

What is at risk?

Species and dollars on the front line

If acidification harms species that are important to the Gulf's food web, it could imperil the region's economically important seafood industry. Tourists who come to swim, fish, dive, and enjoy healthy coastal resources like beaches and wetlands are also an integral part of the Gulf Coast economy.

Key numbers for the seafood industry (2008)

\$10.5 billion in seafood sales

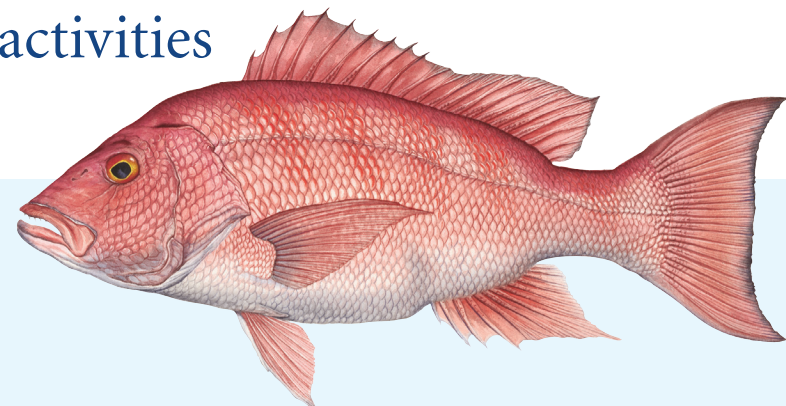
\$5.6 billion in fisheries income

200,000 jobs supported by fishing

Key numbers for the tourism industry (2006)

620,000 jobs created by tourism and recreation in 2006

Between **\$8.3 billion** and **\$32.4 billion** in annual economic value for water-based recreational activities



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Red Snapper ©Flick Ford, from the book FISH: 77 Great Fish of North America, Greenwich Workshop Press, 2006.

Q&A

Answers to common questions

What is ocean acidification? Every day, the ocean absorbs approximately one-third of the carbon dioxide we put into the atmosphere when we burn fossil fuels and clear land. When carbon dioxide dissolves in seawater, it becomes an acid. This acid is lowering the pH of ocean water. pH is an important vital sign of ocean health, and its rapid change raises a red flag. Scientists refer to this shift in ocean chemistry as ocean acidification.

How fast is ocean chemistry changing? Ocean acidification is happening faster than it has in the past 300 million years, catapulting us into unknown territory. Since the Industrial Revolution, the world's oceans have become 30 percent more acidic, on average. Scientists predict the acidity of our oceans could double or triple by the end of the century compared to preindustrial times.

How might ocean acidification affect marine life? As seas become more acidic, they become inhospitable to some sea life. Rising acidity robs seawater of carbonate ions, an essential ingredient used by creatures like shellfish and corals to build their shells. In slightly more acidic water, they must expend more energy to build shells, which may leave them less able to find food or reproduce. On the extreme end, if seawater becomes acidic enough, shells literally dissolve, which can be disastrous for survival.

Will all sea life be negatively affected? Not all ocean organisms will be harmed by ocean acidification. We know that some creatures—corals, clams, oysters, scallops, and some forms of plankton—are sensitive to these chemical changes. More research is needed to fully understand how declines in sensitive species could ripple across the food web and cause harm to commercial finfish.



For more information contact Lisa Suatoni, marine scientist, lsuatoni@nrdc.org

Economic statistics were taken from:

