. Fishing and coral reefs are economically important, and provide cultural value including heritage, sense of place, identity, and pride. This document provides a 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.

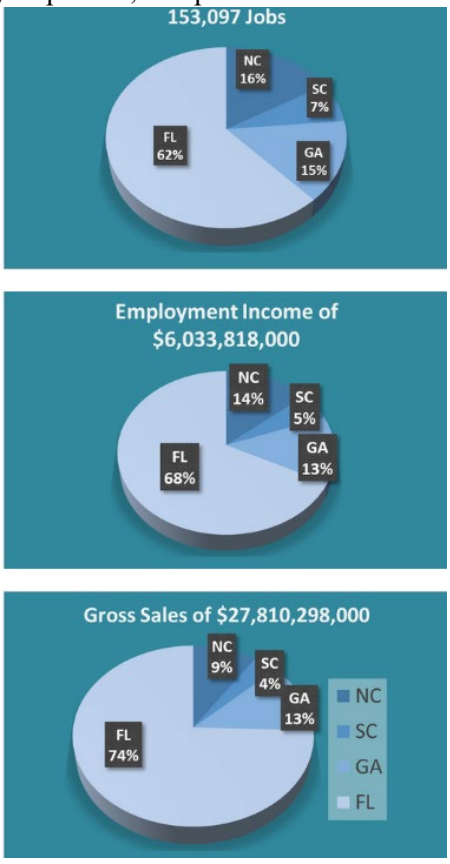

Figure 1. 2019 jobs and economic revenue from the recreational and commercial fishing industry in the Southeast, including the east coast of Florida.

Social Vulnerability Gaps

Ecosystems at risk from ocean and coastal acidification are closely linked to coastal communities, but there are severe gaps in evaluating social vulnerability to acidification. How chemical and biological changes resulting from increased acidification translate into social and economic impacts is not well understood; additional research on this will direct effective management practices, reduction efforts, and community adaptation strategies. Commercial and recreational fisheries have important economic value in the Southeast, with total combined sales value at over $31 Billion, the employment income generated was over $7 Billion, and there were 194,000 jobs within this sector in 2019. Figure 1 shows the number of jobs, gross sales, and employment income by state. Major Southeast fisheries include oysters, clams, lobster, shrimp, blue crab, stone crab, and finfish (flounders, groupers, king mackerels, snappers, swordfish, and tunas); there is a relatively low diversity of commercially harvested species in the Southeast. Acidification reduced larval survival of blue crab, stone crab, hard clams, and eastern oysters in lab experiments and some species such as blue crab and shrimp populations have already shown declines in the last decade, though the cause is unknown. Key gaps in information also include:

- Valuation and quantification of the growing aquaculture industry and potential economic loss
- Quantification of social and economic impacts from structural reef loss and related impacts to the fishing industry
- More research is needed to couple valuations with ecosystem forecasts that predict the effects of ocean and coastal acidification on ecosystems

Exposure Gaps

Monitoring is key for understanding the current levels and spatial coverage and tidal, daily, seasonal, and yearly variability in ocean and coastal acidification in the Southeast. Monitoring various marine environments allows managers to determine the exposure level a species or ecosystem has to acidic conditions. Monitoring also provides information on the causes of acidifications and co-stressors (river water, low oxygen, excess nutrients, currents, atmospheric CO_2, biological usage of CO_2), and data for predictive models. Monitoring sites can include buoys, fixed sites on piers, and samples taken during cruises, however, continuous high-quality measurements are limited. Key monitoring gaps for organism and ecosystem include:

- Shelf water monitoring, both within the water column and in deep water ecosystems
- Monitoring how as biological processes and river discharge affect changes in CO_2 water chemistry
- Monitoring in estuaries, wetlands, mangroves, and marshes that provide important ecosystem services (fisheries, tourism, recreation, essential fish habitat, coastal hazards protection)

Biological Exposure Gaps

More research is needed to fully understand how most of the economically important species' populations will be impacted, which will inform how fisheries and tourism will be financially impacted. Trickle-down effects from harmful biological effects to social and economic impacts are not well understood. Biological exposure to acidification also impacts living habitats such as coral reefs, mangroves, and sea grasses directly, though how habitats respond to multiple environmental stressors is still not well defined. In addition to impacts to species and habitats, acidification may also result in a shift in plankton communities towards an increase in harmful algal blooms, such as Florida red tide, which affects human health, the survival of marine organisms, and can ultimately disrupt coastal economies. Species survival, habitat health, and water quality are all impacted by acidification. Figure 2 shows which species have been studied and of those species have been commercially evaluated and impacted by acidification. Ultimately, very little is understood about the impacts of acidification on biological organism.

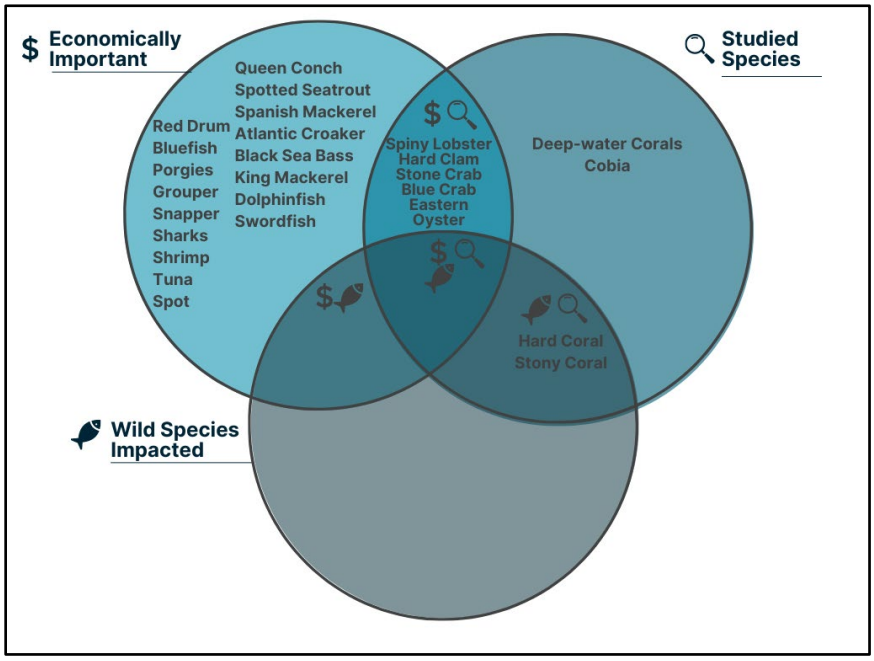

Figure 2. Of the economically important species, very few have been studied and it is not yet known if any of these species are impacted in the wild.

- Species specific studies are very limited, especially for commercially important species
- Determination of the effects of timing of acidification events with other environmental stressors
- Data that does exist has not yet been combined throughout the Southeast to better understand biological responses
- Acidification impacts on various different life stages of organism is unknown