

Scientists looking for answers to climate impact along coast

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As the ocean changes due to climate change, the pressure is on scientists and others to find a way to determine how the ocean will adapt and if people can help protect it.

During a discussion with the Oregon Shores Conservation Coalition last week, Mark Carr, a professor of marine ecology in the Department of Ecology and Evolutionary Biology at the University of California Santa Cruz, said the challenge is immense.

"In my humble opinion, climate change is the greatest challenge in our current time," Carr said. "It manifests itself in many ways."

Carr said as the ocean warms up, especially near the coast, there are clear changes in currents, sea levels, acidity as well as temperature and precipitation.

To prepare for a changing coastal ocean, scientists like Carr must be prepared.

"How can we best prepare coastal marine life and human communities for the impact," he said.

When looking at a species in the coastal ocean, Carr said there are three questions that must be answered. First, the likelihood of exposure. Second, sensitivity to change and finally, adaptive capacity.

"Those three factors ultimately determine the vulnerability of a particular species," Carr said.

To prepare for the changes, Carr and a team created a climate vulnerability assessment. The assessment is not easy, but it could be effective.

"Climate change impacts are really complicated," Carr said. "They have lots of feedback to the system that most of the vulnerability assessments don't capture."

The goals of the assessment plan created by Carr and his team are to identify vulnerabilities and adaptive capacities, empower communities for mitigation and adaptation to climate impact and avoid unintended consequences.

After creating a framework for the assessment, Carr and his team at Cal Santa Cruz tested it by looking back a few years. They looked back at the devastation of the red sea urchin fishery. That event was brought on by two events, a marine heat wave from 2014 to 2016 from California to Washington at the same time that sea star wasting disease began eliminating most of the sea stars from the ocean.

The heat wave played a role by killing large portions of the kelp forest, which is the primary food source for urchins. Sea stars, the main predator of urchins, were eliminated at the same time. The result is red urchins were forced to move to deeper water and purple urchins, which reproduce faster, began to take over.

When looking at the assessment, Carr said they look at four areas - the resource of interest, in this case the red sea urchins, the ecological community, human users and the overall human community.

"It's important to recognize each one of these domains impacts the other domains, either directly or indirectly," Carr said. "Each of these feedbacks interact with the resource domain. Climate impacts are likely to impact all the domains."

With the red sea urchins, the loss of kelp and a predator to control the purple urchins impacted the red sea urchins. As a result, the purple urchins reproduced rapidly, leading to greater loss of the kelp forest as the urchins ate. The human users, or the people who fished for and processed the urchins lost work, and the greater community suffered when there were no urchins to eat.

The impact was felt greatest from Port Orford into Northern California, where the water temperature climbed 2 degrees.

"That marine heat wave is thought to be one of the largest marine heat waves in the world," Carr said. "In the absence of food and the absence of predators, the purple sea urchin just went crazy. They came out and fed on all the algae."

Interestingly, the warmer water itself did little to hurt the red sea urchin, but the impacts down the line did.

"The sensitivity of the red urchin to the heat was minimal," Carr said. "Rather, indirect ecological interaction in the kelp field impacted the urchin."

Carr said the impact is being felt five years later because the kelp forests have not fully recovered.

"As soon as the kelp recovers from the heat wave, the red urchin will be back," Carr said. "The marine heat wave only impacted the Northern California fishery. The Southern California fishery was not impacted."

Carr said the people who fish for urchins had minimal impact as well because they were able to find other work. However, the processors did struggle.

Carr said going back and looking at a past event will help scientists prepare for a future one.

"If we have another heat wave, you could ask what's going to do to the Port Orford fishery," Carr said. "You could adjust this to get some answers. It requires local experience. It requires the knowledge of people in that system."

Another question that can be answered is how long the impact will last. And it could be longer than expected.

"To this day, we're only now starting to see more of the kelp recover," Carr said. "The prognosis of Northern California is pretty bleak. You need to change the urchin population in order for the kelp to recover."

There is good news and bad news when looking at the 2014-16 heat wave.

"How often are we going to see the event," Carr asked. "That will be a big key as to recovery. If we start seeing more heat waves that could shift the system."

Phillip Johnson, the executive director of Oregon Shores, said Carr's presentation is one of a series of events Oregon Shores is doing in 2021 as part of a celebration of its 50th anniversary.

"We potentially address any conservation issue along the Oregon coast," Johnson said. "Anything that does threaten the Oregon coast, we do care about deeply."