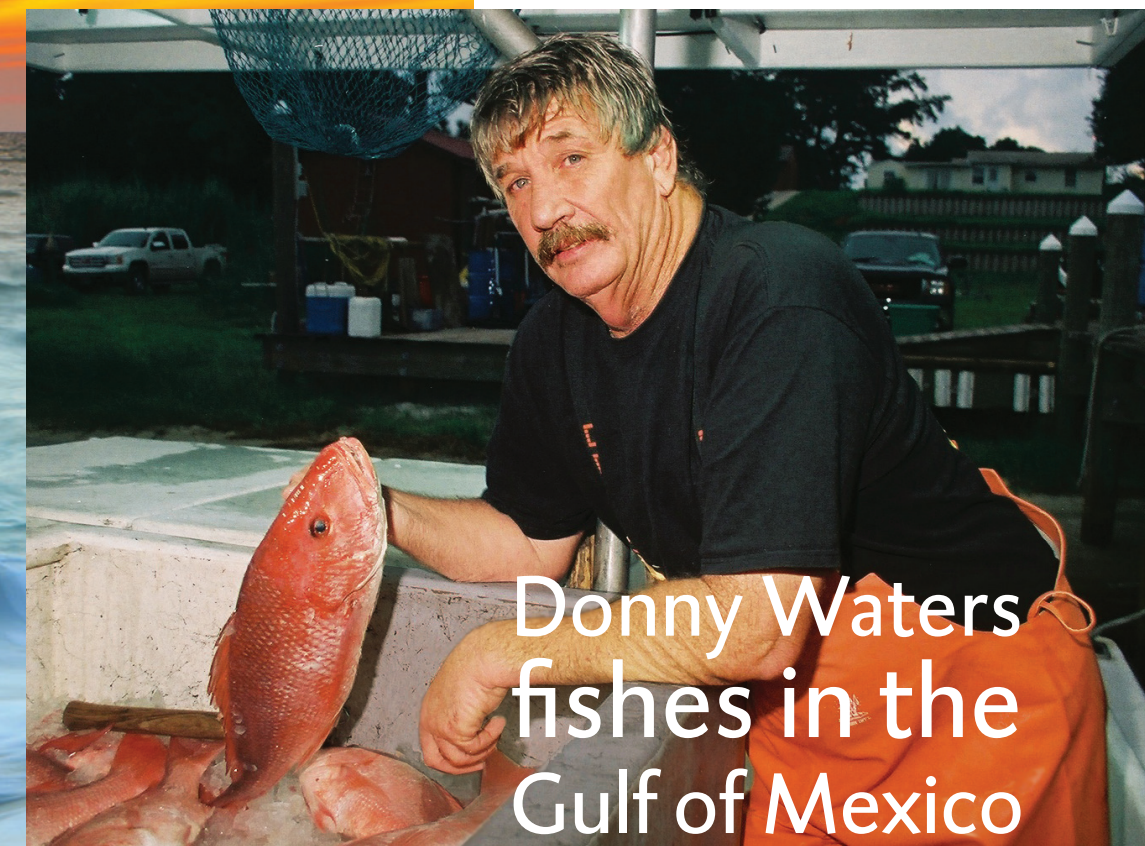
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Gulf of Mexico

Ocean Acidification



Donny Waters fishes in the Gulf of Mexico

Donna Mackey

for red snapper, which eat shrimp, crab, and other shelled creatures that could fare poorly as seawater becomes more corrosive. So when carbon dioxide emissions threaten to start changing ocean chemistry, that gets his attention.

This process—called ocean acidification—occurs a little more slowly in warm waters like the Gulf. But the extreme nutrient pollution that creates the world's second largest dead zone intensifies the acidification of the Gulf's waters. And the importance of potentially vulnerable species such as shrimp, crab, and deep sea corals put this region at risk.

Still, the Gulf of Mexico and eastern Florida, where seafood businesses generate \$10 billion in annual sales, currently lack even basic information to assess acidification's threat. "Please don't ignore the scientists. Please spend a little bit of money to find out the truth," said Waters. "The last thing we need is to have our recovery threatened by something we didn't see coming."

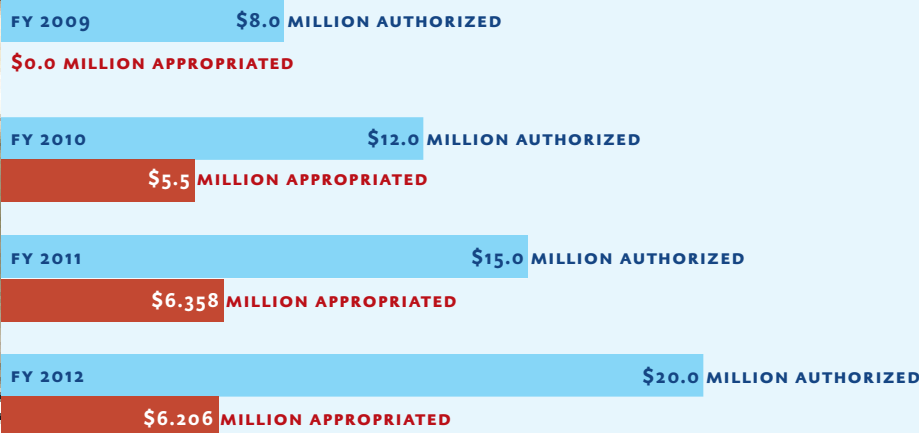
ABOVE: DONNY WATERS WITH HIS CATCH OF RED SNAPPER.

Fully fund FOARAM

What we don't know *can* hurt marine industries

In 2009, Congress passed the **Federal Ocean Acidification Research and Monitoring (FOARAM)** Act to monitor the progression of ocean acidification and better understand how it threatens national fisheries. This important program suffers from severe underfunding, which is now stalling its implementation. Without full funding, industries that depend on robust fish and shellfish populations and vibrant coral reefs will lack basic information they need to protect their businesses. The authorized level of funding is modest in comparison to the high value of these resources.

FOARAM appropriations over the last four years



“There is a lot at risk for the fishing industry and anyone who eats seafood. But, as long as we have good science, we may have the opportunity to make adjustments as these changes take place over time. Without funding for science, we’ll be in the dark until it’s too late.”

