



# Ocean Acidification

## What It Means to Alaskans and How We Can Adapt



Pteropod, *Limacina helicina*

### What is ocean acidification?

Carbon dioxide ( $\text{CO}_2$ ) occurs naturally in the atmosphere and the ocean. In addition, the ocean acts like a sponge and absorbs about one-third of human-caused atmospheric  $\text{CO}_2$  emissions. Since the industrial revolution, human activities have increased the amount of  $\text{CO}_2$  in the atmosphere. When  $\text{CO}_2$  dissolves in seawater, hydrogen ions are released, lowering the pH of the seawater. Seawater currently has a pH of 8.1 (7.0 would be neutral)—so a small decrease in pH doesn't actually make it an acid, but it does make it less basic. A shift toward a lower pH is called "ocean acidification."

### Why does it matter?

This "acidification" is a looming threat to fisheries because of its potential impact on organisms that form protective shells, such as coral, calcifying phy-

toplankton, crabs, and other shellfish that derive their calcium and carbonate ions from seawater. The calcium carbonate structure of the shells of these organisms may corrode if  $\text{CO}_2$  levels in the water increase enough. A more immediate concern, however, is that many organisms depend on carbonate ions dissolved in seawater to build their shells. In seawater,  $\text{CO}_2$  reacts with carbonate ions and lowers carbonate concentration. If the carbonate ion concentration is too low, those creatures will be unable to form their shells.

The very basis of the oceanic food chain is made up to a significant extent of calciferous plankton, which are tiny drifting organisms. Of particular concern to Alaska fishermen is the effect acidification can have on a planktonic, free-swimming snail called a pteropod, or sea angel, which is an important food for commercial fish such as pink salmon, herring, and pollock. Entire ecosystems may change with ocean acidification.

Ocean acidification has happened before in the geological record, but the rate at which it is increasing now is at least ten times faster than any change in acidity experienced by marine organisms for the last 20 million years or more.

### How do we know that ocean acidification is happening?

Research by many scientists worldwide, including the University of Alaska, has shown that acidification is occurring in deep ocean waters, particularly in the Arctic and North Pacific. Upwelling,

possibly caused by changes in weather patterns, brings more of this lower pH water to the surface and coastal zone where most fisheries productivity is.

### What are Alaskans observing?

So far, people other than scientists have not observed effects of acidification in Alaska waters, but studies of oyster larvae die-offs in Oregon point to acidification as a possible cause. Some fishermen speculate that recent failures of a few pink salmon runs may be related to pteropod decreases, but this link is not proven.

### Is ocean acidification an immediate threat to Alaska's commercial fisheries, subsistence resources, recreation, or lifestyles?

Scientists think it is unlikely that Alaskans will experience significant general decline in ocean productivity due to acidification over the next decade. However, it is known that some organisms respond more dramatically to environmental change than others. Some scientists believe that by mid-century there will be observable changes in species composition in local seas if immediate steps aren't taken to slow down or stop the  $\text{CO}_2$  emissions that are causing acidification. The question has not yet been studied sufficiently to provide precise estimates of impacts, but it is not too soon to think about ways to halt acidification as well as steps for adapting to the changes likely to come.

## What can we do to stop ocean acidification?

Scientists generally agree that the only way to slow or stop ocean acidification is to reduce “greenhouse gases” by cutting fossil fuel emissions.

## What can we do to adapt?

- Support increased research into ocean acidification, its causes, and potential responses.
- Stay current on research results and news, especially observations in Alaska and other high-latitude waters.
- Review your commercial fishing business plan, and look for ways to minimize the impacts that changes in species abundance would have on your operation. Options might include diversification of fishing/aquaculture operations or learning new skills to diversify income such as non-fishing/non-aquaculture business or employment.

## For more information or assistance

**Climate Change Adaptation, Alaska Sea Grant Marine Advisory Program**  
<http://www.marineadvisory.org/climate>

**Alaska Center for Climate Assessment and Policy (ACCAP)**  
[http://ine.uaf.edu/accap/alaska\\_arctic.html](http://ine.uaf.edu/accap/alaska_arctic.html)

**European Project on Ocean Acidification (EPOCA)**  
<http://oceanacidification.wordpress.com/>

**Frequently Asked Questions, EPOCA**  
<http://www.epoca-project.eu/index.php/FAQ.html>

**Impacts of Ocean Acidification, National Oceanic and Atmospheric Administration (NOAA)**  
<http://www.noaanews.noaa.gov/stories2006/s2606.htm>

**NOAA Climate Services**  
<http://www.climate.gov>

**NOAA Pacific Marine Environmental Lab**  
<http://www.pmel.noaa.gov/co2/OA/>

This Alaska Sea Grant Marine Advisory Program (MAP) project is supported by the Alaska Center for Climate Assessment and Policy (ACCAP). MAP is a statewide outreach and technical assistance program that helps Alaskans sustain economic development, traditional cultural uses, and conservation

of marine and coastal resources. ACCAP's mission is to assess the socioeconomic and biophysical impacts of climate variability in Alaska, make this information available to local and regional decision-makers, and improve the ability of Alaskans to adapt to a changing climate.

