



Coastal Acidification Network Stakeholder Feedback Project

Emily R. Hall, Ph.D., Janet J. Reimer, Ph.D.,
Jennifer Vreeland

The Southeast and Gulf of Mexico Coastal Acidification Networks

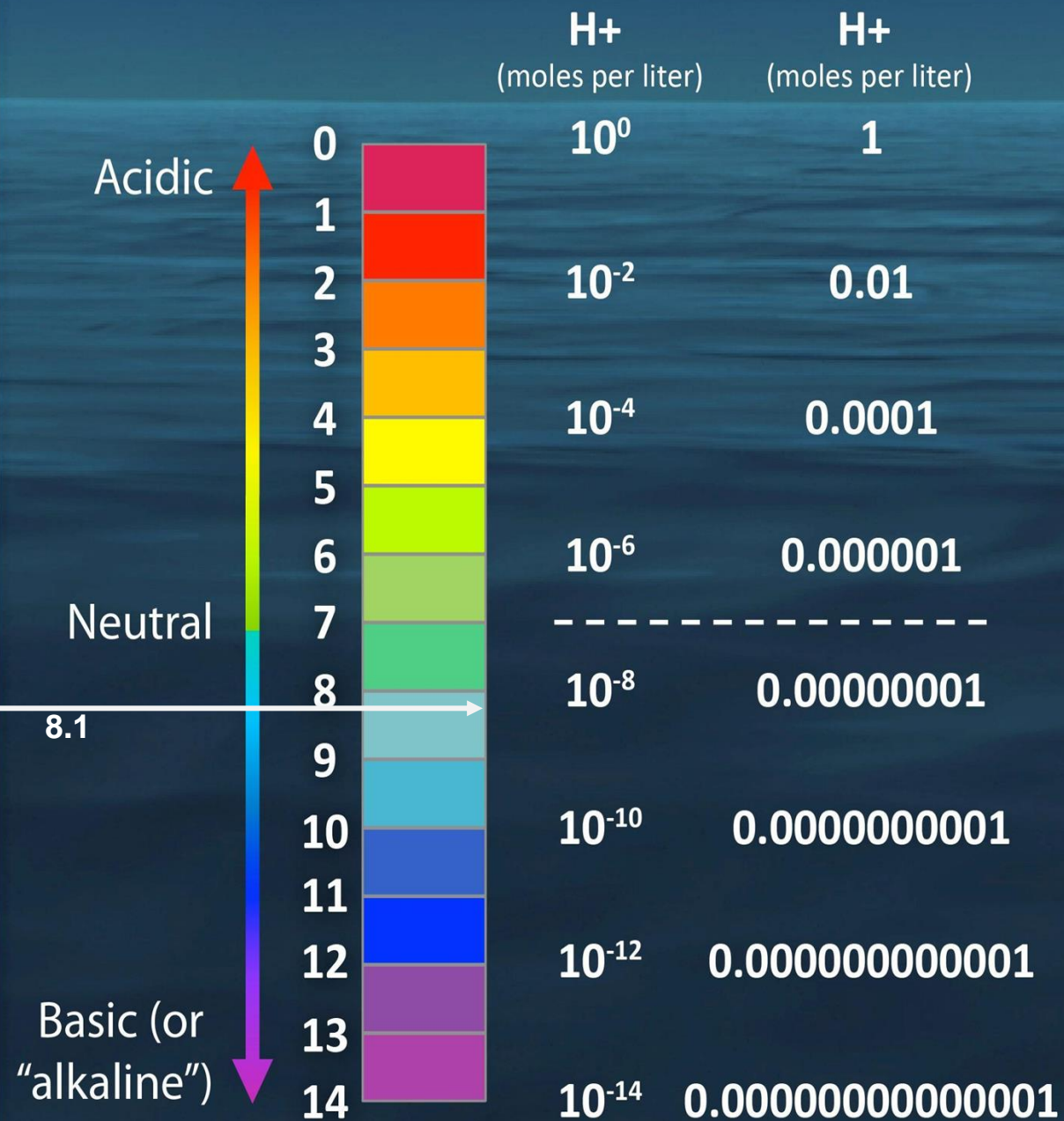


Who We Are

The Executive Team, Science Working Group, and Stakeholder Working group are researchers, resource managers, communication specialists, and educators.

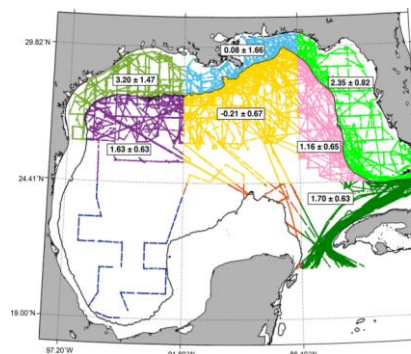
Our Mission

Work directly with scientists, resource managers, data end-users, educators, & policy makers to synthesize & communicate the state of OA science & meet regional community needs.



What is ACIDIFICATION and how do we measure it?

- Acidification is chemical/water quality problem
- CO₂ increase that causes a pH decrease that is harmful to biota – NOT all low pH conditions are necessarily “harmful”
- We make high-quality pH measurements of the free-floating Hydrogen atoms in water
- Directly measure biogeochemical parameters: alkalinity (base properties), total dissolved inorganic carbon, and CO₂
- Cruises, fixed platforms, discrete sample sites

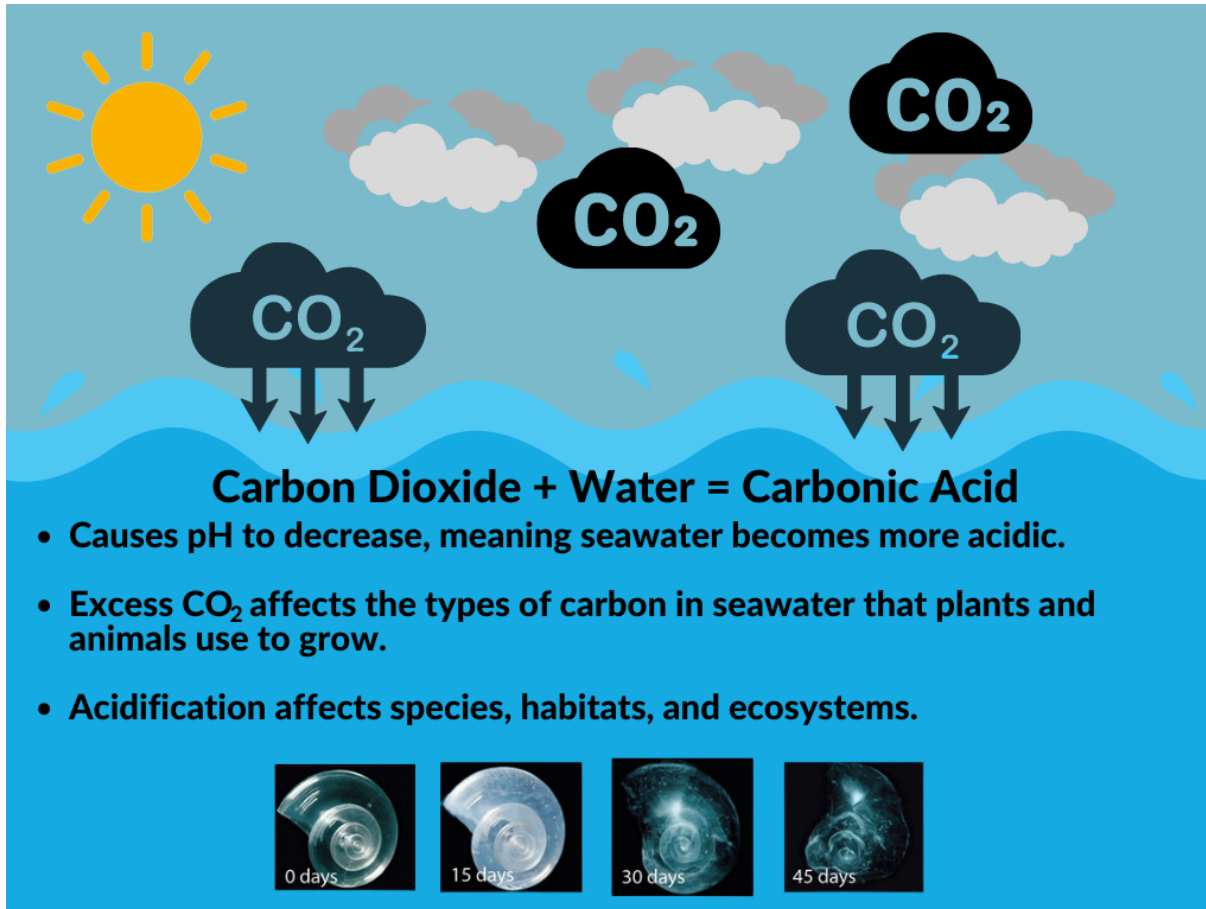


(Kealoha et al., 2020, Scientific Reports)



Photo credit: Sarah Fangmen

What is Ocean Acidification?

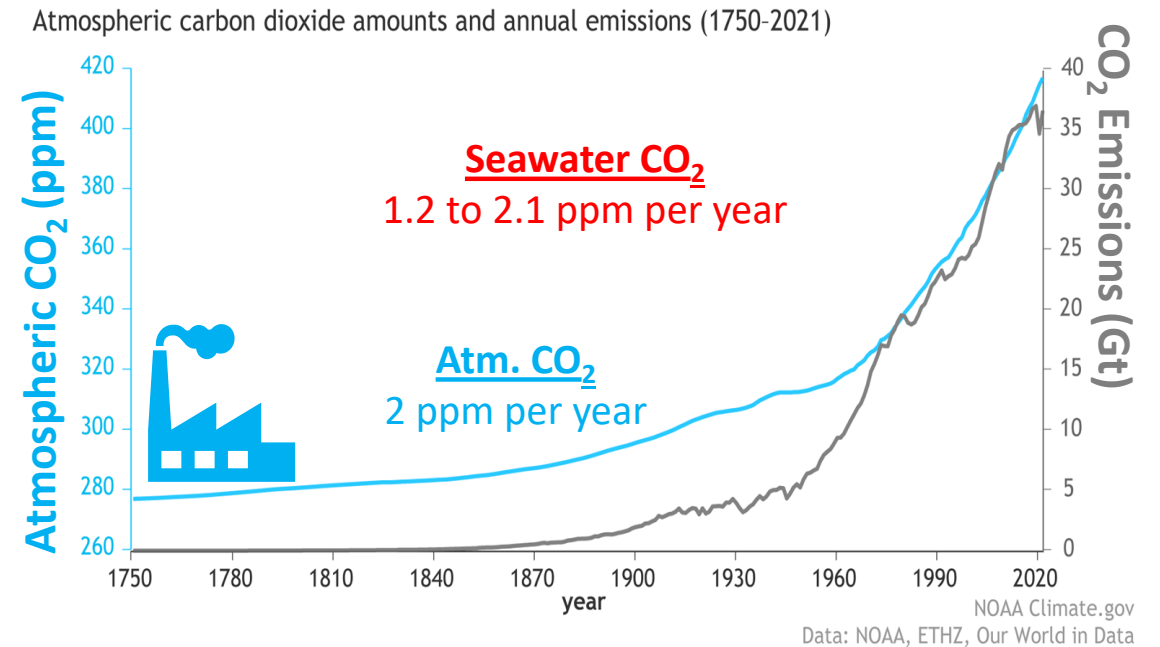


The diagram illustrates the process of ocean acidification. At the top, a sun and clouds are shown. Several dark clouds labeled 'CO₂' are depicted, with arrows pointing downwards towards the ocean surface. Below the surface, the text reads 'Carbon Dioxide + Water = Carbonic Acid'. Three bullet points describe the effects: 1) Causes pH to decrease, meaning seawater becomes more acidic. 2) Excess CO₂ affects the types of carbon in seawater that plants and animals use to grow. 3) Acidification affects species, habitats, and ecosystems. At the bottom, four images show the development of a nautilus shell over time, labeled '0 days', '15 days', '30 days', and '45 days', showing a progressive darkening and structural weakening of the shell.

