

<http://apps.seattletimes.com/reports/sea-change/2013/dec/21/food-for-millions-at-risk/>

“Sea Change: Food for millions at risk: Shifting oceans could hit vulnerable cultures hard” Story by Craig Welch Photographs by Steve Ringman "Sea Change" was produced, in part, with funding from the [Pulitzer Center on Crisis Reporting](#).

A remote Indonesian village highlights the threats facing millions of people who depend on marine creatures susceptible to souring seas and ocean warming.



HOGA ISLAND, Indonesia — He sat shirtless on his thin bamboo floor in a home built on posts rising out of the Banda Sea.

Tadi had just returned in his dugout canoe from scanning crevices in a nearby reef for octopus. He and his neighbors spend every day this way — scouring the ocean for something to eat or sell. Fishing, here, is about survival.

Their stilt village has no industry, no land, no running water. They dive without oxygen, wearing hand-carved wooden goggles, and carry spear guns hacked from logs with their machetes. They

eat what they catch and sell the rest, using the money to buy everything else they need: boat fuel, root vegetables, rice, wood.

Without fishing, “how would I feed my family?” asked Tadi, who like many Indonesians has only one name.

Now Tadi’s community, like countless others across the globe, is on a collision course with the industrialized world’s fossil-fuel emissions.

Hundreds of millions of people around the world rely on marine life susceptible to warming temperatures and ocean acidification, the souring of seas from carbon dioxide emitted by burning coal, oil and natural gas. That includes [Northwest oyster growers](#) and [crabbers in the frigid Bering Sea](#), who now face great uncertainty from shifts in marine chemistry.

But from Africa to Alaska, many coastal communities face a substantially greater risk. These cultures are so thoroughly dependent on marine life threatened by CO₂ that a growing body of research suggests their children or grandchildren could struggle to find enough food.

The science of deciphering precisely who might see seafood shortages remains embryonic.

But with many of the most at-risk coastal communities already facing poverty, marine pollution, overfishing and rising seas, the potential for calamity is high.



“I can’t tell you how many people will be affected,” said Sarah Cooley, at Woods Hole Oceanographic Institution in Massachusetts, who studies links between acidification and food security. “But it’s going to be a very big number.”

Said Andreas Andersson, an acidification and coral-reef expert with the Scripps Institution of Oceanography in San Diego: “These people are literally going to be fighting for their lives.”

Among the most vulnerable to changing ocean conditions are people like Tadi and his 1,600 fellow villagers — even if they don’t quite view it that way yet.

Culture built on sea

From his elevated perch sheltered from the midday sun, Tadi could see huts with wispy thatch roofs connected by the rickety planks of his village boardwalk. Everything stood a dozen feet above emerald waters.

Like many in his village, he's uncertain of his age. But for as long as he can remember, Tadi has netted, trapped, hooked or speared grouper, snapper, wrasses and parrotfish. Sometimes the men in his village disappear to the open sea for days to chase small tuna.

Women swarm the tide flats gathering clams, sea cucumbers, urchins and sea grass. They then paddle to a fish market on nearby Kaledupa Island, where even meaty catches fetch just a few dollars.

Among his peers, Tadi is considered one of the best spear fishermen. And no wonder: He said he stabbed his first fish when he was barely older than a toddler.

That childhood in the ocean left an impression. Every animal seemed huge. Sea life teemed wherever he looked.

"I could choose with my spear whatever fish I want," Tadi said through a translator. "I never caught any small fish."



Laoda hauls a colorful reef fish called a sweetlips to the surface after shooting it with his spear gun. Laoda, like many villagers, dives without oxygen and usually wears hand-carved wooden goggles.

Tadi taught his son, Laoda, to fish this way. Laoda has since taught his son, Adi.

The Sama people, or Bajau, are known as sea gypsies or sea nomads because they once lived mostly on boats. They roamed Southeast Asia between Malaysia, the Philippines and Indonesia, living off the sea, until governments began encouraging them to settle. Tadi's offshore village was built in the late 1950s.

Today, [up to a million sea nomads](#) are sprinkled throughout the Coral Triangle. Their lives are a blend of old ways and new.



The Bajau travel everywhere by boat. Some women dab their faces with rice paste to protect against the sun.

Some divers in Tadi's village ruptured their eardrums as kids to make equalizing easier. Women dab their faces with rice paste for sunscreen. Villagers stack dead coral for support around the poles that hold their homes. Even fishing weights are sometimes homemade, forged by melting lead in aluminum cans over small open fires and pouring it into wooden molds.

Diesel generators provide electricity a few hours each night, and some residents use it to power televisions. Some fishermen wear expensive dive watches. On a mound of coral rubble beneath one hut is a surprisingly well-maintained billiard table.

