

Bay Watch: Guard Our Ocean From Acid!

The Issue

San Francisco Bay Area, CA, like many places in the world, is experiencing **lots of pollution; one of them being ocean acid**. Ocean acidification has been around for a very long time, but it has been more noticeable in the recent decade. However, for some background, ocean acidification increased after the Industrial Revolution when greenhouse gases and factories became common. The gases were, and are, very bad for the atmosphere. Eventually, some of the gas got seeped into the ocean. This used to be thought to be good! We used to think that it would prevent excess gas from floating in the air. **But what happens to the seawater that is contaminated with gas pollution? Acidification. Although unfortunate, it needs to be talked about.**



Artificial Intelligence created this image showing the Golden Gate Bridge in San Francisco along with the topic of ocean life.

CHUSPT (ALL) 13

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Beach in San Francisco in 2017, relating to the topics.

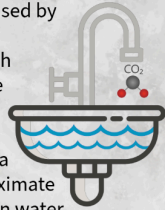
Why Read This?

Whether you are local to the San Francisco Bay Area, or live nowhere near it, this paper will be beneficial to you.

Although this refers mostly to the Pacific Sea in the Bay, it is important to know that these issues are happening elsewhere too. We need to be aware of these issues, where they are happening, why it's happening, and what we can do. **Continue to page 2** to become aware so that you can protect our multi-functional seas.

Acidification Abyss

Ocean acidification is caused by **human activity**. A lot of the greenhouse gasses from such activities get sucked into the ocean as a “carbon sink,” which is helpful for the air but not for the ocean and sea life. In fact, there’s an approximate 30% increase of acid in ocean water (generally).



But who and what does this impact?

Everything. One of them is the animals, “this [ocean] acidity has the potential to affect a variety of marine and estuarine life, particularly animals like oysters and mussels that build their shells from calcium carbonate” (Monahan). It explains how the shells of certain sea animals in San Francisco Bay can dissolve.

Additionally, the **sea creatures lack carbonate ions (which they use to survive)**. This is caused by the carbon dioxide (from the pollution) that mixes into the seawater to create Hydrogen ions. These ions also want carbonate ions, stealing them from the sea creatures. The animals cannot find appropriate habitats as well.



Another group impacted is **humans who rely on fish for protein**. The availability of fish decreases as the fish cannot grow properly. In fact, it is so concerning that Francisco Chavez, a biological oceanographer for the Monterey Bay Aquarium Research Institute and a lead researcher of a study in San Francisco says **“We’ve estimated that this could increase the amount of carbon dioxide entering coastal waters by roughly 20 percent”** (Fimrite). Over time, the carbon cycle will cause too much acid-

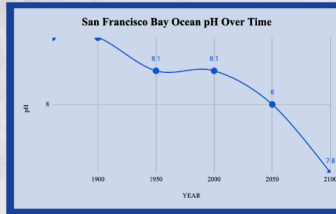
ification and carbon in the ocean.



Study predicting ocean acidification levels in San Francisco.

Dip into the Chemistry

Due to a change in the oceans' acidification, there is also a change in the pH. For some rapid-fire background, the pH is the potential hydrogen ion concentration, to test whether a solution is acidic or alkaline (or neutral). Ocean water is a homogenous mixture, made up of water (the solvent) and numerous ions, like sodium chloride (the solute). This means that changes in the acidification will change the composition of this solution, impacting the San Francisco ocean.



Graph 1. Visual of the San Francisco Bay ocean's pH over time using data numbers from article

By looking at the graph, it is clear that the pH is decreasing (becoming more acidic) since it is currently about 8.15, and has the potential to be 7.8 in 2100. Although the change might not seem large, it is. Compared to the years in the past, it is a big deal that the pH decreased, since changes in the ocean chemistry happen very slowly. **More acidity causes more hydrogen ions, which will once again take away carbonate from the sea creatures.**

For context, the last time the pH was 7.8 was millions of years ago during an extinction of certain species, which should worry us.

Waves of Ecosystem

Another area of concern is the biodiversity and ecosystem of the San Francisco ocean. Biodiversity is all types of organisms and how the sea creatures all connect in some way — the food chains, food pyramids, and how they support each other. It is crucial for life, as it is the **“assortment of life on Earth.”** (The Nature Conservancy) In other words, variety is key. This includes the ecosystem, biotic and abiotic organisms. The food web shows us how the energy between animals is transferred from one to another. The ocean is a very large ecosystem, which is why ocean acidification can have a large impact on it, in numerous ways. This may seem daunting, but there may be a sliver of hope involved. The fact that there is a diverse food web and ecosystem, will mean that the ecosystem will likely survive if a few animals in San Francisco, unfortunately, go extinct.

A research article on San Francisco's ocean says **“This effect, as it multiplies, has the potential to change the chemical makeup of all the oceans on Earth, warming the water enough to cause an ecosystem collapse that would reverberate up and down the food chain, ruining the fishing and seafood industries and causing the economic crisis”** (Fimrite).



Next Splashes

“You’d think by now, given the **intensity** of this issue, that people, somebody, would have invested already in knowing what’s going on” (Simons).

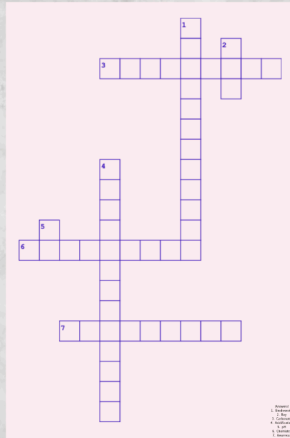
It won't seem easy to fix this issue, because it's not easy. That does not mean that it's impossible. This topic is rather under-researched in some areas. **San Francisco studies have used monitors to try and change the amount of data in order to make a change** (Monahan). Smaller sustainable practices over time can have an effect. The bigger things, like having a **change of pace on infrastructure, farming, and economy will help our ocean life the most-- which will lead to a better life for humans** as well.



Sail a Little Futher!

Crossword

Bay Watch: Ocean Acidification



Good luck!

Across

3. Ions that sea creatures lack
6. Changes in the Oceans ____
7. Purpose of the article

Down

1. Variety in organisms
2. ____ Area
4. The main issue
5. Measuring the acidity

Zoom into bottom of the image for answers!

Word Search

Chem and Cali: Oceans

Check that you understand these topics!

Word List:

Acid
Alkaline
Carbonate
Ecosystem
Hydrogen
Ion
Solute
Solution
Solvent

The chemistry is important to fully understand the issue!



Citations

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