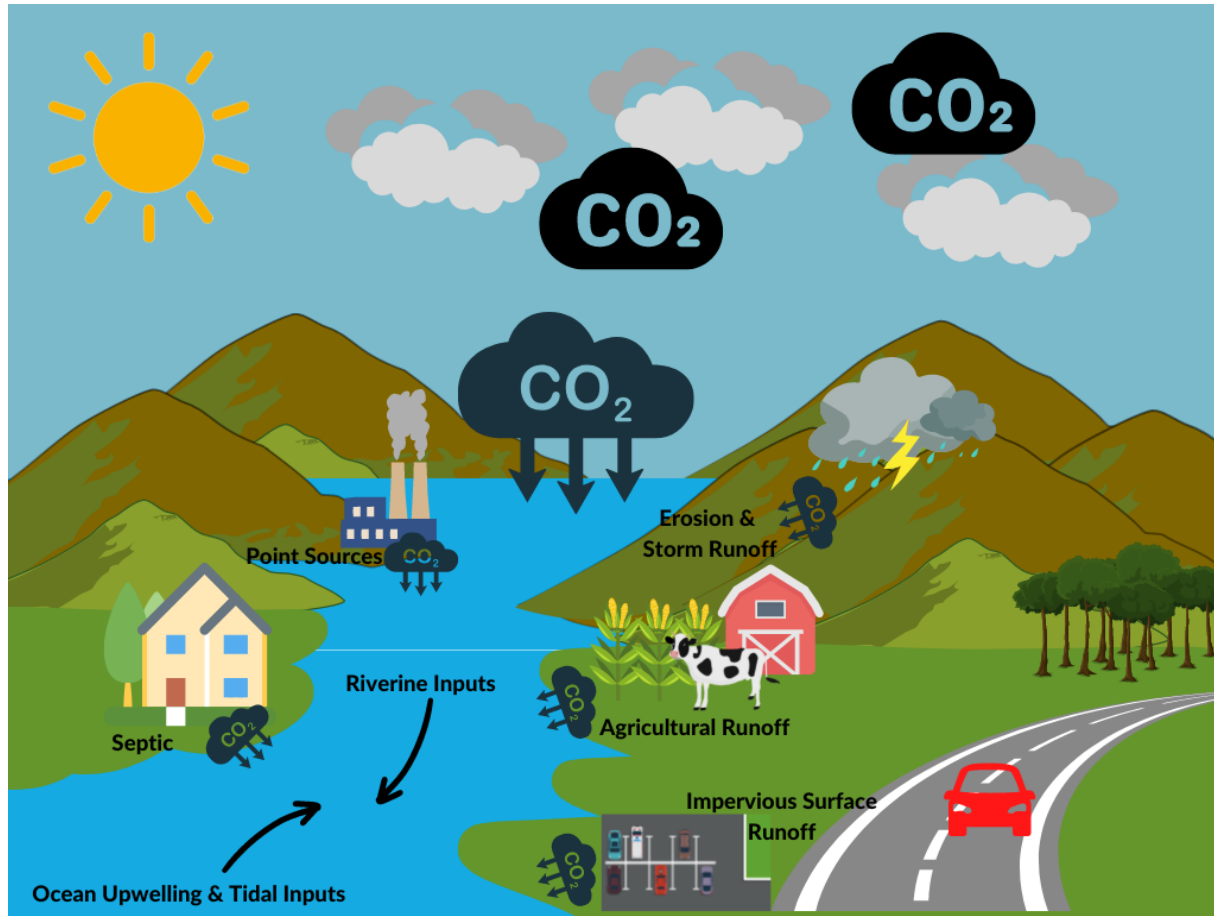
Carbon Dioxide + Water = Carbonic Acid

- Causes pH to decrease, meaning seawater becomes more acidic.
- Excess CO₂ affects the types of carbon in seawater that plants and animals use to grow.
- Acidification affects species, habitats, and ecosystems.

0 days 15 days 30 days 45 days



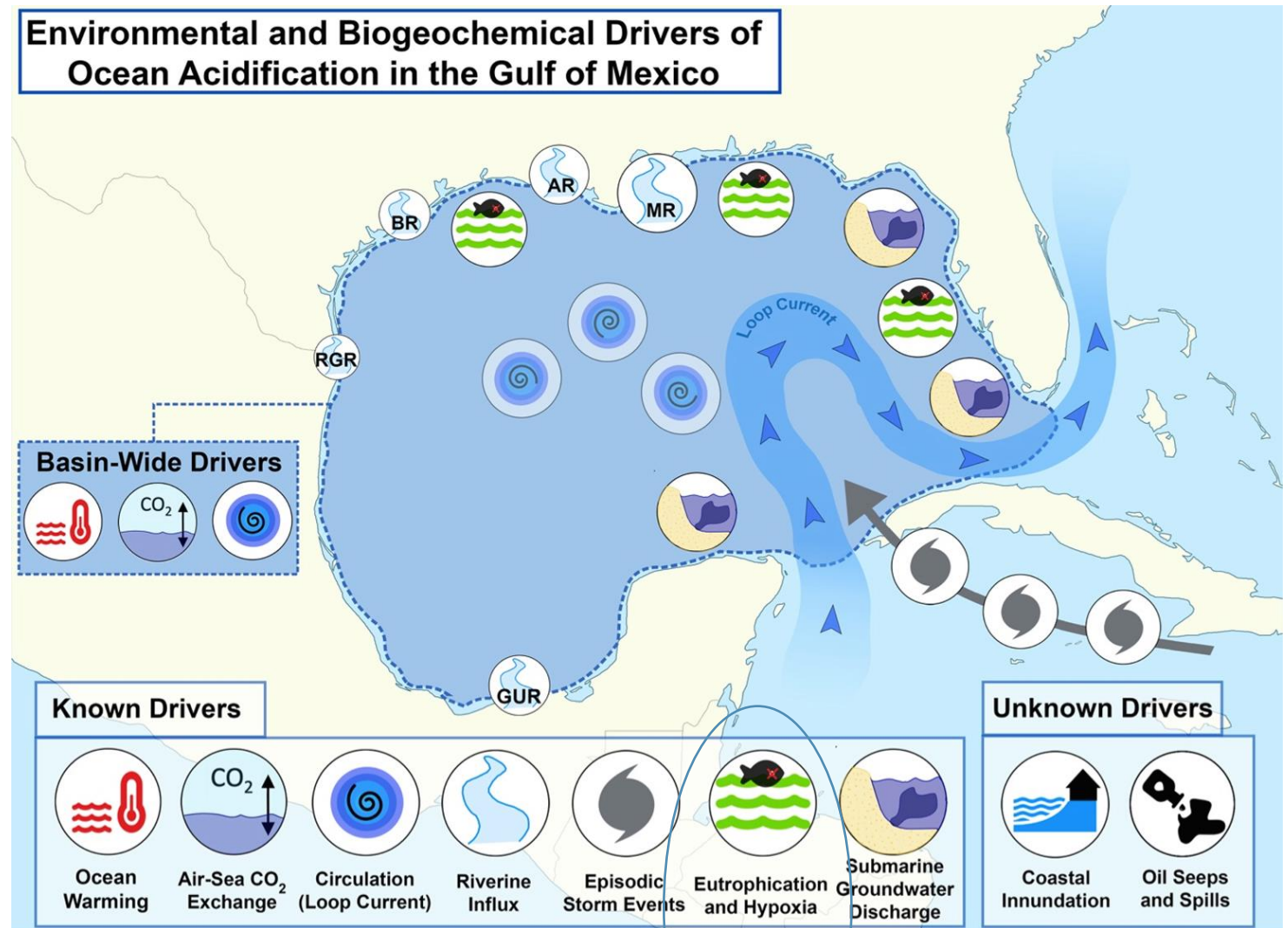
What is Coastal Acidification?



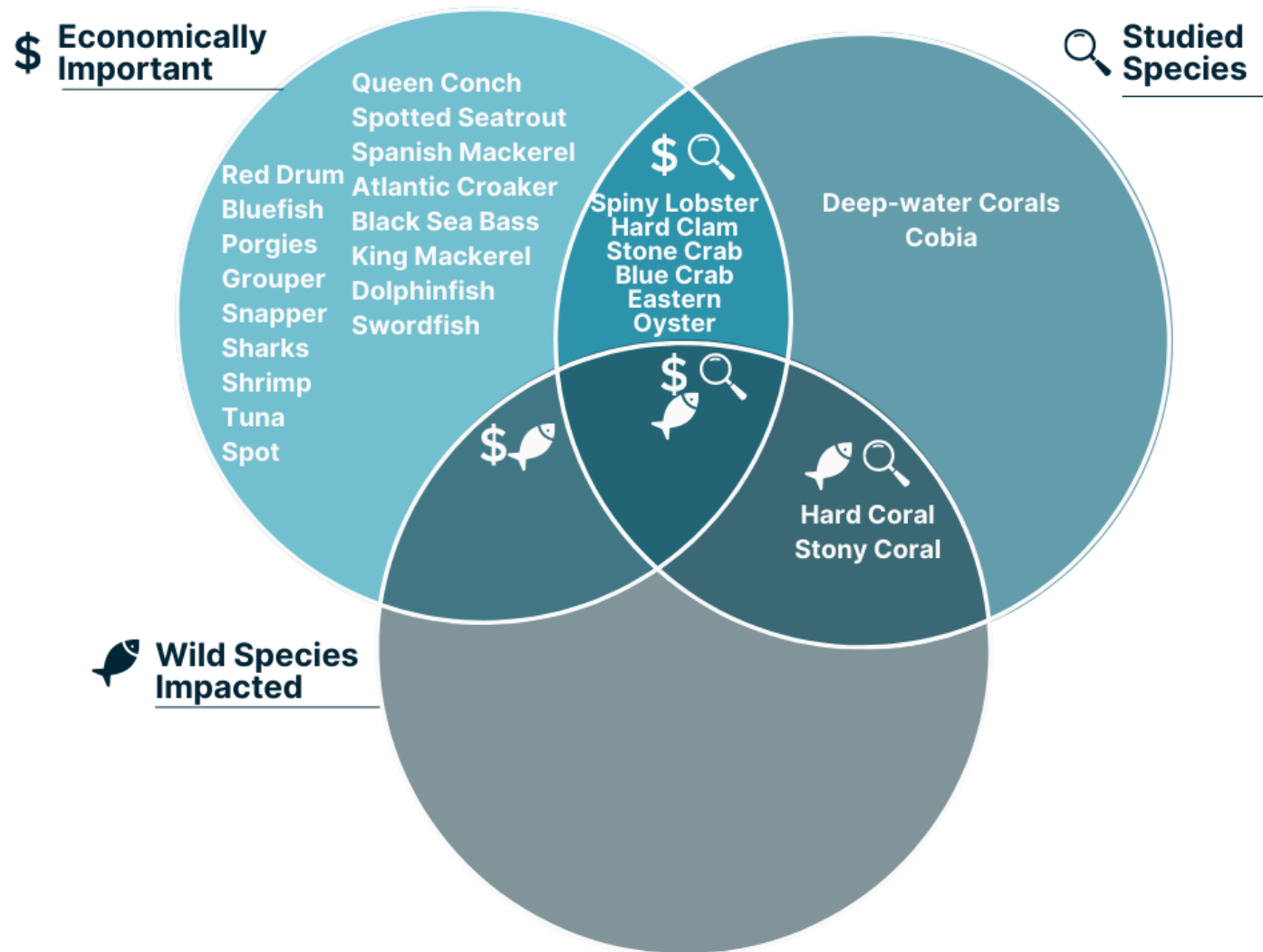
- Absorption of atmospheric CO₂ plus...
- Eutrophication – excessive nutrient input that cause increased algae, phytoplankton, and plant blooms
- When cells die and decay after a bloom, they release CO₂
- Upwelling and transport of acidified waters
- Freshwater inflow (lower pH, higher CO₂)
- Runoff, septic leaching, and point sources
- However, adequate resource management can mitigate decreasing pH
- If we can control point source output, regulate fertilizers, and manage storm water, we can mitigate acidification and the negative impacts to the environment

What we know: Gulf of Mexico

- We have known and potential unknown drivers that affect acidification
- The main cause of acidification, CO_2 , is increasing in GOM waters
- Low pH occurs following and during hypoxic events
- Calcium Carbonate formation of reefs throughout the FL Keys is decreasing and some areas experience dissolution
- pH is variable and decreasing over time

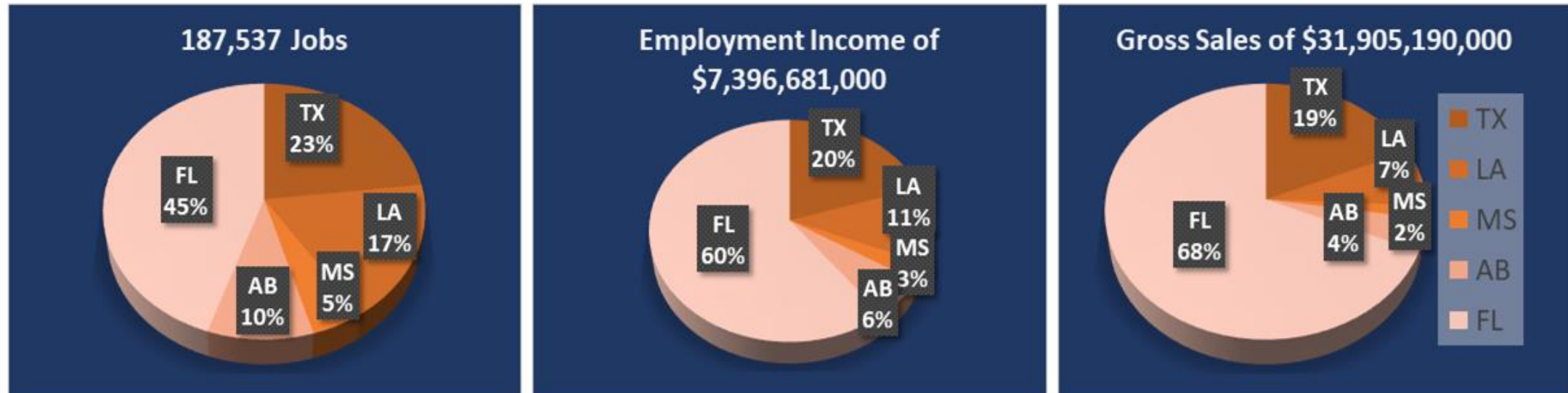


What we know: Gulf of Mexico



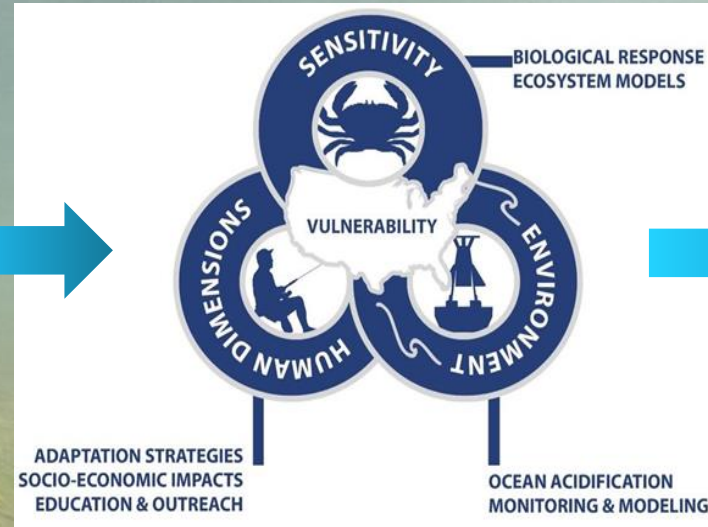
Understanding the sensitivity and adaptive capacity of organisms and ecosystems to acidification