After centuries of traveling far and wide, the Bajau's relocation concentrated their human waste and limited the range of their fishing. This happened just as some in their village adopted the destructive practices of Asia's worst fishing fleets. A few here fish with coral-destroying bombs

or cyanide. Some from the village and nearby islands gather colorful reef fish for sale to the aquarium trade. Commercial trawlers from elsewhere cause more damage. It all takes a toll.

“There’s been a pretty substantial decrease in their catches per amount of effort since the 1990s,” said Paul Simonin, a Cornell University graduate student who has tracked Bajau fishing data.

Tadi’s neighbors and nearby island communities still land plenty of fish, but their reefs have seen better days. Everyone works a bit harder to find food.

And a coming storm from CO₂ will only make things worse.

Troubled reefs

Scientists are still navigating the complex ways carbon dioxide can alter the marine world. But some impacts are clear.

Rising temperatures [already wreak havoc](#) on corals. Warming waters can cause corals to eject the algae that give them their vibrant color, weakening or killing reefs and turning them white. This process is known as bleaching. Without reductions in global emissions, 90 percent of reefs by midcentury are projected to see [severe bleaching episodes](#) every year.

Ocean acidification will just compound the problem.

A quarter of the CO₂ spewed by cars and power plants winds up in the ocean. That lowers the pH, makes waters more corrosive and reduces carbonate ions, which then makes it harder for marine creatures to build their shells and skeletons.

Acidification can directly harm animals throughout the food web, from [microscopic plankton](#) to [some fish](#). It endangers corals, weakening their skeletons, [inhibiting growth](#), and increasing the [likelihood of bleaching](#). In fact, acidification even [accelerates the dissolution](#) and breakdown of the reef.

Join the conversation

Ocean acidification could disrupt marine life on an almost unfathomable scale. What are your thoughts and reactions?

Together, souring seas and warming [can be worse](#) than the sum of their parts.

“Temperature has zapped a lot of reefs so far, but longer-term effects are likely to come from acidification,” said Charles Sheppard, a professor at England’s University of Warwick who studies climate-change impacts on coral reefs.

These ocean changes may not directly hit the octopus and fish Tadi catches, but will almost certainly rearrange the foods available for those creatures to eat. And loss of coral, by itself, usually translates to fewer fish and marine creatures — often [substantially fewer](#).

Earlier this month, researchers working on reefs [naturally bathed in CO₂](#) in Papua New Guinea reported finding [half as many small invertebrates](#) — crabs, shrimp, sand dollars, marine worms — as on healthy corals.

“Think about a coral reef as a city, a lot of buildings and houses,” Andersson said. “Without the houses, you have no inhabitants.”

Scientists are still learning how much — or how little — marine life [might adapt](#). Some corals [appear more resilient](#) than others, and bleaching [doesn't always ruin](#) healthy reefs, said David Kline, a coral and climate-change scientist at Scripps.

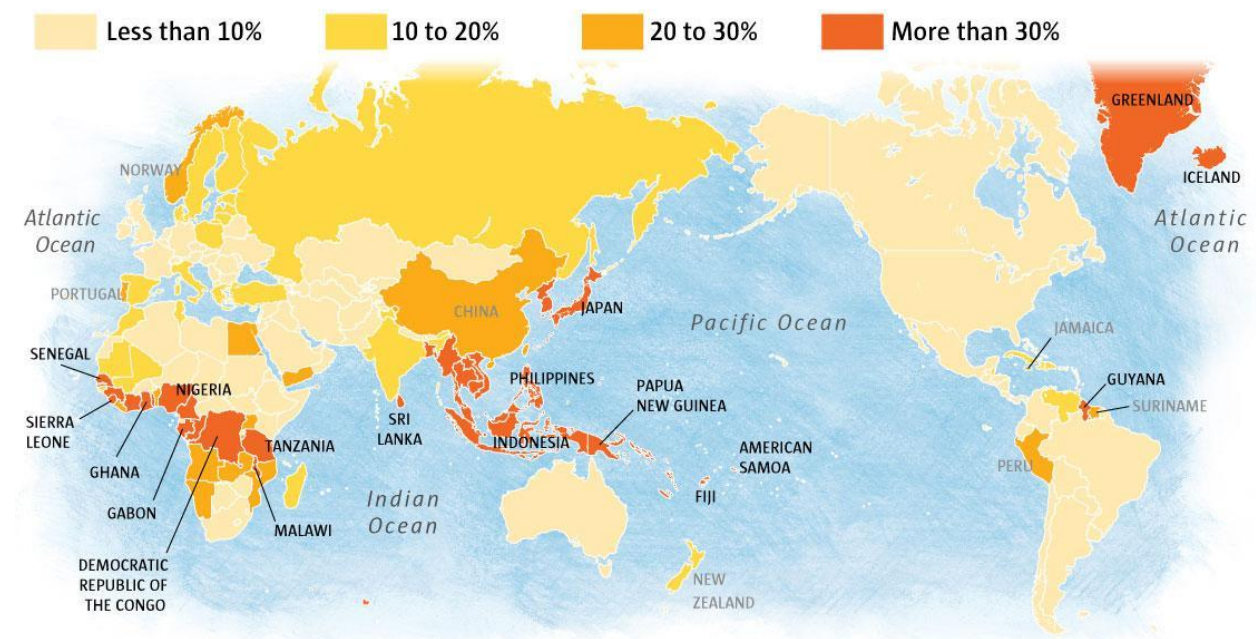
But reefs across Southeast Asia, in particular, already are a fraction of what they once were, [according to a 2007 analysis](#). And reefs taxed by pollution or overfishing [are more susceptible](#) to mat-forming algae. In the worst cases, after bleaching, this weedy slime can smother corals for good.

