

Earth to Sky Climate Cast Climate Change, Upwelling, and Alcatraz's Seabirds

Music Begins & Fades Slightly

[Sarah Acosta]

Without upwelling the marine food source for seabirds would be pretty poor. Upwelling brings nutrients to the surface of the water and these nutrients along with the sunlight allow phytoplankton to grow rapidly.

Music Fades in, then Fades out

[James Osborne]

I'm James Osborne, park ranger at the Golden Gate National Recreation Area in San Francisco, California, and I'll be your host for this episode of Earth to Sky's Climate Cast in which we delve into the influence climate change may have on upwelling, and specifically how these changes may affect our coastal seabirds.

California's marine ecosystem relies on upwelling to support the diversity of its plant and animal life. Upwelling is the wind-driven movement of cooler, nutrient rich deep-ocean waters to the ocean's surface. This nutrient-rich water replaces the warmer, nutrient-depleted surface water. The nutrient rich water acts as a fertilizer, triggering the growth of phytoplankton, which are the basis of the marine food web. Fish, marine mammals, and marine birds are all dependent on phytoplankton as the foundation of their food supply, and most rely on strong and consistently timed upwelling during breeding seasons and for species survival.

I met with Frank Schwing, an oceanographer with NOAA's National Marine Fishery Service, to discuss the importance of upwelling and how climate change may influence it. He told me it's important to humans and animals alike.

[Schwing]

The reason it's important is because it supports the biology of coastal waters, including many of the commercial and recreational fish and marine mammals that are really important to us, both economically and culturally. So, as this nutrient rich water comes up to the surface it acts as a fertilizer in the sunlit surface waters, and triggers the growth of phytoplankton which are these one cell plants and form the basis of a very productive food chain.

[James]

Although Schwing can't say for certain whether climate change is affecting this vital life process, much of the scientific evidence points towards climate change's influential effect.

[Schwing]

We can go back reliably roughly sixty years in our area to get fairly reliable estimates of what the upwelling has done. We don't have direct measurements because it's very difficult to measure these vertical motions of water they are quite small, but we use other measures such as the strength of the wind and changes in surface temperatures to give us an idea of how much upwelling occurs and how much it changes from year to year. Over that time period we have seen a fairly consistent increase in the total amount of upwelling which is actually slowing the affect of global warming at the surface and the

reason is because we're seeing winds intensifying due to a generally warmer and energetic atmosphere occurring. So in some ways global warming is a good thing for our area because it's producing more upwelling and a more productive system.

[James]

Although climate change may have some positive effects on upwelling, there are still negative consequences.

[Schwing]

There's also a downside to what we're seeing. There's some evidence that the upwelling isn't beginning as early as it used to, it's being delayed. And that has real serious consequences to many of these species who have evolved and adapted very strict and well-timed life histories. And if they are reproducing when they expect upwelling to occur and the upwelling is not going on then that is going to have a major effect on those particular species.

[James]

Scientists can not predict exactly how climate change may affect California's upwelling. It is likely that there will be stronger long shore winds which would increase upwelling and could be beneficial to the fish and other marine organisms. In a second scenario, climate change may depress the thermocline, and cause lower nutrient waters from above the thermocline to upwell to the surface, as now happens during El Niño events. A third scenario pushes upwelling further offshore and out of reach for many of California's seabirds.

To learn more about upwelling's effects on seabirds, I met with Sara Acosta, and Lara Rachowicz. Acosta is a biologist with PRBO Conservation Science, a group dedicated to bird ecosystem research. Rachowicz is a biologist, who studies water birds on Alcatraz Island for Golden Gate National Recreation Area. Acosta explained the importance of upwelling to the seabirds' survival.

[Acosta]

Without upwelling the marine food source for seabirds would be pretty poor. On Alcatraz, Brandt's Cormorants in particular, which was once the most numerous seabird breeding on the island, would be especially affected because they heavily rely on forage fish like anchovy to make up their diet, and forage fish are prey that rely on the nutrients that upwelling brings.

[James]

According to Rachowicz, the National Park Service is doing its part to protect the habitats of seabirds and their marine ecosystem.

[Rachowicz]

I think what the park service is trying to do in general is make the species habitat, and their food webs, and their ecosystems as resilient as possible to this change that cannot be stopped necessarily by the Park Service or any one group. So that's the approach of the Park Service, we're doing a lot to help species in the face of climate change. (

[James]

The National Park Service not only protects the habitat of Alcatraz's seabirds, it also works to actively educate the public about the needs of the birds. PRBO and National Park Service staff together have worked on outreach programs in the area, speaking to local marinas, kayak rental shops, and boater

groups to raise awareness of the seabirds' needs. Getting too close to the birds will disturb their nesting cycles and reproduction. Both Rachowicz and Acosta are confident that education will lead to a bright future of seabird conservation.

[*Rachowicz*]

So we can't change the fact that climate change is going to occur, so there's not exactly a silver lining for seabirds when it comes to climate change, but we can continue to educate the public on the effects of climate change to seabirds and their environment and how to potentially mitigate those changes. And at PRBO we currently have a Seabird Education Awareness, or a SEA, program in partnership with the Golden Gate National Recreation Area and the Farallones Marine Sanctuary Association. And the program educates fourth and fifth grade students about marine food webs, seabirds at Alcatraz, and disturbances they face living in an urban environment. They are currently learning what they can do to protect seabirds, for example small things like not littering and giving wildlife their space. They understand how getting close to seabirds on Alcatraz, either by boats, planes or on foot would be disruptive to their nesting cycle. So pretty much by teaching these kids about wildlife and the environment we can begin to make positive changes. These kids are going to be the stewards of the marine environment in the future.

Music Fades in

[*James*]

Although we don't know with certainty what effect changes in upwelling will have on our coastal ecosystems, we can expect that changes will occur and alter our species populations. We need to take steps now to protect and preserve these species and educate the public about upcoming changes and what you can do to help. We all have the power to reduce our own greenhouse gas emissions and slow the progression of global warming. Each of us has the power, now we need to take our stand.

Earth to Sky's Climate Cast is made possible through an innovative partnership between the National Park Service, the Fish and Wildlife Service, and NASA. The theme music was composed and performed by Karen Savoca. Each episode is written and produced by employees and partners of the National Park Service. For more information on the NASA Earth to Sky Project, and to learn more about how climate change is impacting our national park system, visit www.earthtosky.org.