What we know: Gulf of Mexico



2019 U.S. jobs and economic revenue from the recreational and commercial fishing industry in the Gulf of Mexico.

Stakeholder Survey



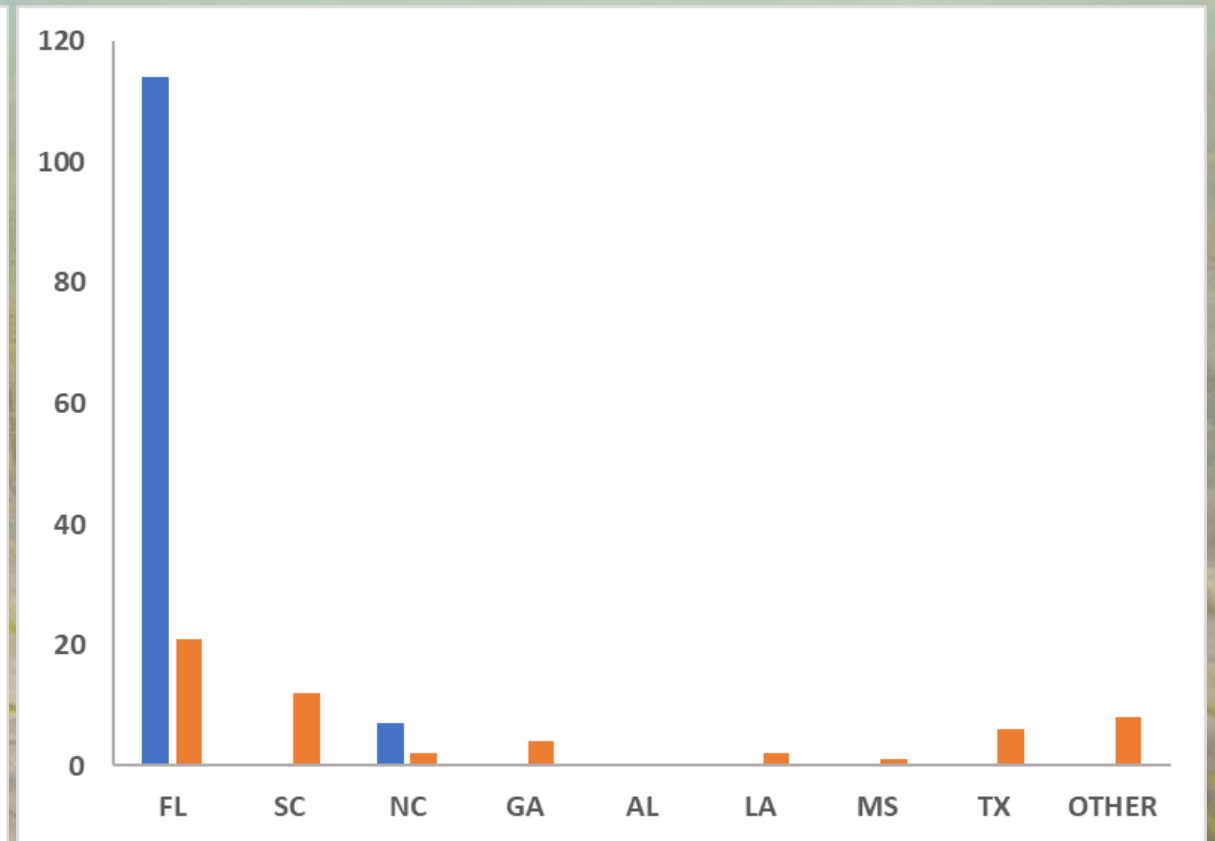
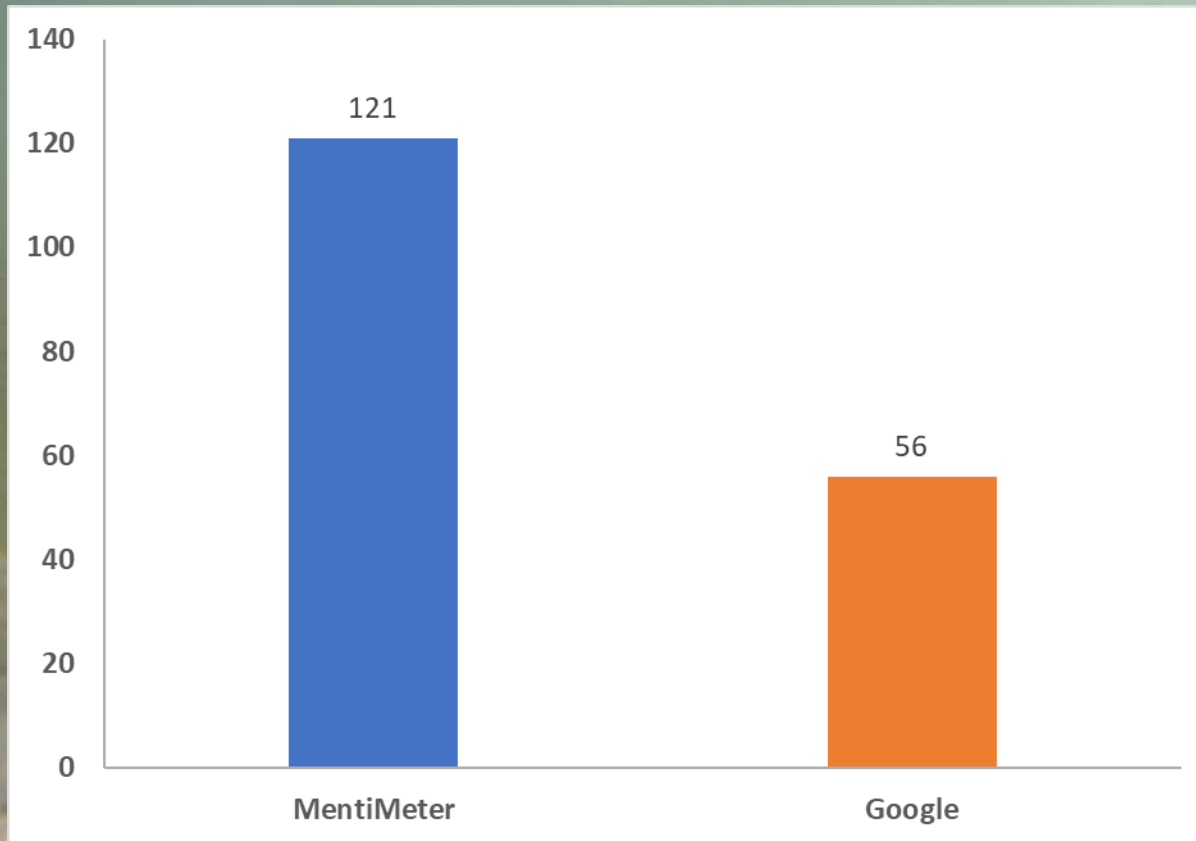
Using survey methodology modeled after *CHNEP CCMP Climate Change Vulnerability Assessment*, and input from CHNEP staff and committees.



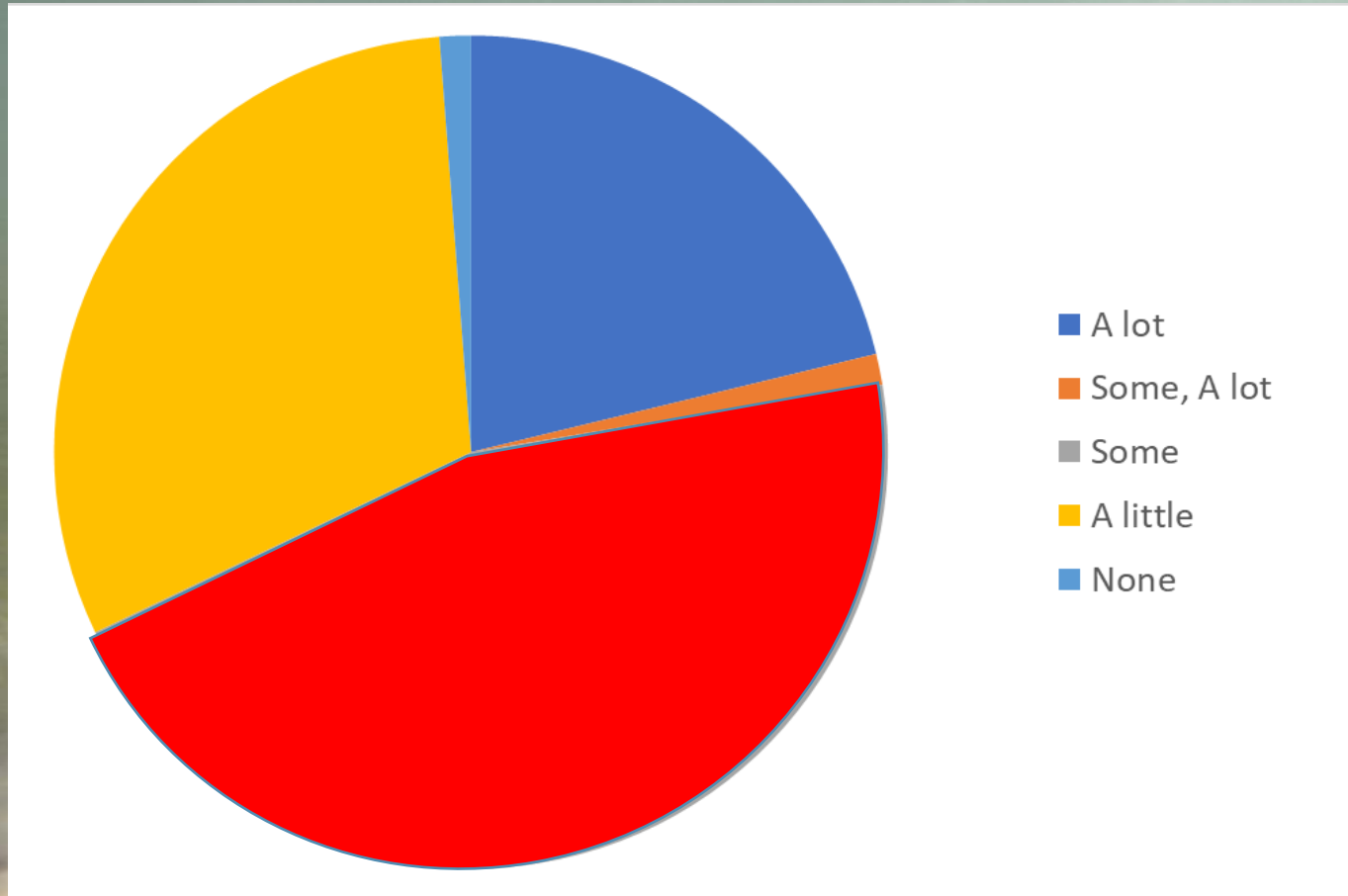
Stakeholder Survey Results!

Surveys were presented in two manners (20 Questions Total)

1. Live MentiMeter questions at in person meetings (e.g. at NEP TAC and CAC meetings)
2. Online Google Form questions (via email and posted on the SOCAN and GCAN websites)

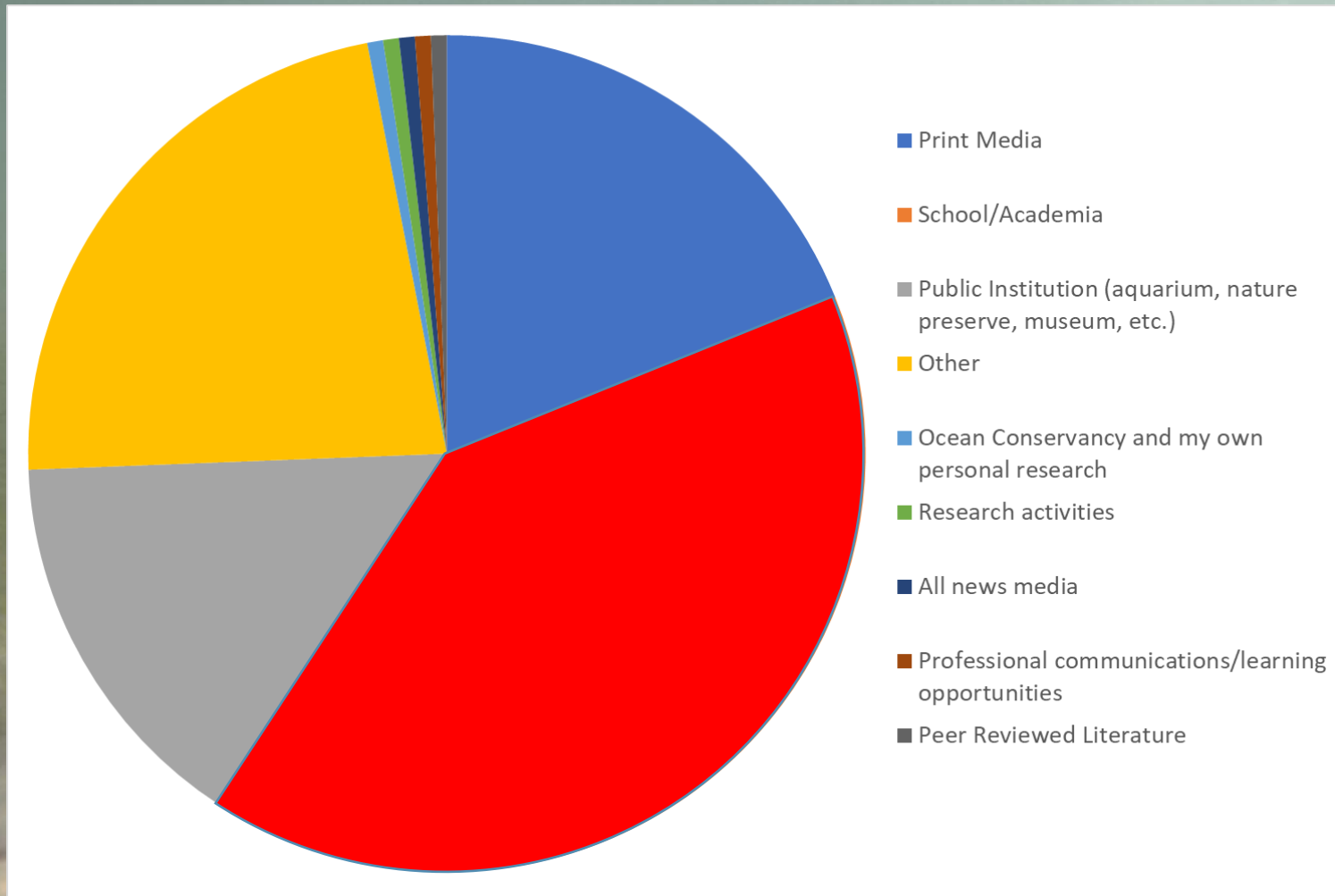


1. Do you have any knowledge on this topic prior to today? If so, how would you classify your level of knowledge on ocean acidification?