Sheppard has seen how bad things can get. A few years after a 1998 bleaching off Qatar, he went diving on a nearby reef.

Except for weeds, “I didn't see one other living thing,” he said. “No fish, urchins, starfish, mollusks. Nothing. For acres and acres, it was all dead.”

He likened the stress many reefs face to a person suffering multiple illnesses.

“A bit of temperature rise. A bit of acidification. A bit of overfishing. These things add up,” he said. “If someone has measles and influenza and chickenpox and malaria all at the same time, they're probably going to die.”



Source: Earthtrend database, World Resources Institute, Food and Agriculture Organization of the United Nations

Mark Nowlin / The Seattle Times

“In the 15 or 16 countries we’ve surveyed, 50 to 90 percent of their protein comes from fish,” said Johann Bell, a fish expert helping Pacific Island nations deal with threats to seafood. “It’s a huge problem. There are going to be many who just fall below the radar.”

Some places, like the [South Pacific’s Cook Islands](#), import much of their food, including chicken, mussels, beef, pork and shrimp, with income generated by industries at risk from CO₂ — reef fishing, pearl-oyster growing, reef tourism.

In one village in Tanzania in East Africa, three-quarters of households fish or make their living off troubled reefs, with no other jobs nearby. And most villagers migrated from places with even less work and poorer food options.

“Getting another job would mean starting a farm or setting up a bodega, both of which take a huge upfront investment they don’t have,” said Joshua Cinner, a research fellow with James Cook University in Australia.

Poor vanilla farmers in Madagascar already work several other jobs — yet fish reefs for food and income. In Haiti and Senegal, residents already struggling with malnutrition eat large volumes [of wild shellfish](#), which are particularly threatened by acidification.

Even in southeast Alaska, a few coastal communities are so isolated that subsistence gathering of at-risk clams and crab is essential.

“There may be a grocery store but food is tremendously expensive,” said Cooley, at Woods Hole. “Not everyone has \$10 for a can of Spam.”

‘It chills me’

Thirty feet below the sea surface, Tadi’s son, Laoda, inched toward a hefty perch-like reef fish called a sweetlips. He squeezed the spear gun’s trigger. A metal shaft pierced the fish’s scales. Laoda floated up and grabbed a breath.

Some young men in their village already escape to Malaysia to work on ships. Others dream of their children working on land.

Scientists hope growth in fish farming could help remote villages keep hunger at bay. Bell and others are helping subsistence fishermen boost their luck [catching tuna](#) and other open-ocean species. A few Bajau villages now farm seaweed for income. But without CO₂ reductions, many see rough seas ahead. Carol Turley, at the United Kingdom’s Plymouth Marine Lab, was among the first to suggest that some coastal people will face starvation risks as a result of warming and acidification. Even now, she said, “it chills me.”

“I keep, keep hoping that I’m wrong about all this, but I don’t think I am,” she said.

For now Tadi and Laoda will keep fishing — and continue not thinking much about the future. That is how Tadi was raised. It’s how he raised Laoda.

Laoda would like his son, Adi, to get an education, so he could try something new if he wishes. But Laoda and Tadi also said it would be OK if Adi stayed a fisherman.



Laoda hovers close to the reef, staying out of sight until he spies a fish big enough to target with his spear gun. Laoda frequently dives to 50 feet or more without oxygen and comfortably stays under water for 90 seconds on a single breath.