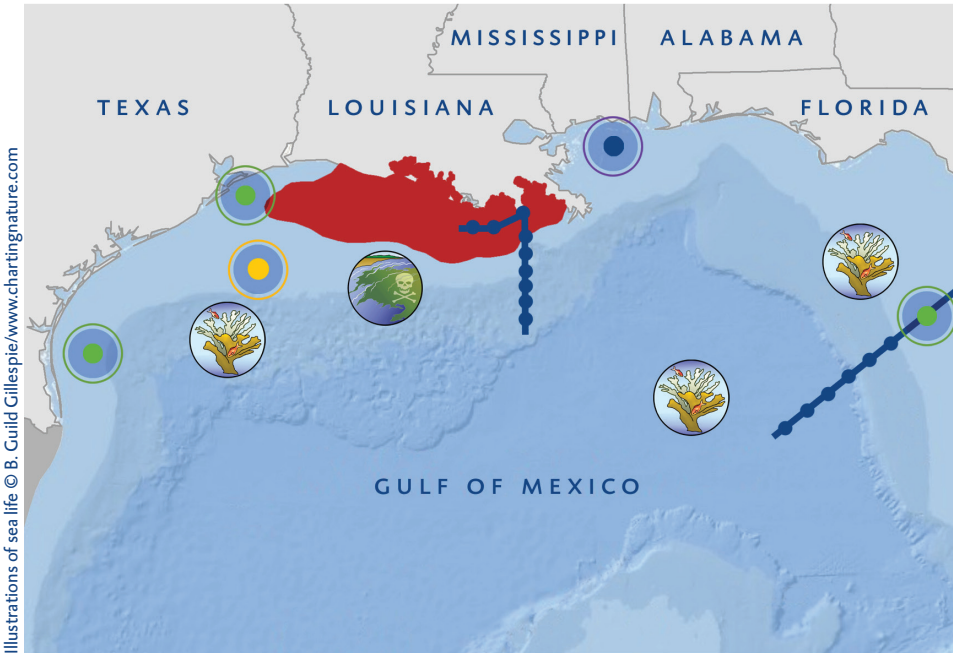
— MARK VINSEL
EXECUTIVE DIRECTOR OF UNITED FISHERMEN OF ALASKA

The Gulf of Mexico hotspot

Why we need to be concerned

Nutrient pollution from America’s breadbasket has created a “dead zone” in the Gulf of Mexico larger than some U.S. states. Scientists believe the combination of this pollution and global fossil fuel emissions is causing the region’s waters to become more acidic more quickly than expected. In short, these waters are getting a double dose of carbon dioxide from two different sources. This one-two punch is more damaging than either problem alone.

In addition, marine creatures already stressed by oil drilling, spills, pollution, overfishing, and other industrial practices in the Gulf may be less able to adapt to changing water chemistry.



Dead Zone

Pollution from fertilizers used in the Mississippi River Basin cause the second largest dead zone in the world. The excess algae sink, decay, and contribute to local acidity.



Coral Sensitivity

Corals, which provide an important habitat for the Gulf of Mexico’s valuable reef fisheries, demonstrate a particular sensitivity to ocean acidification in laboratory trials.



PLANNED
MONITORING
STATION (unfunded)



EXISTING
MONITORING
STATION



PLANNED CORAL
REEF MONITORING
STATION (unfunded)



ACIDIFICATION HOTSPOT



WATER SAMPLES
TAKEN FROM RESEARCH
VESSEL EVERY TWO YEARS

The value of information

Invest in FOARAM to help small businesses

Just as mariners rely on accurate weather forecasts before heading out to sea, aquaculture facilities and fishermen need to know when ocean conditions are threatening vulnerable species with elevated acidity.

Two oyster hatcheries in the Pacific Northwest have suffered from massive die-offs in recent years. Scientists have determined that oyster larvae could not survive when local conditions made the seawater that hatcheries use to grow shellfish too corrosive.

A \$500,000 federal appropriation for a monitoring network that now measures pH, carbon dioxide, and other variables in seawater has kept the Northwest shellfish industry intact, for now. By helping oyster hatcheries identify and avoid potentially lethal water, that initial investment has provided an estimated \$35 million in economic benefit to coastal communities. Yet the funds to operate this early warning system ran out at the end of 2012, and it is unclear whether money to continue the monitoring program will be appropriated.

Taylor Shellfish, the West Coast’s largest producer of farmed shellfish, saw its oyster production plummet by 80 percent a few summers ago. Thanks to the new equipment and favorable weather, the company has since hit record production levels.

Continued inadequate funding for ocean acidification monitoring puts shellfish producers and commercial fishermen in a risky position.



OYSTER FARM
SAMISH BAY, WASHINGTON

“The monitoring equipment has literally put the headlights on the car for us. We were flying pretty blind before.”

— BILL DEWEY
CLAM FARMER AND SPOKESMAN
FOR TAYLOR SHELLFISH