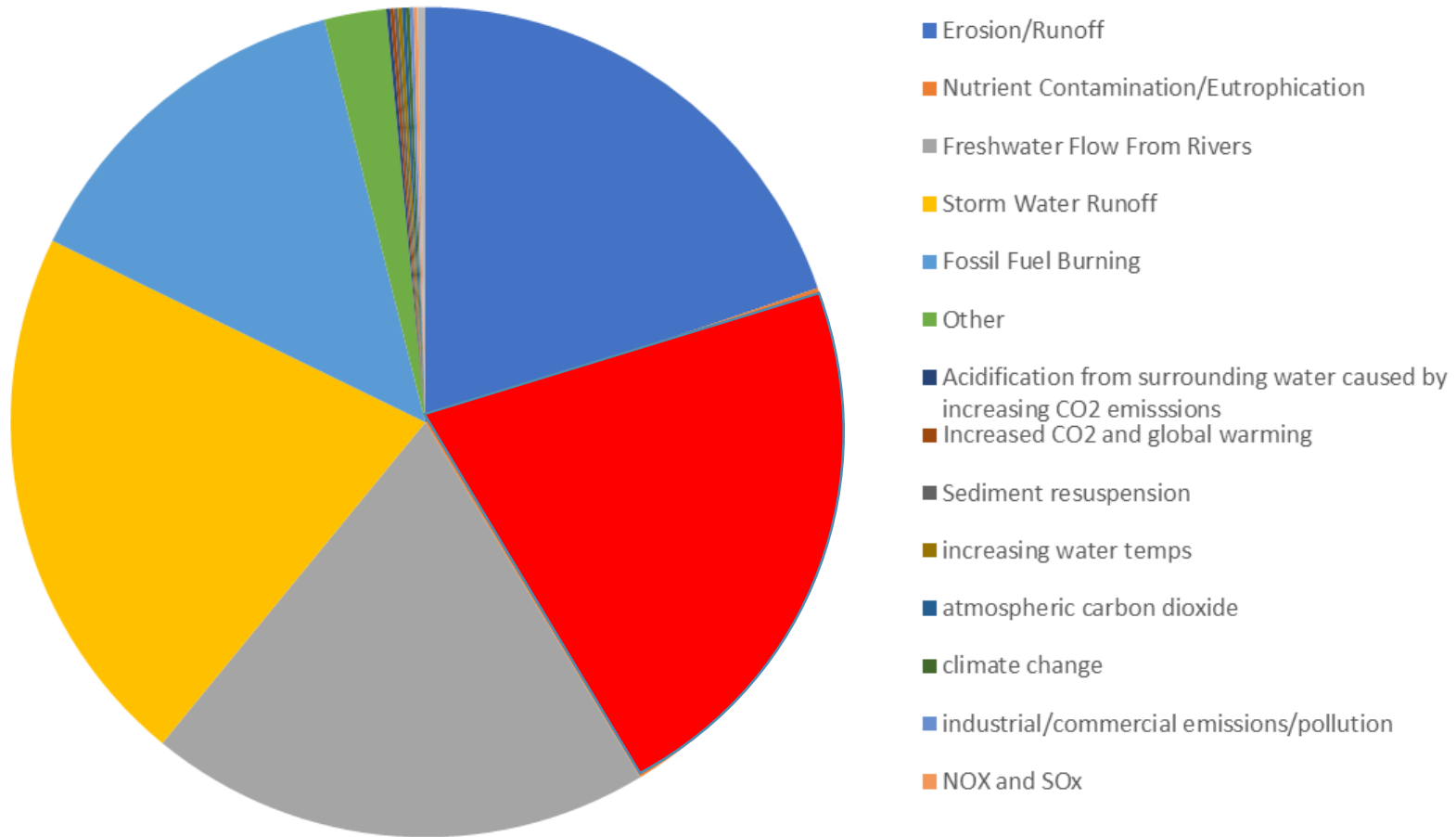
1. Some
2. A Little
3. A Lot

2. How would you describe your main source for information about acidification?



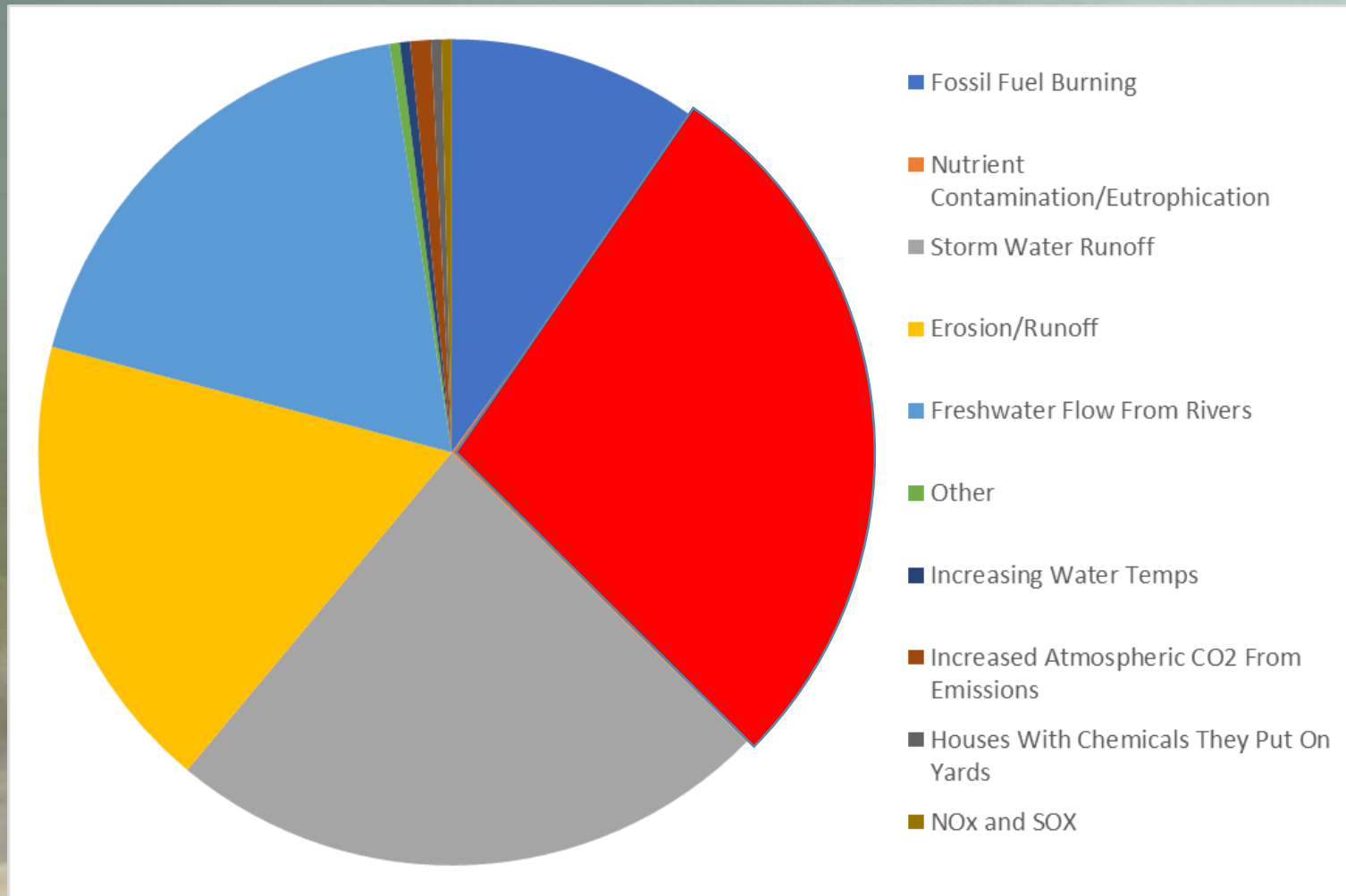
1. **School/Academia**
2. Other
3. Print Media
4. Professional Communications/Learning Opportunities.
5. Ocean Conservancy and my own personal research
6. Research activities
7. All news media
8. Peer Reviewed Literature

3. Which of the following processes are you familiar with?



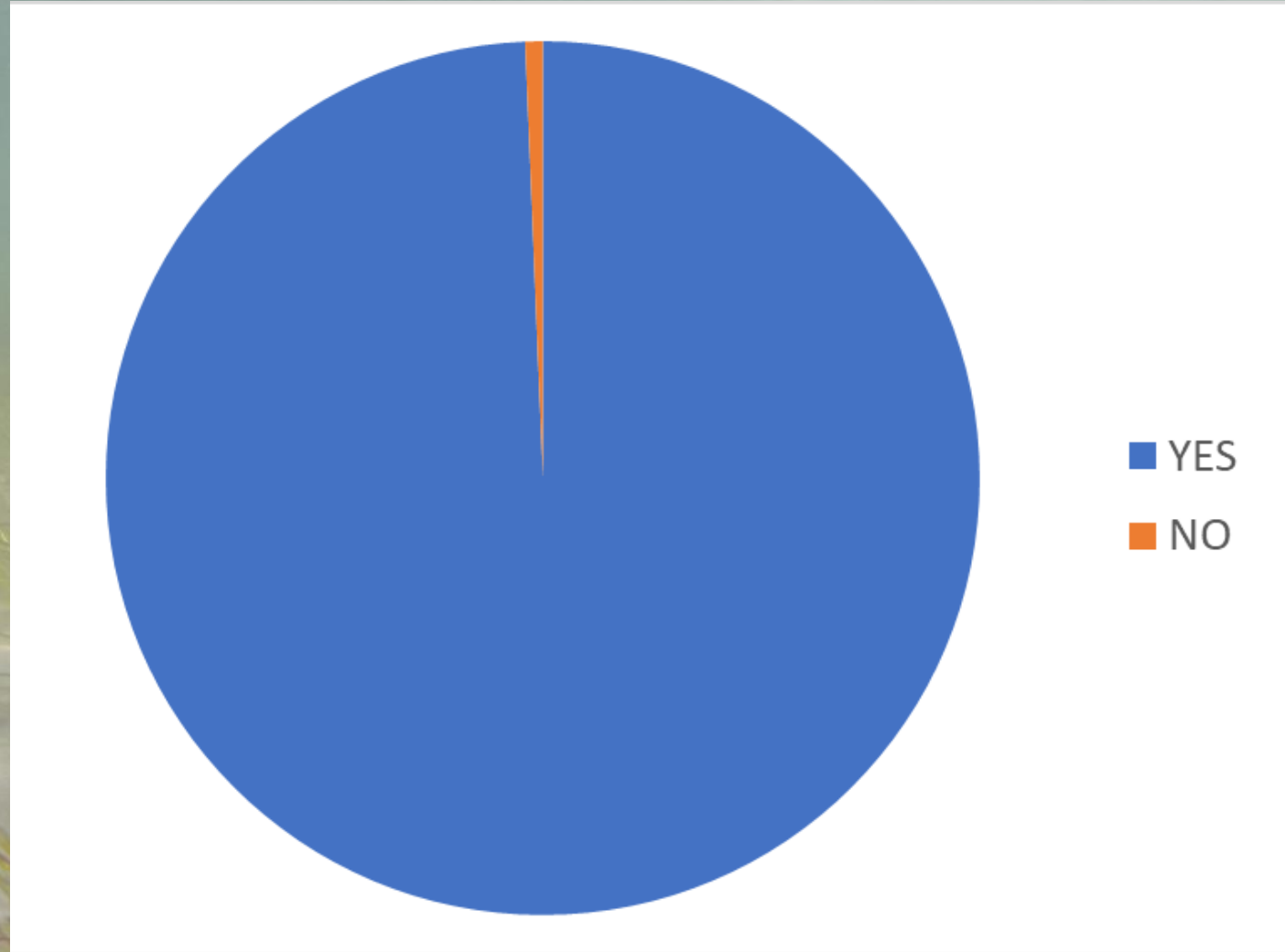
1. **Nutrient Contamination/Eutrophication**
2. Storm Water Runoff
3. Erosion/Runoff
4. Freshwater Flow from Rivers
5. Fossil Fuel Burning
6. Other