A boy carries a platter of watermelon along the boardwalk in the Bajau village. Most of their fruits and vegetables are bought from nearby islanders with money made selling fish. But some here ferry soil from the island and try to grow melons in their stilt village.

<http://www.bizjournals.com/pacific/news/2013/10/28/ellisons-latest-plan-for-lanai.html?page>

Ellison's latest plan for Lanai includes large research university campus

Oracle Corp. CEO Larry Ellison's Pulama Lanai has outlined plans to the community for a 524-acre research university campus on Lanai, according to a report in the Lanai Today newspaper.

A research university campus on 524 acres — nearly twice the size of the University of Hawaii's flagship Manoa campus in Honolulu — is being planned for [Larry Ellison](#)'s island of Lanai.

The Lanai Community Plan Advisory Committee recently came up with its final draft, which includes the planned university, in a process that took about nine months, according to [Butch Gima](#), chairman of the committee.

By comparison, the University of Hawaii Manoa campus is roughly 300 acres.

The planned Lanai campus, which would be located just south of Lanai City is years down the line, Gima told PBN.

“Below the Dole Park is going to be a residential expansion and below that is a possible research university,” he said. “They will have to move the wastewater treatment plant.”

Gima also noted that Pulama Lanai, the operational entity formed by the Oracle Corp. CEO to run the island, hasn't ruled out having a working relationship with the School of Travel Industry Management at UH Manoa.

The development of such a campus would mean hundreds of jobs both in the educational and support services areas.

Meantime, the overall plan, which was featured on the front page of the Pineapple Island's community newspaper, Lanai Today, tackles such issues as housing, economic development and protecting precious natural resources.

It includes doubling the island's population, which now totals around 3,000 people. To house this influx of residents, the plan is to build more residential projects, including a 50-acre development at Koele, a nearly 80-acre residential project at Manele and a couple of other projects totaling a little more than 100 acres above areas like Kaumalapau Harbor and Manele Mauka.

<http://pulitzercenter.org/reporting/south-america-peru-coastal-ocean-health-dolphin-slaughter-shark-fishing-harpoon-bait-meat>

Fishing for Secrets: My Stormy Mission to Expose the 'World's Biggest Dolphin Hunt'

Published October 17, 2013 Jim Wickens [Peru dolphin slaughter](#) from [ITV News](#) on [Vimeo](#).

The rumours have swirled around conservationists in Peru for over a decade, a secret slaughter that the world is almost completely unaware of, a brutal practice of slaughtering dolphins for shark bait.

But nobody has ever been able to get close enough to prove the killing in Peruvian waters - until now.

After 9 months of careful negotiations by our fixer we were given the call with one week's notice. At home with my young family in Brighton I rang cameraman Alejandro in Buenos Aires. It was now or never.

We dropped everything and flew to Peru. Arriving at the port at midnight, we were illegal stowaways, ferried on to our boat.

The boat

Our hearts sank when we saw the vessel, a tiny 30 foot boat, with just a cramped corner and 4 bunks carved out in the bow. Conditions were grim. The sleeping arrangements are tiny, four bunks for six people, and the space between too small for more than one person at a time to stand.

Hunting pigs

The first task of our journey was to get the bait to catch the sharks. The pigs of the sea is what the fishermen called the dolphins, "chechos" and soon enough the cry and the crew ran to the deck. The dolphins had been spotted riding along with the boat, meaning it was time to go hunting.

Crouched by the gunwale close to the harpoon, I am dizzy with conflict; excited, relieved and yet sickened that after two years of preparation, planning and incredibly complex logistics, we are about to film something that has never been filmed before.

This adrenaline is an addictive buzz that investigative journalists so often get when they know they are about to capture something otherwise hidden to the rest of the world. I have done this work for years, but never filmed the killing of a dolphin.

This is one of the most intelligent animals on the planet - highly developed, socially complex dusky dolphin, an animal who has chosen to come and bow ride a boat just for the fun of it. I defy anyone not to be moved by their grace, and beauty.

The captain takes up the harpoon. He waits, watches and throws. Silence, then a cry goes up.

The line goes taught under the boat. The boat throttles into reverse, 30 yards distant at the end of the line a dolphin is thrashing wildly on the surface, flipper moving quickly amidst a growing cloud of blood in the choppy waters.

The men carefully pull the line in, closer and closer. The dolphin lies by the boat, belly up, shuddering. Its intestines spill out as it rises out of the waters.

The men drag it to the corner, its beak still shuddering in its death throes. With experienced ease, almost without blinking, one of the men sets to work slicing the fins of the dolphin as it swishes about in a puddle of blood.

