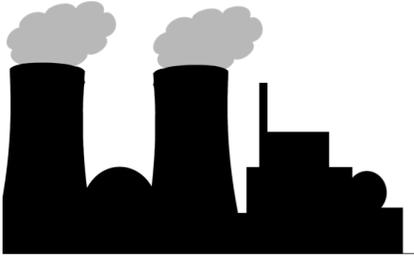


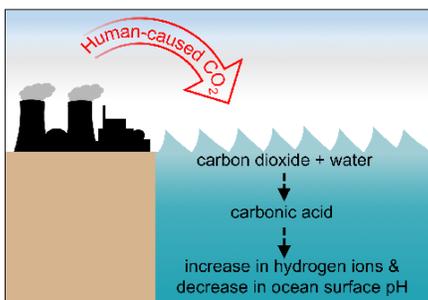
Ocean Acidification Case Study: Dungeness Crab

What is Ocean Acidification?

Since the industrial revolution, the concentration of carbon dioxide (CO₂) in the atmosphere has increased due to the burning of fossil fuels such as coal, gas, and oil, along with deforestation.



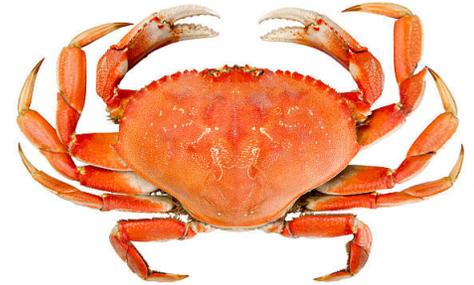
Annually, about 25% of CO₂ emissions is absorbed by the ocean, making the ocean's chemistry more acidic.



This decrease in ocean pH over time is called ocean acidification and it makes it harder for calcifying animals like Dungeness crab to thrive.

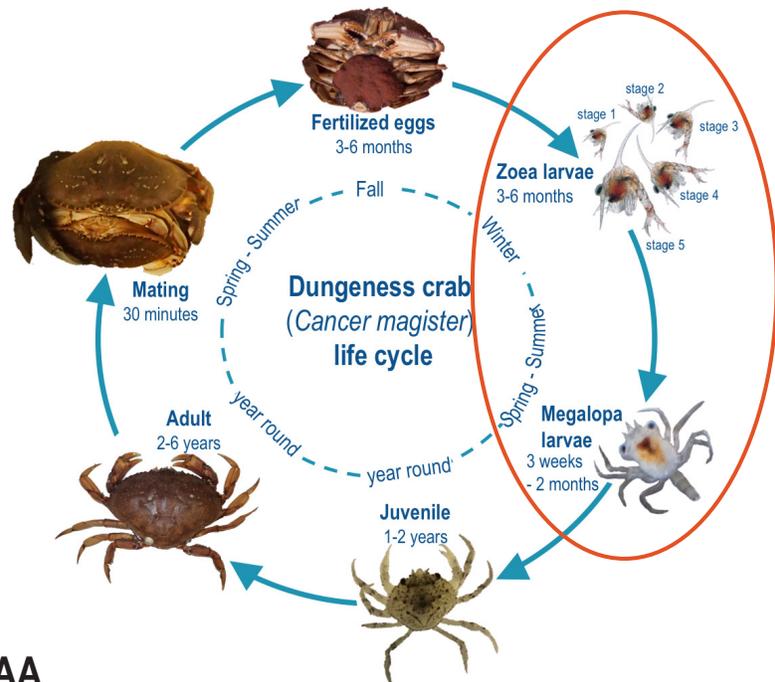
How will Ocean Acidification Affect Dungeness Crab?

Dungeness crab are an abundant and valuable species throughout national marine sanctuaries along the West Coast of the United States. NOAA research shows that crabs in their early larval stages are vulnerable to low pH seawater.



Life Cycle of the Dungeness Crab

Molting from one stage to the next and carrying fertilized eggs require a lot of energy, as does dealing with stress from global ocean change.



Stages most likely vulnerable to ocean acidification

NOAA

Research Shows Crabs are Vulnerable

In lab studies, exposure to lower pH seawater decreases Dungeness crab larval development rates and survival. It also impacts prey species, such as bivalves which they depend on.

Complex modeling projects a decline in Dungeness crab biomass and loss in economic revenue in the next 50 years due to ocean acidification.



Graphical summary of data described in Miller et al. 2016 Marine Biology.

Dungeness Crab are Important to People

NOAA supports research to understand the impacts of ocean acidification on Dungeness crab. Additionally, NOAA's Ocean Acidification Program collaborates with states, universities, and industry to continue extensive monitoring of ocean chemistry along the West Coast of North America to best adapt to our changing environment.



Photo: Austin Trigg, NOAA



Photo: Austin Trigg, NOAA

The jobs and livelihood of many fishermen, restaurant workers, and seafood retailers depend on healthy Dungeness crab.

The Dungeness crab fishery in the United States is valued at \$220 million annually.

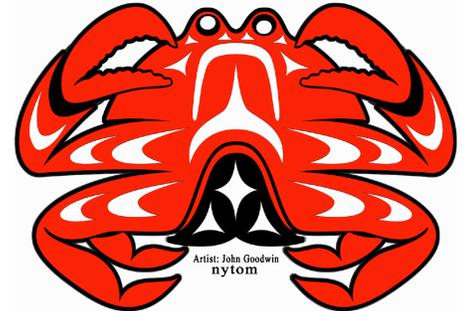


Photo courtesy: Dungeness Crab Festival, Artist: John Goodwin "Nytom"

Tribal Dungeness crab fisheries are culturally important to many Native Americans, providing food, income, and communal activities.

NOAA's National Marine Sanctuaries of the West Coast are:

- actively eliminating and reducing risks to the ocean by working with communities through focus groups, advisory councils, education, outreach and resource protection programs;
- supporting and conducting research that brings experts together to safeguard habitats and maintain healthy fisheries for people; and
- protecting crab habitat encompassed in >15,000 square miles of ocean conservation space by prohibiting oil and natural gas exploration and extraction, deep sea mining, and reducing water pollution.



Photo: NOAA

NOAA Northwest Fisheries Science Center leads research efforts in the laboratory on the effects of ocean acidification on Dungeness crab.

How Can You Help?

- **Be energy smart!** Use less energy generated by fossil fuels, like coal, oil and natural gas. Burning less fossil fuel will reduce your carbon dioxide emissions, making ocean life safer.
- Find out what your local government, businesses, and schools are doing to **reduce use of fossil fuels** and transition to **renewable, clean energy**.
- **Educate others** about how carbon dioxide emissions are impacting ocean life.
- **Support research** to inform management decisions that will best protect Dungeness crab populations into the future.



Photo: Olympic Coast National Marine Sanctuary

Dungeness crab outreach aboard a vessel in Washington.



NOAA FISHERIES



NATIONAL MARINE SANCTUARY FOUNDATION



NOAA OCEAN ACIDIFICATION PROGRAM

<https://sanctuaries.noaa.gov/education/crab-toolkit.html>