4. Which of the following processes do you think could lead to or worsen acidification?

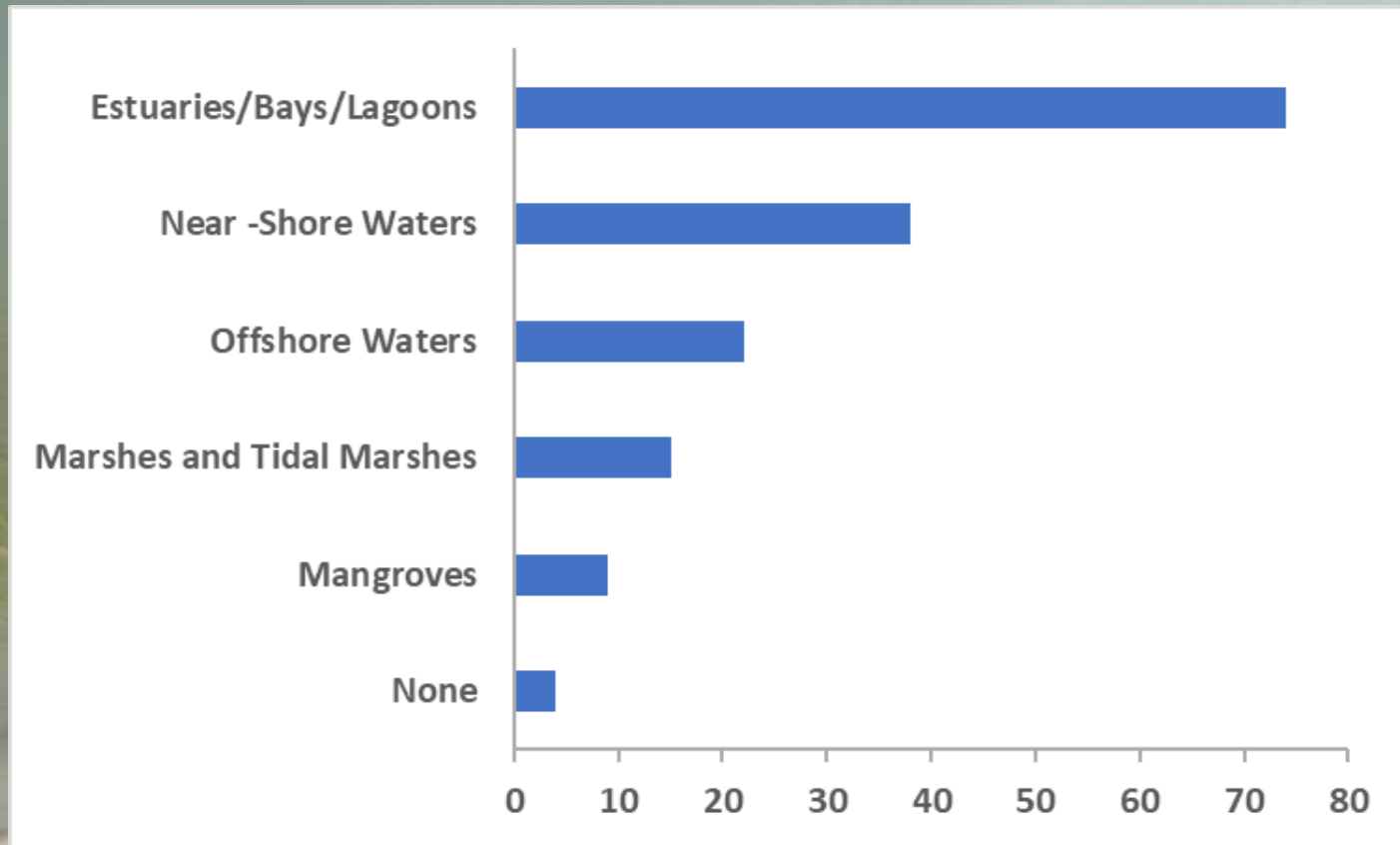


1. **Nutrient Contamination/Eutrophication**
2. Storm Water Runoff
3. Freshwater Flow from Rivers
4. Erosion/Runoff
5. Fossil Fuel Burning
6. Increased Atmospheric CO2 from Emissions
7. Other

5. Are you concerned about the effect acidification will have on the environment?

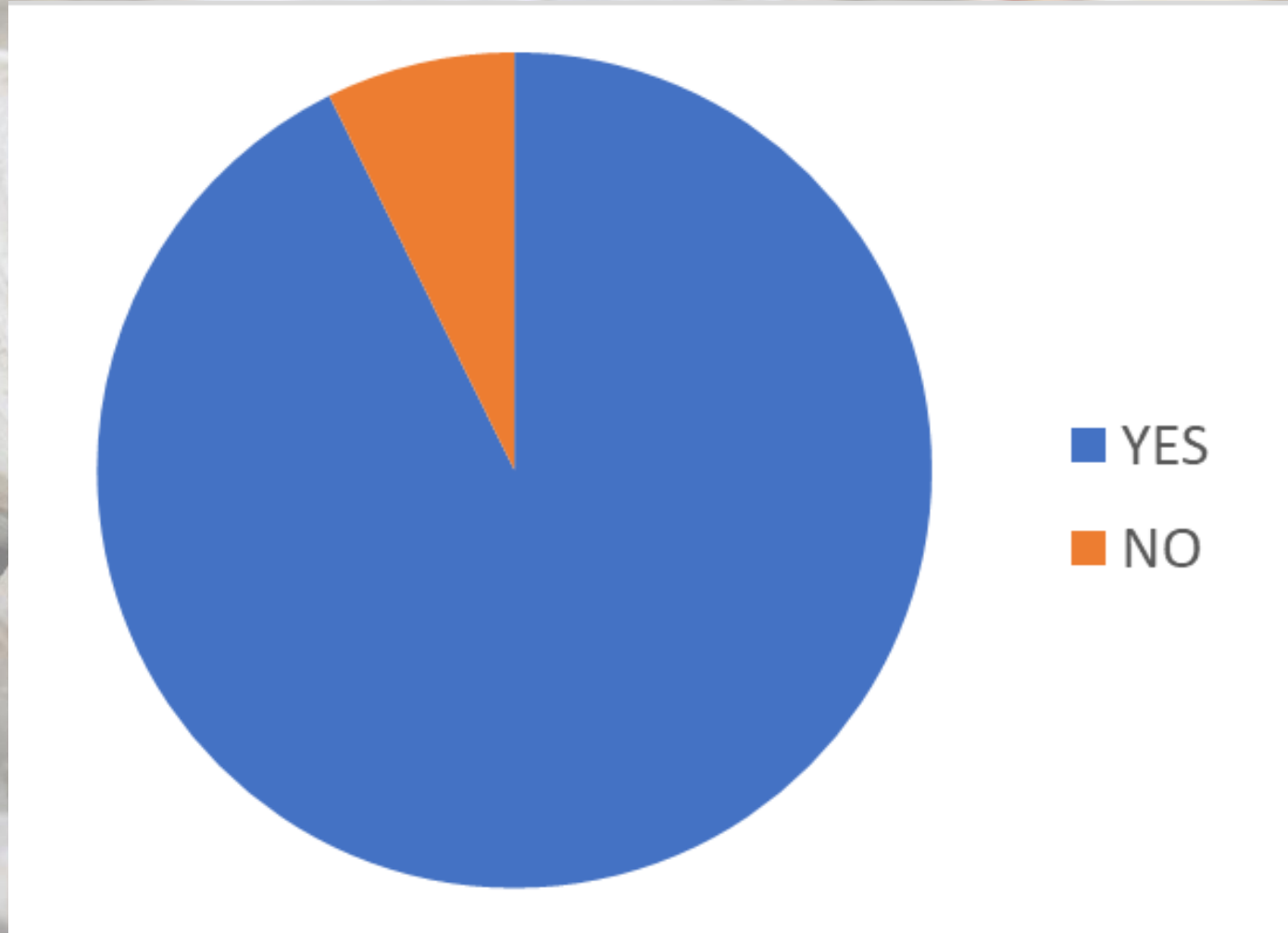


6. If you are concerned about the effects of acidification on the environment, please rank the ecosystems on concern to you.