Shark hunting

The men have bait and we are underway again. A day later we arrive in the shark fishing zone, our 600km trek south has brought us to the narrow temperature gradient where the sharks should be waiting in large numbers.

A narrow escape

A few days later the captain agreed to drop us off to shore earlier than planned. They have 20 more days of this work ahead, but our work is over. I am relieved and excited at the prospect of dry land, and anxious to get our footage to safety.

As we slept and sailed, unbeknownst to us all, we had sailed into the middle of a collection of rocks. At first we celebrate the near miss, but then we hear the roar of rising thunder as the waves began to gather around us, frothing.

A huge wave sucks the water out of the rocks before crashing down on top of us. A wall of water runs across the boat on top of us. We are all knocked off our feet, thrown from the bows with the wave as it rips off the rigging, the mast and smashes through the glass windows of the wheelhouse at the aft of the vessel. We lurch from side to side. I managed to pull my soggy iPhone out of my pocket and call our fixer.

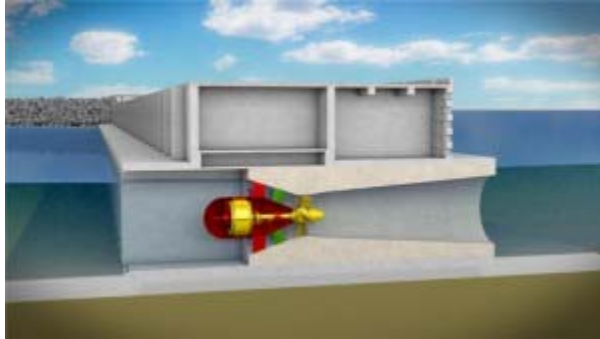
The boat is on the rocks, the crew desperately trying to ply us away before the next set of colossal waves turn the boat over.

A coastguard is summoned out of bed via our fixer and a hefty encouragement fee. However, foreigners on a fishing boat with lots of luggage in the early hours spells narco-trafficker in Peru. Jail awaited us, albeit it on dry land. To our great relief, the engine sprung to life, another soggy call was made to the coastguard to send him back to bed and another fee agreed. We pass round cigarettes, coke, painkillers, to celebrate our narrow escape. The captain's face is still bleeding from the window which exploded in his face from the force of the wave. We are battered and bruised, but we are safe. We head north and on to Lima and bid a quick goodbye to our crew.

<http://www.zeitnews.org/applied-sciences/energy/kevin-lee-worlds-first-tidal-powered-lagoon-could-be-coming-swanse-bay>

Kevin Lee World's First Tidal-Powered Lagoon Could be Coming to Swansea Bay

December 3, 2013 - 6:35am



In its heyday in the 19th century the Port of Swansea on the south coast of Wales was one of the most important in the British imperial sphere. Over half of the world's copper was exported from its bustling waterways and docks, which provided a critical link between the resource rich Welsh valleys and demand throughout the empire and beyond.

Today, of course, things are rather different. Whilst still a working port, parts of the old docks are being turned into a new waterfront development, and Swansea Bay in the 21st century is known as much for its water-sports as its metal exports.

And now, with plans for the world's first tidal lagoon progressing fast, the city is set to become a global exemplar for harnessing the tides to generate power.

What is a tidal lagoon?

According to Dr Simon Boxall of the University of Southampton's National Oceanography Centre, tidal power is nothing new. Since the 7th century in Europe, mills have been built across coastal inlets to trap water in ponds at high tide, releasing it later to turn wheels and grind grain into flour.

The same principal lies at the heart of tidal lagoons. Similar in appearance to harbours or marinas, large lagoon structures would impound sea water and separate it from the natural ebb and flow of the tides. When the water level between the inside and outside of the lagoon is large enough, sluice gates would open, allowing water to rush through and turn turbines to produce power.

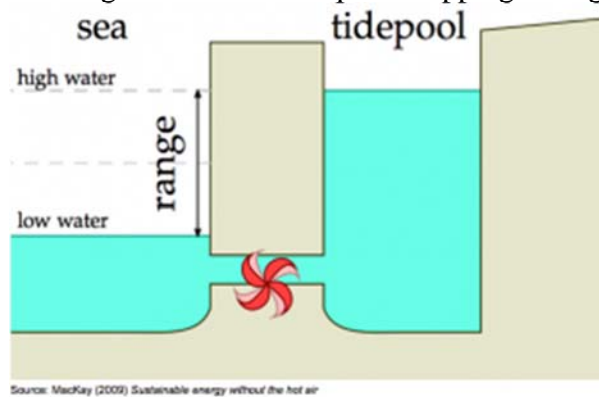
The fundamental technology is established and proven, and the concept has been promoted by environmental groups like Friends of the Earth as a way of generating power from the tides whilst minimising damage to habitats and wildlife.

More than anything, it is the fact that tidal energy is both low carbon and completely reliable that is its greatest asset. The Swansea Bay project would operate on both ebb and flow tides to

provide power at four periods each day. According to David MacKay, chief scientific advisor to the UK Department for Energy, in the future lagoons could even be divided into separate pools to generate power on demand, much like pumped storage hydro plants do today. This would be extremely valuable in any power system with high levels of intermittent renewables.

There are of course other methods of generating power from the tides, such as the barrage built at La Rance in France, or the proposed 6GW barrage across the UK's Severn Estuary (a true mega project). However it is the disadvantages and controversy of these barrages that give lagoons such comparative appeal.

For example, whilst both approaches involve trapping water with breakwater walls, a barrage cuts straight across an estuary or river, whereas lagoons are 'curved' harbour-type which do not. Thus lagoons need not impede shipping - a big plus in many people's eyes.



In addition, large barrages such as the one proposed for the Severn Estuary would likely have a very significant adverse impact on bird breeding grounds (due to loss of intertidal habitats) and fish populations (blocked from their migration routes and vulnerable to turbine blades).

Tidal lagoons would likely be less environmentally damaging. This is both because estuaries and rivers would remain open to fish movement, and because if built 'offshore' - i.e. away from the coast - lagoons could avoid the loss of inter-tidal habitats.

Even with 'land-connected' lagoons like the one proposed at Swansea Bay, it is suggested that the impact would be substantially less than barrages. Mark Shorrocks, head of the Swansea project, told me that "our modelling suggests a large number of smaller land-connected lagoons will have a net-positive environmental benefit by creating localised slower or faster water movements but leaving the intertidal area exposed and mud flats intact"

There is reason for cautious optimism about the potential of tidal lagoons, but the challenges ahead should not be underestimated. Experience tells us that navigating the complex issues that inevitably arise as a new renewable technology is developed is not easy.

In any case, perhaps for now we should resist the temptation to get ahead of ourselves. As things stand there is not one operational tidal lagoon anywhere in the world, and focussing on changing this fact seems like challenge enough. Over to you then, Swansea.

<http://www.dailystar.co.uk/news/latest-news/354006/Climate-change-warning-Killer-winter-storms-for-next-THIRTY-years>

Climate change warning: Killer winter storms for next THIRTY years

KILLER freezes, floods and heatwaves will devastate Britain during the next 30 years, climate - experts have warned.

By [Matthew Young](#)/Published 8th December 2013



EXTREME: Experts issued an official warning regarding freak weather patterns [NORTH NEWS]

“EASAC feels obliged to draw attention to the growing impact of extreme weather in Europe”

Sir Brian Heap, president of the European Academies Science Advisory Council

Many people could die as extreme weather becomes common.

There will be more freak winds like the October storm, which killed four people.

Heatwaves will be lethal and the sea level will rise, leaving coastal towns at risk of being swamped by storm surges.

Sir Brian Heap, president of the European Academies Science Advisory Council, said he felt “obliged” to issue the warning after a new study by the Intergovernmental Panel on Climate Change.

It comes on the back of Typhoon Haiyan in the Philippines, which has killed more than 5,000 people.



LETHAL: Sea storms and colossal waves will batter towns and villages [ALAMY]

Sir Brian said: “Given the tragic events this year in the rest of the world and the recent IPCC report, EASAC feels obliged to draw attention to the growing impact of extreme weather in Europe.”

The continent’s leading experts had made a detailed study of likely extreme weather, he said.

Sir Brian warned: “From the major loss of lives in heatwaves to the economic and human costs of floods and storms, the implications are worrying.

“They present the European Union and Member States with significant challenges in preparing Europe for a future with greater frequency of extreme weather.”



<http://www.globalissues.org/news/2013/12/23/18003>

Mystery Oil Spill Turns Miles of Trinidad's Beaches Black

by Peter Richards (port of spain) Monday, December 23, 2013 Inter Press Service

PORT OF SPAIN, Dec 23 (IPS) - Whether it is a case of sabotage or simply poor management practices by the state-owned PETROTRIN, as the union claims, a mysterious oil spill in south Trinidad is wreaking havoc on homes and wildlife in the area.



PETROTRIN claims it has no idea as to the source of the spills, and Energy Minister Kevin Ramnarine, who toured La Brea and other affected areas on Sunday, said "the mystery remains where this oil is coming from."³

The Environmental Management Authority also said it had been unable to ascertain the source and that its immediate concern was the protection of life and the environment.