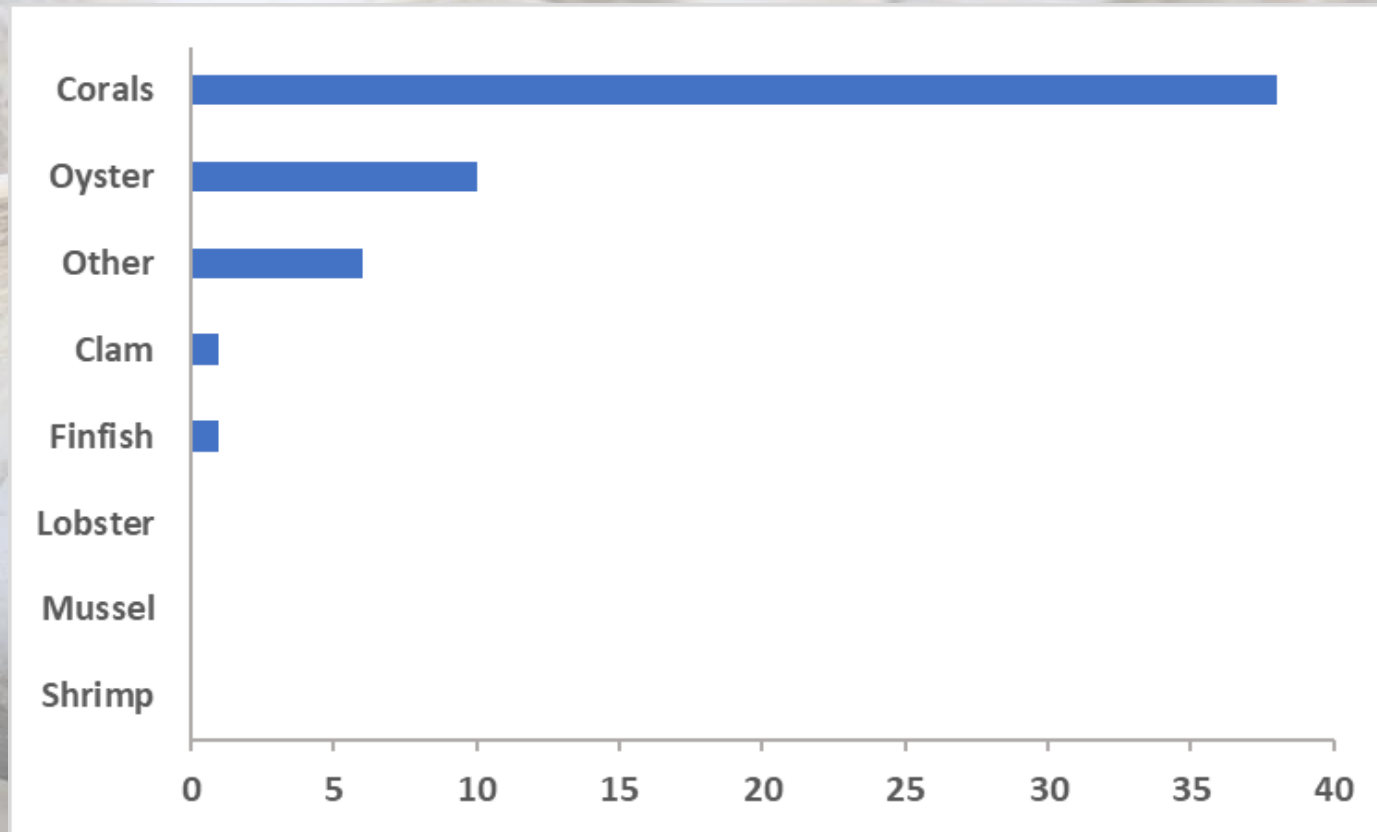


1. Estuaries/Bays/Lagoons
2. Near-Shore Waters
3. Offshore Waters
4. Marshes and Tidal Marshes
5. Mangroves
6. None

7. Are you aware of the potential effects of coastal or ocean acidification on marine animals?

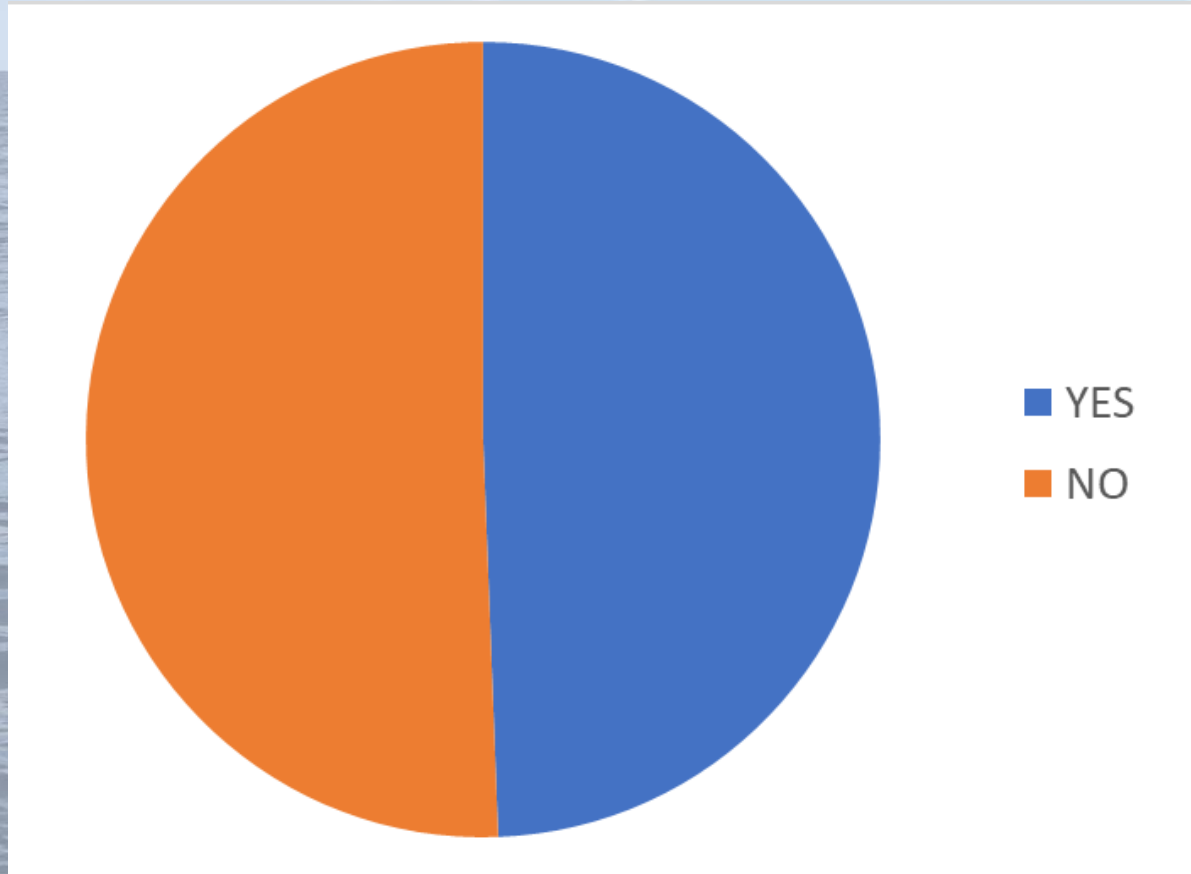


8. Of the marine animals that may be affected, which are you most concerned about?

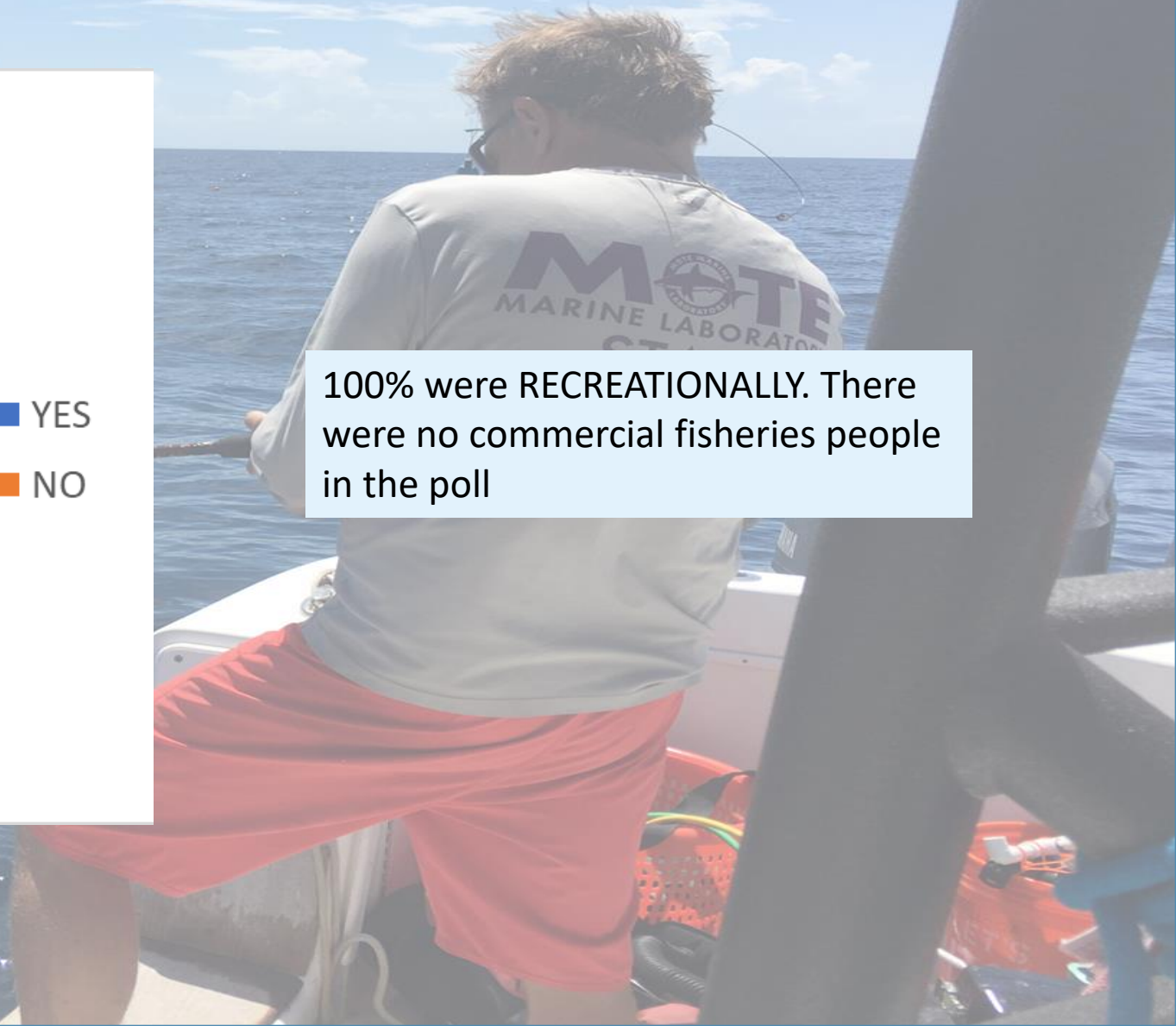


1. Corals
2. Oysters
3. Other
4. Clams
5. Finfish
6. Lobster
7. Mussels
8. Other (crabs, everything else, all species, coccolithophores, pteropods, phytoplankton, shorebirds)

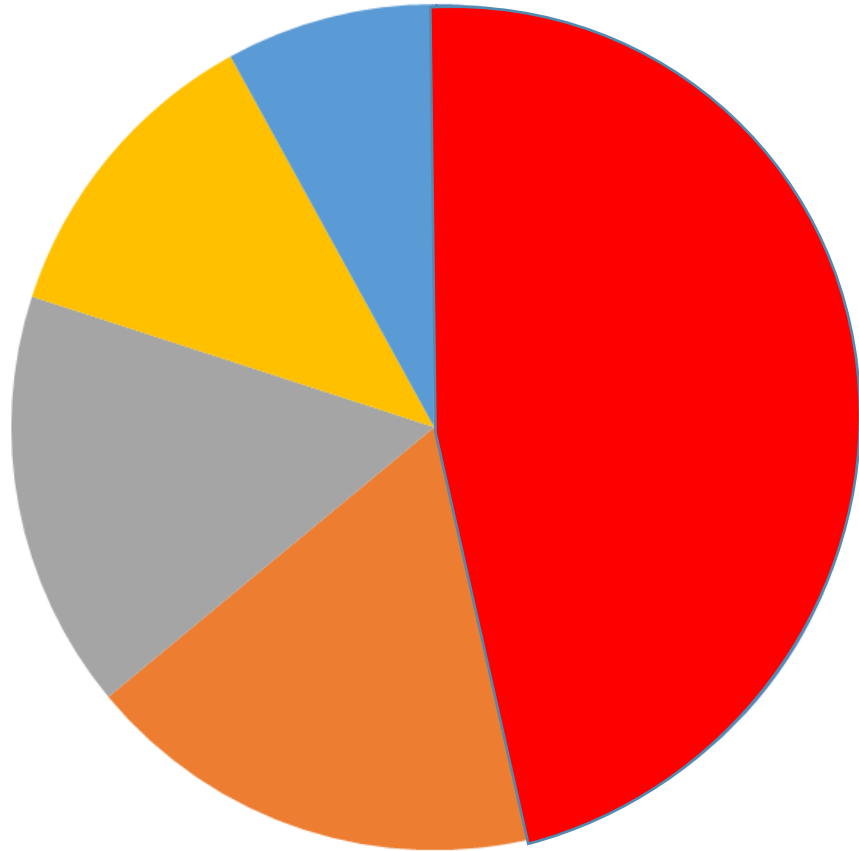
9. Do you fish recreationally or commercially for finfish or shellfish?



100% were RECREATIONALLY. There were no commercial fisheries people in the poll



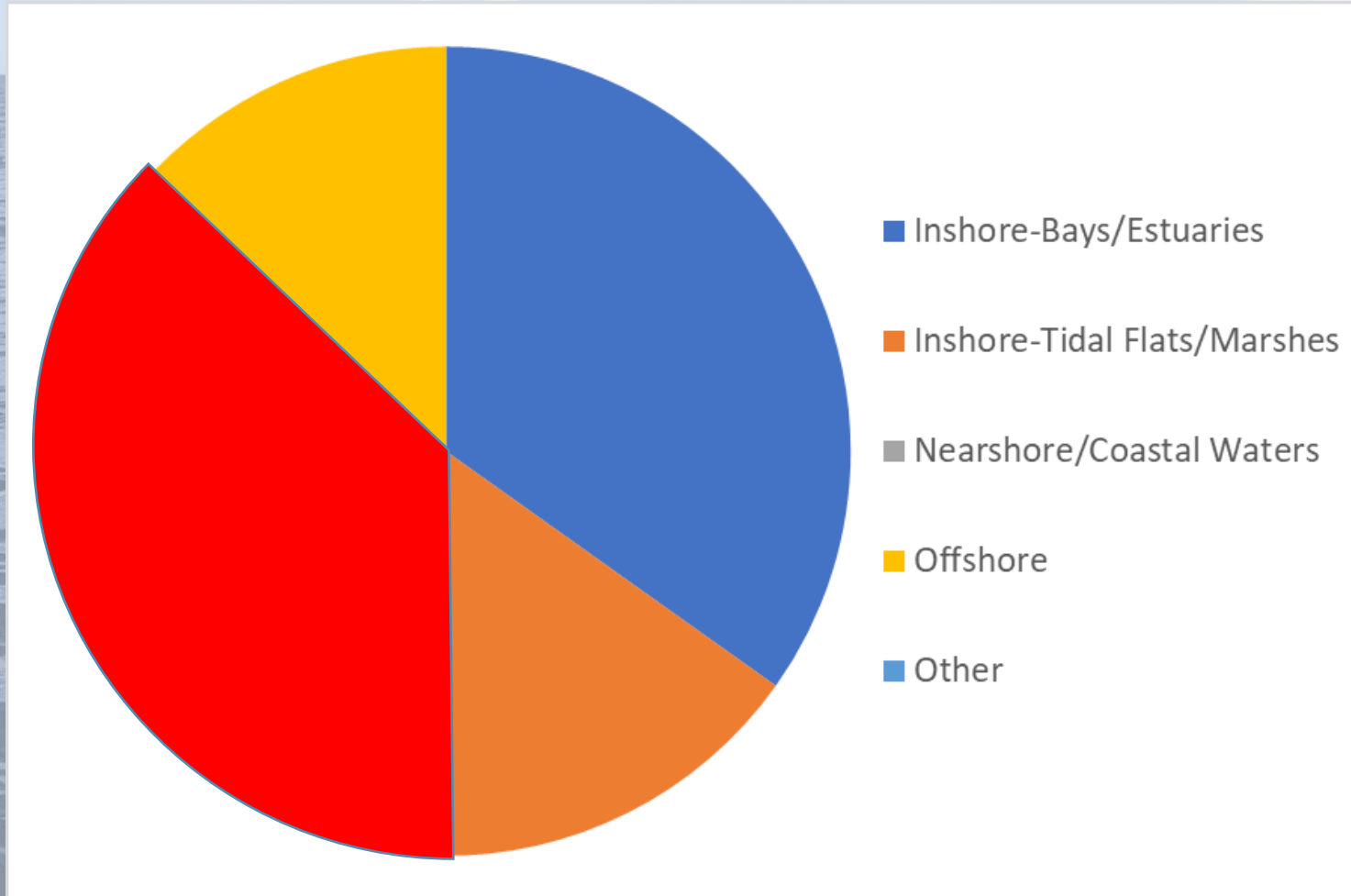
10. If yes, please specify which zone best describes your fishing grounds.



- Inshore-Bays/Estuaries
- Inshore-Tidal Flats/Marshes
- Nearshore/Coastal Waters
- Offshore
- Other

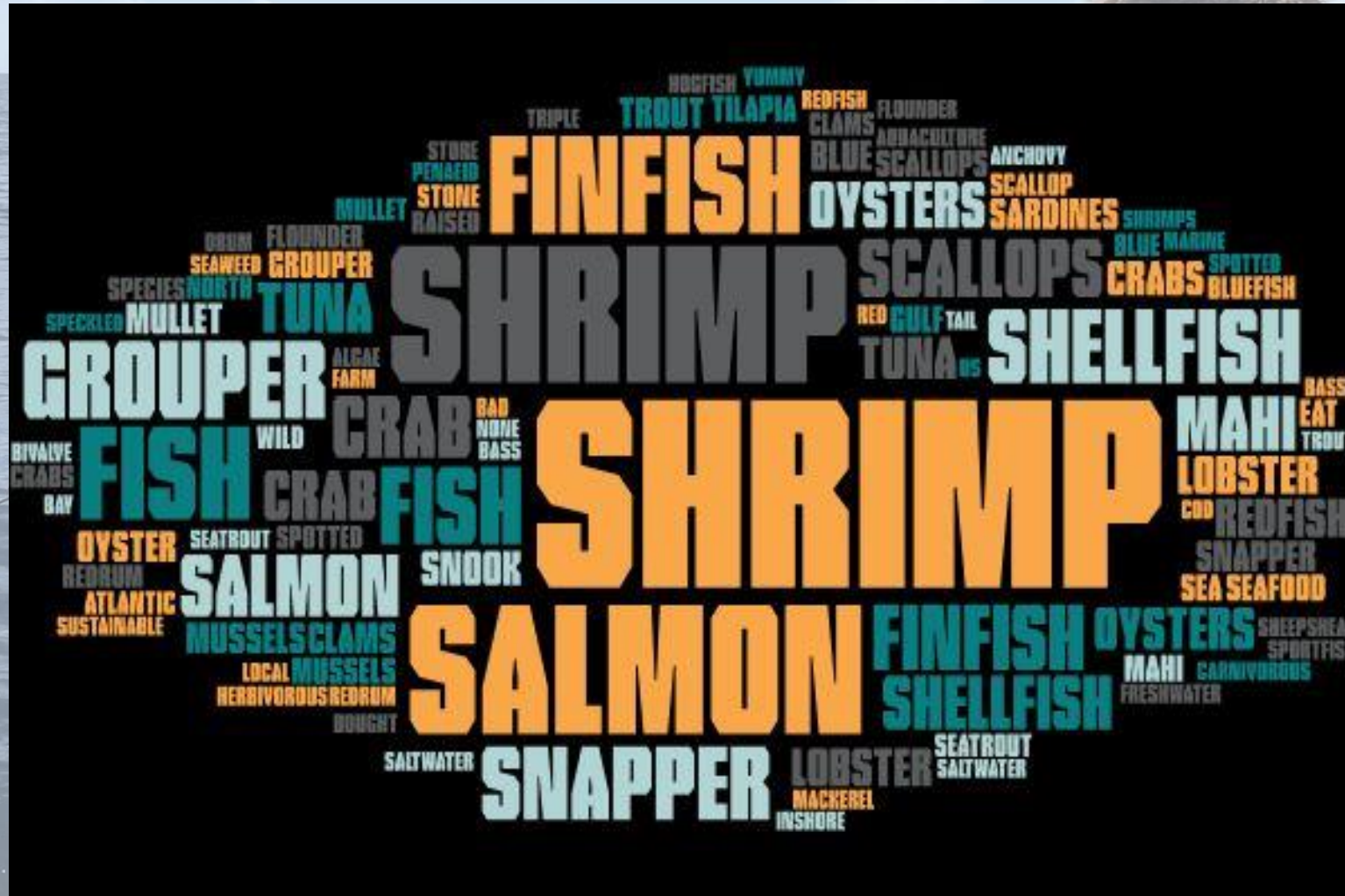
- 1. Inshore - Bays/Estuaries**
2. Inshore – Tidal Flats/Marshes
3. Nearshore/Coastal Waters
4. Offshore
5. Other

11. If these ecosystems are affected by acidification, which, in your opinion, is most important to focus on?

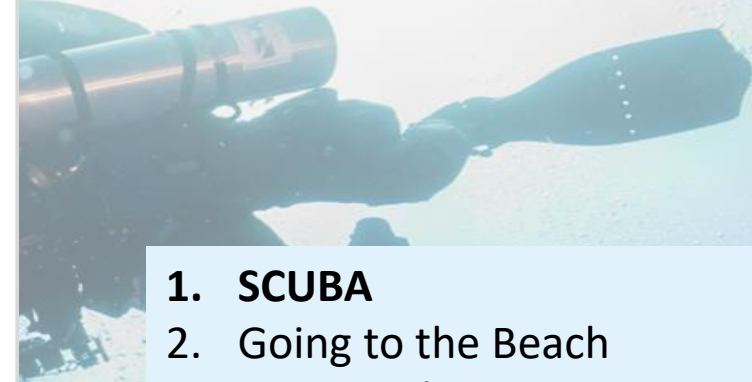
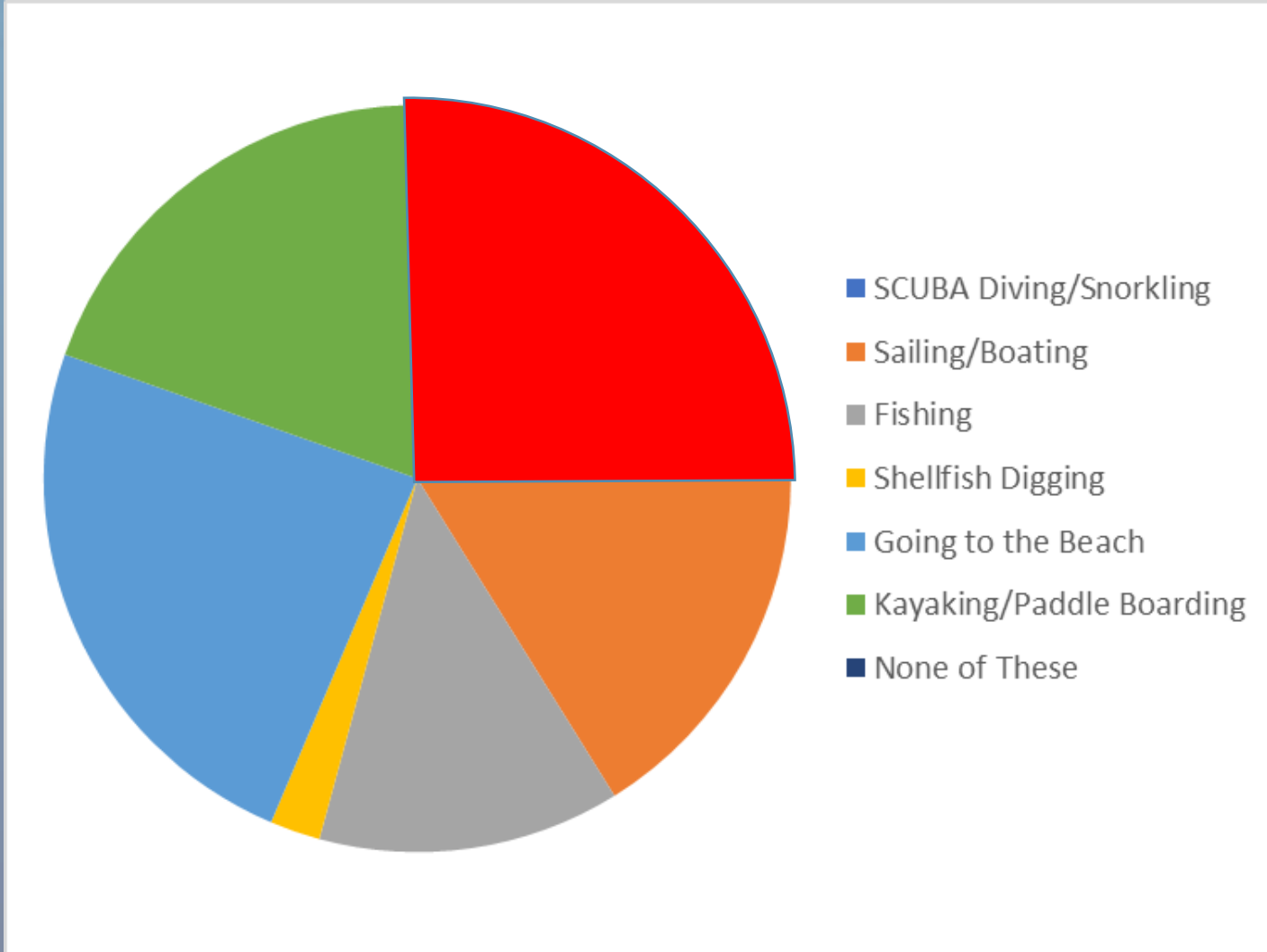


1. **Nearshore/Coastal Waters**
2. Inshore - Bays/Estuaries
3. Inshore – Tidal Flats/Marshes
4. Offshore
5. Other