Gary Aboud, president of Fishermen and Friends of the Sea, told IPS that the only solution was to shut down all oil production in the area.

"As we speak, more and more oil is being pumped into the sea. Why doesn't the minister order the shutdown of all oil being transported in the Gulf of Paria? Shut it down, if you don't know where it is coming from," he said. "We find it totally unbelievable."

According to the head of the La Brea Fisherfolk Association, Alvin La Borde, "fishermen cannot go out to work. They need to buy things for their families for Christmas. They would not be able to leave until this oil is cleared.

"The fishermen have also lost nets and ropes used to secure their boats," he told IPS.

In a statement, the EMA said it "will continue to closely monitor clean-up efforts and ensure that environmental best practices are carried out.

"Once the source of the spillage is determined, the EMA will be assessing the situation from a legal and compliance perspective to ascertain whether there is any breach in environmental legislation."

Fitzgerald Jeffrey, the member of Parliament for the La Brea region, which is known for having the largest natural deposit of asphalt in the world, told IPS that he is hoping the evacuation is carried out "as quickly as possible".

"There are young people and it is difficult for them to breathe...and as much as 24 families are directly affected. In addition, there are fishing vessels contaminated with oil. We are seeing crabs and dead fish along the beach.

"Yesterday I was down there and there is a very strong gas scent and people have been advised not to do any cooking in the area," he added.

On Monday, the environmental group Papa Bois Conservation issued an urgent appeal for paper towels, dishwashing liquid and other supplies to aid birds that are covered in oil.

The Wildlife Orphanage and Rehabilitation Centre (WORC), which is also trying to rescue animals affected by the oil spill, reports "oil in the mangrove as well as a strong hydrocarbon smell". The WORC also posted on its website a picture of an oil-slicked dead pelican at La Brea.

PETROTRIN, which has been in operation for 100 years, has acknowledged that there are installations across the country engaged in refinery activities and that some of its pipelines may still contain hydrocarbons that can be hazardous to health.

Ramnarine said the authorities were now seeking international assistance in dealing with the oil spill, even as the Oilfield Workers Trade Union (OWTU) maintained that PETROTRIN should shoulder the blame for the environmental disaster.

"We do not concur with the company's offering of the excuse that it is some kind of sabotage or otherwise," OWTU president general Ancel Roget told a news conference on Sunday.

"We want to say there is a massive cover-up of the PETROTRIN management to shield their friends, the lease operators, who they invited to and in fact gave away some of the lucrative acreage of PETROTRIN assets, and therefore a cloud of silence and secrecy has shrouded the lease operators in the La Brea situation," he said.

Roget has accused the company of knowingly reducing the level of security in the fields, allowing thieves to roam freely.

"The reduction and removal of morning tower shifts...these shifts provided as a monitoring effort and additional security effort so that if there are any oil spills throughout fields they were reported in real time."

Roget said PETROTRIN had no emergency response contract to deal with the latest series of oil spills, saying "they violate their own investigation policy which states that investigations of that nature ought to take place within the first 24 hours."

But Ramnarine said that unmanned platforms were part of the industry globally.

"We can't put people on every single platform," he said, adding "in the Gulf of Mexico, there are unmanned platforms."

Over the weekend, PETROTRIN's president Khalid Hassanali said one of the company's lease operators, Trinity Oil and Gas, had discovered several valves open at its operations in Rancho Quemado, allowing oil to flow out of the tanks onto the lands.

"This is of concern because the other spills have been marine. It is extremely disturbing because...the valves were found opened which doesn't normally happen. All these things happened together," he said, saying that the company was now investigating whether the oil spills were acts of sabotage.

"To reach that conclusion one needs to go through a process of investigation. It's early, we can't reach that conclusion without being fair and without investigating fully," he told a news conference.

The company issued a statement informing residents in nearby villages that oil had been sighted along the coastline near shore and on land and that they should avoid venturing in or near the sea.

<http://www.globalissues.org/news/2013/12/19/17984>

Nevis Embarks on Geothermal Energy Journey

by Desmond Brown (charlestown, nevis) Thursday, December 19, 2013 Inter Press Service

CHARLESTOWN, Nevis, Dic 19 (IPS) - The tiny island of Nevis in the northern region of the Lesser Antilles is one of the few remaining unspoiled places in the Caribbean. It is now seeking to become the greenest, joining a growing list of Caribbean countries pursuing clean geothermal power.



Mount Nevis

Last month, legislators on the volcanic island selected Nevis Renewable Energy International (NREI) to develop a geothermal energy project, which they said would eventually eliminate the need for existing diesel-fired electrical generation by replacing it with renewable energy.