12. What describes the top 3 types of seafood you fish for or consume at home?

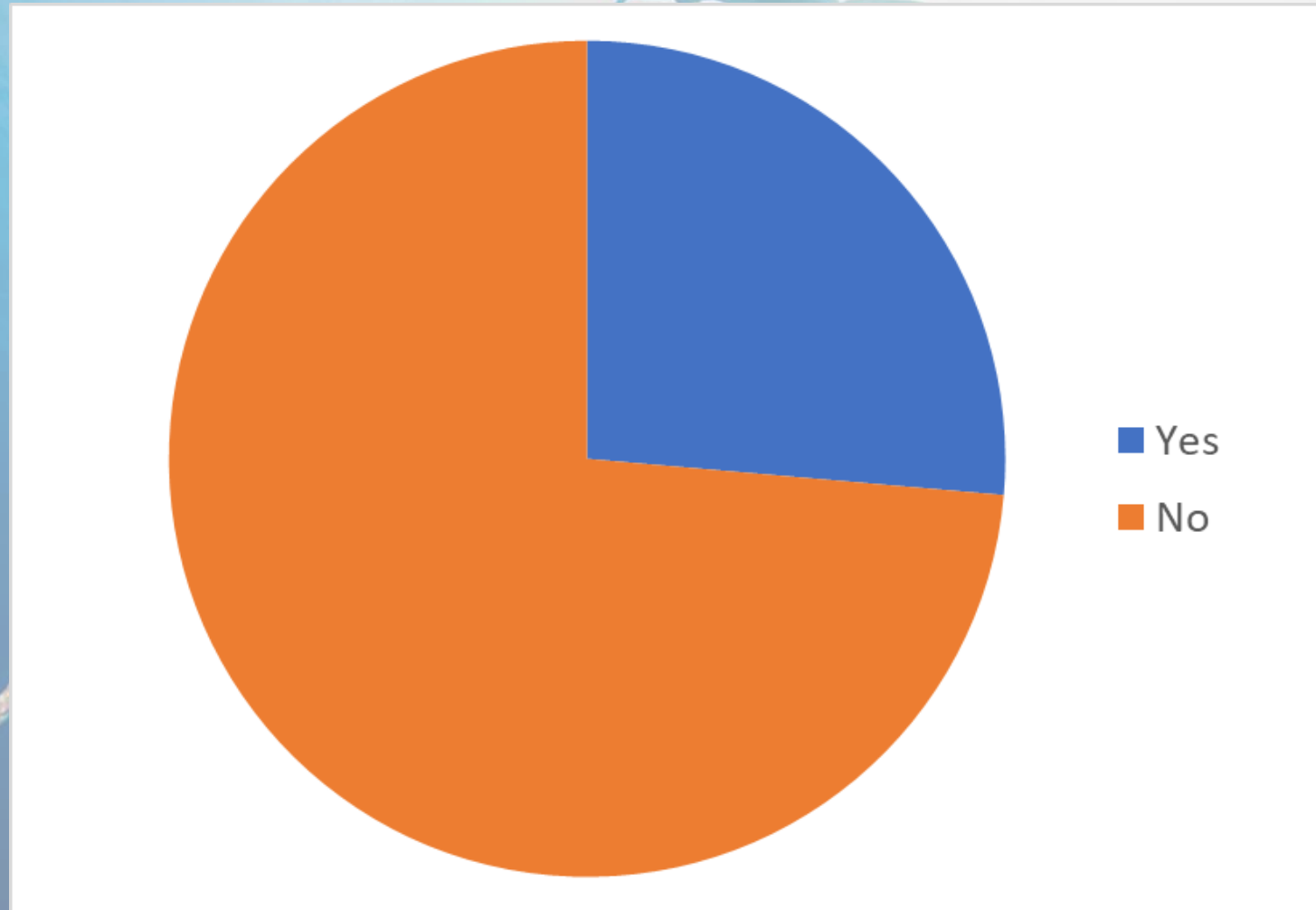


13. What recreational marine activities do you take part in?

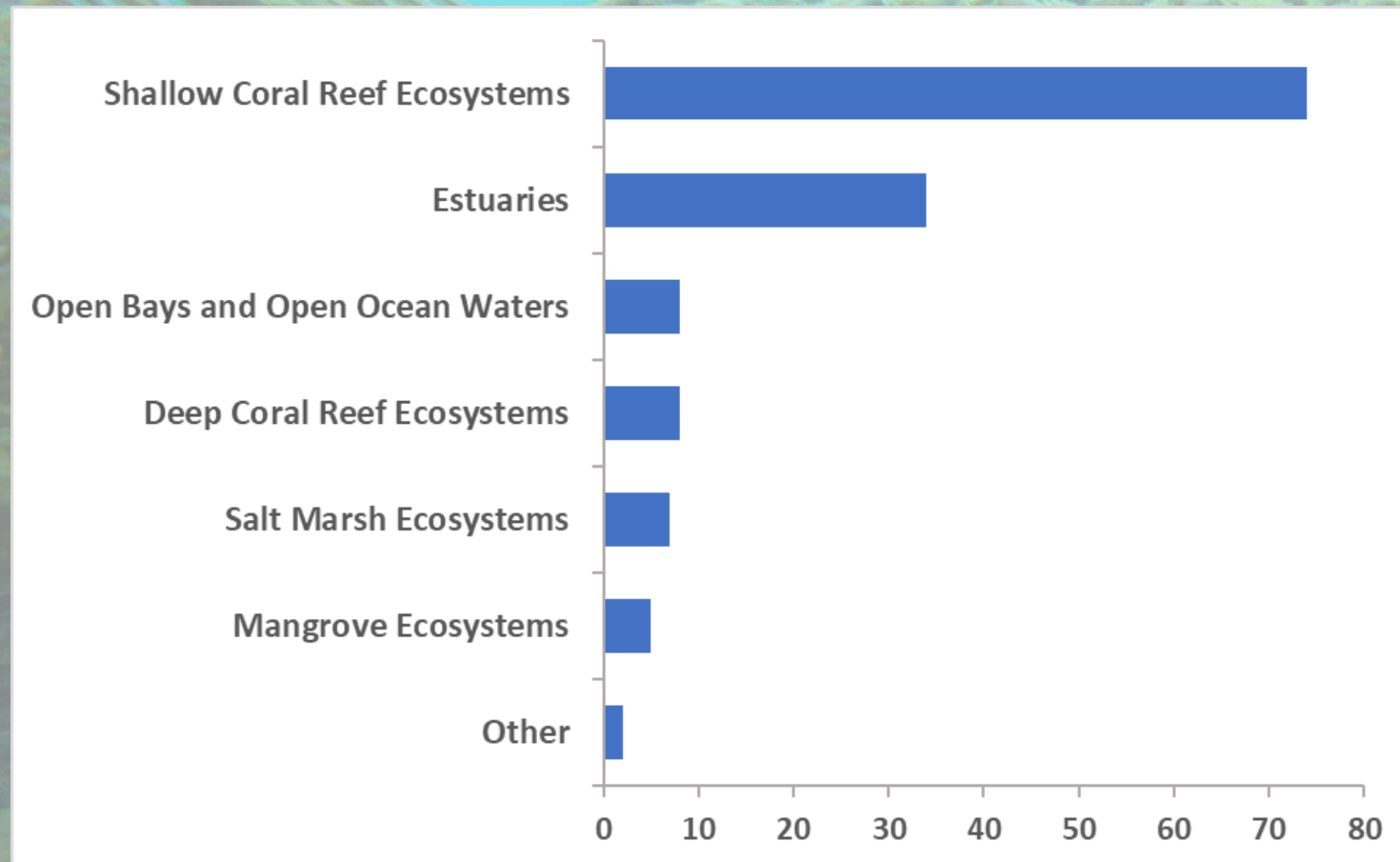


1. **SCUBA**
2. Going to the Beach
3. Kayaking/Paddle Boarding
4. Sailing/Boating
5. Fishing
6. Shellfish Digging
7. None of These

14. Are you concerned that acidification may affect your employment in the future?

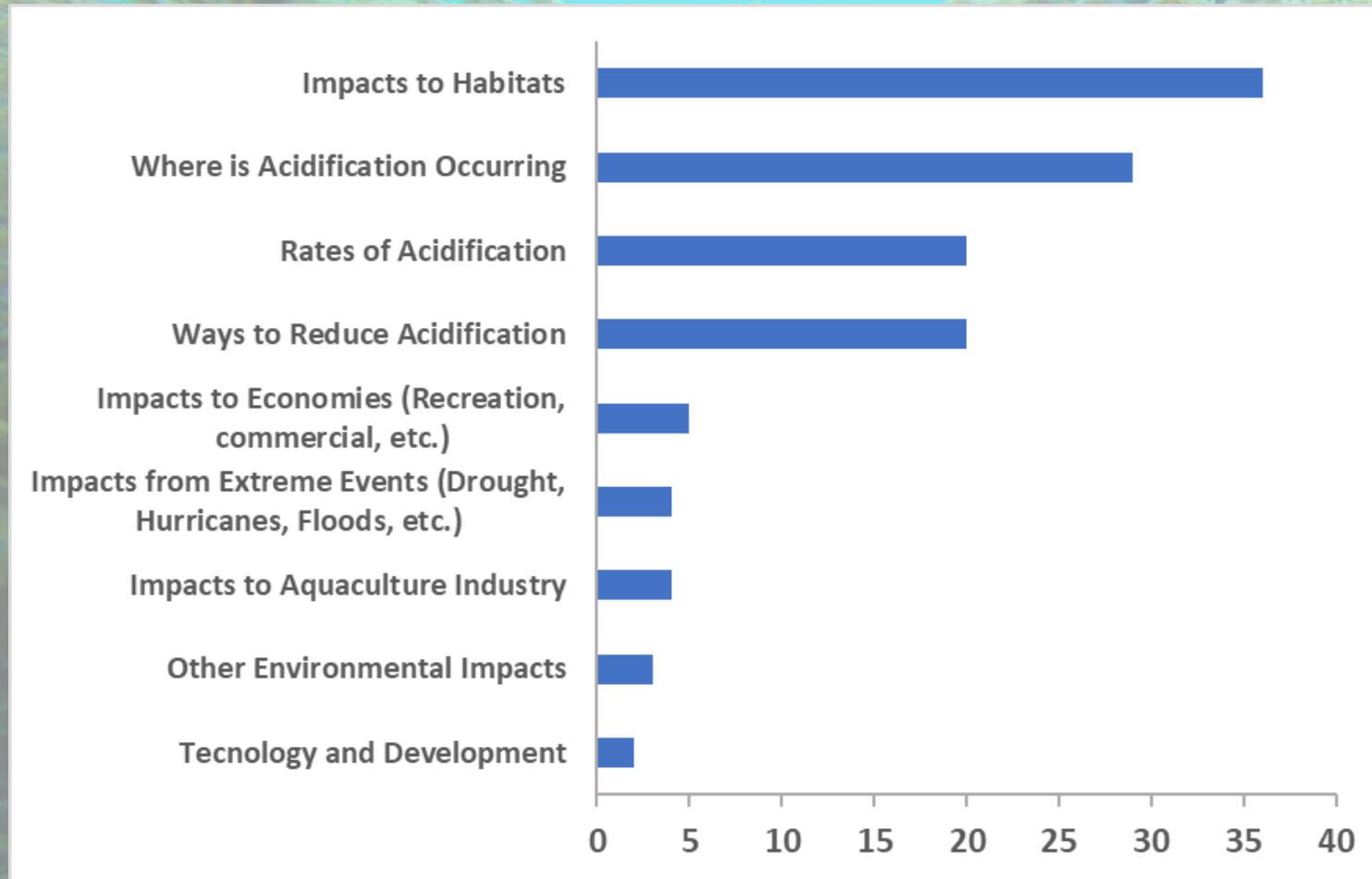


15. The following locations could be affected by acidification. Rank your concern about the potential effects of acidification?



1. Shallow Coral Reef Ecosystems
2. Estuaries
3. Open Bays and Open Ocean Waters
4. Deep Coral
3. Salt Marsh Ecosystems
4. Mangrove Ecosystems
5. Other

16. Rank aspects of acidification research that you think should be prioritized.

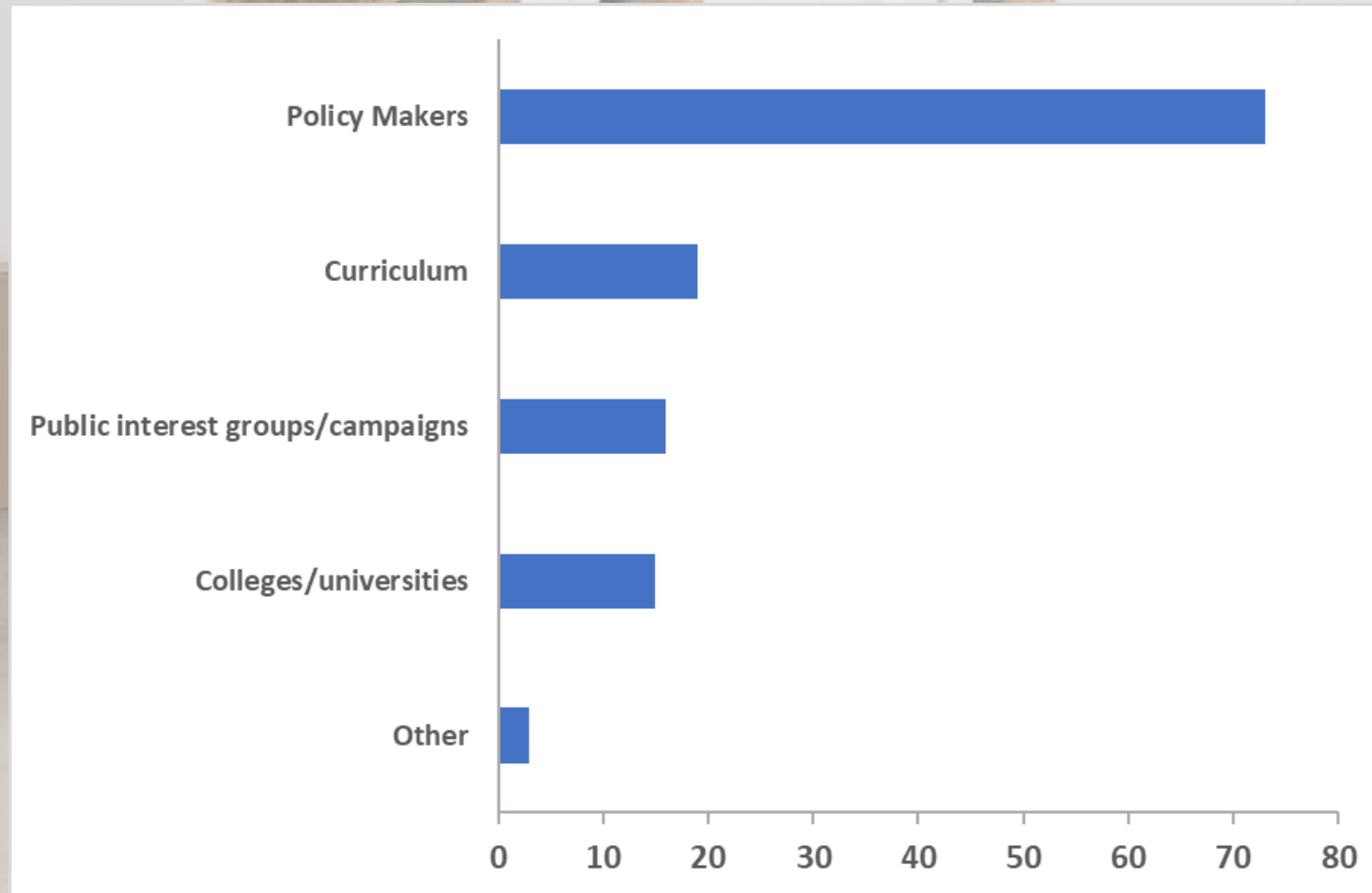


1. **Impacts to Habitats**
2. Where is Acidification Occurring
3. Rates of Acidification
4. Ways to Reduce Acidification
5. Impacts to Economies (Recreation, commercial, etc.)
6. Impacts from Extreme Events (Drought, Hurricanes, Floods, etc.)
7. Impacts to Aquaculture Industry
8. Other Environmental Impacts
9. Technology and Development

17. Any research areas we left out?

1. Better understanding the relative role of global climate change and atmospheric co2 levels versus nutrient inputs to
2. Acidification from air pollution, human health and plant impacts
3. Impacts on wildlife
4. Behavioral changes to reduce causes
5. Social surveys to understand what the public and decision makers know about this topic.
6. sediment/erosion
7. Buffering capacity of ecosystems/estuaries
8. Micro flagellates, food chain base
9. Larval recruitment
10. food web impacts
11. critical planktonic food webs
12. Trend analysis of acidification over time
13. chemical erosion of carbonate sediments
14. Acidification contributing factors in our area
15. Florida aquifer
16. where impacts come from most
17. How ocean acidification affects prevalence and toxicity of harmful algal blooms.
18. Compiling existing water quality data to help understand trends in areas across Florida
19. How to best educate the public and policy
20. Modeling of acidification for future impacts
21. Measurement tech improvements
22. Would like to see more studies done on the slowly rising alkalinity levels vs acidification
23. Impacts to subsistence fishing communities
24. Research promoting non-carbon fuels
25. Public education on what OA is and how people can be proactive to mitigate
26. impacts on cultural resources- overlap with habitat and economy

18. Rank the following educational opportunities that we should target for acidification.



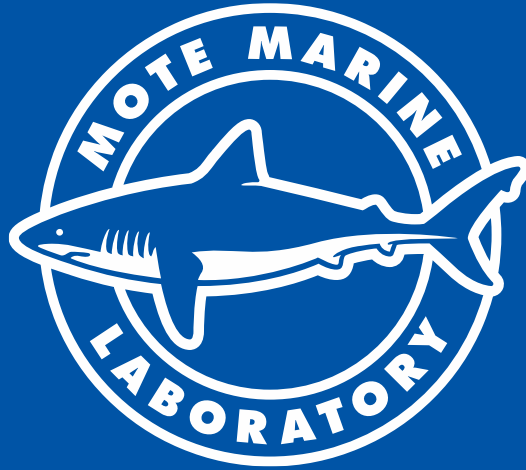
1. Policy Makers
2. Curriculum
3. Public Interest Groups/Campaigns
4. Colleges/Universities
5. Other

19. What type of communication would be helpful for conveying information about acidification?



SUMMARY:

- First attempt at this type of survey for NOAA OAP/CANs
- Still sorting the data
- Will be reported and presented to NOAA OAP
- Will be a part of NOAA OAP nation-wide survey for decision making on prioritizing monitoring and assessment
-and ultimately a report to the White House



Thank you

Emily R. Hall, Ph.D. • emily8@mote.org