In January 2014, NREI will begin to construct a geothermal power plant and injection and production wells on Crown Land leased from the Nevis Island Administration.

Acting Premier Mark Brantley said the island, with a population of 9,000, plans to remain "how the Caribbean used to be" while striving to earn the title of "greenest place on earth".

"Nevis is committed to beginning this journey on the path to greener living," Brantley told IPS. "The use of renewable energy will result in a reduction of emissions of pollutants and greenhouse gases, thus advancing Nevis' commitments under the United Nations Framework Convention on Climate Change."

The [UNFCCC](#) is an international environmental treaty negotiated in June 1992 at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro. The treaty's objective is to "stabilise greenhouse gas

concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

The treaty itself, which set no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms, is legally non-binding. Instead, the treaty provides a framework for negotiating specific international treaties (called "protocols") that may set binding limits on greenhouse gases.

The parties to the convention have met annually from 1995 in Conferences of the Parties (COP) to assess progress in dealing with climate change. In 1997, the Kyoto Protocol was concluded, establishing legally binding obligations for developed countries to reduce their greenhouse gas emissions.

The 2010 Cancún agreements state that future global warming should be limited to a two-degree Celsius increase from pre-industrial levels. The twentieth COP will take place in Peru in 2014.

Utilities Minister Alexis Jeffers said Nevis currently imports 4.2 million gallons of diesel fuel annually, at a cost of 12 million dollars, a bill the island hopes to cut down significantly. Nevis consumes a maximum of 10 mw of energy annually.

"The use of geothermal energy will not only make Nevis a greener place in the future, but also make it less vulnerable to volatile oil prices, as the cost of geothermal energy is stabilised under a long-term contract," Jeffers told IPS.

"In addition to providing lower cost, cleaner electricity for Nevis, this can potentially be expanded to include St. Kitts and other islands in the future," Premier Brantley said. St. Kitts, which lies two miles northwest of Nevis, uses a maximum of 46 mw of energy each year.

Nevis is the smaller island of the pair, known as the Federation of St. Kitts and Nevis. It is home to active hot springs and a large geothermal reservoir. Seven volcanic centres have been identified on Nevis and drilling at three sites has indicated that the geothermal reservoir is capable of producing up to 500 mw of constant baseload power year round.

Dominica recently launched its own geothermal project with the construction of a small power plant for domestic consumption and a bigger plant of up to 100 mw of electricity for export to the neighbouring French islands of Guadeloupe and Martinique.

The nearby island of St. Vincent subsequently announced the launch of a 50-million-dollar project, funded by the Bill, Hillary & Chelsea Clinton Foundation, the St. Vincent and the Grenadines government, Barbados Light and Power Holdings and Reykjavik Geothermal.

Prime Minister Dr. Ralph Gonsalves said a contingent of Icelandic scientists had arrived on the island and would remain until the end of the year investigating the mountainous nation's geothermal potential, estimated at 890 mw.

Barbados is also making a major shift away from fossil fuels, aiming for 29 percent of its power generation from renewable sources by 2029. An electric light and power bill was passed with bipartisan support in parliament on Dec. 17.

Opposition leader Mia Mottley said the most significant thing the government can do for residents is to reduce the cost of electricity to 29-30 cents a kilowatt-hour as soon as possible.

"We have said consistently that the most important thing the government can do is to reduce the cost of electricity next month. Not two years from now; not five years from now; not 10 years from now," Mottley said.

"If we understand how the costs are incurred, we then understand it can only be unacceptable for the government to preside over the Barbados National Oil Company profiteering to the tune of 53 million dollars last year, and ordinary people in this country in households and business are struggling to pay electricity bills."

Barbadians currently pay 41-42 cents per kilowatt-hours.

Prime Minister Freundel Stuart said that as part of the drive to make Barbados more sustainable, the government had entered a partnership with the Inter-American Development Bank (IDB), which would help develop a framework to diversify the country's energy mix and reduce its heavy dependence on fossil fuels.

<http://apps.seattletimes.com/reports/sea-change/2013/sep/11/oysters-hit-hard/>

“Oysters dying as coast is hit hard: A Washington family opens a hatchery in Hawaii to escape lethal waters.”

Story by Craig Welch Photographs by Steve Ringman

"Sea Change" was produced, in part, with funding from the [Pulitzer Center on Crisis Reporting](#).

HILO, Hawaii — It appears at the end of a palm tree-lined drive, not far from piles of hardened black lava: the newest addition to the Northwest's famed oyster industry.

Half an ocean from Seattle, on a green patch of island below a tropical volcano, a Washington state oyster family built a 20,000-square-foot shellfish hatchery.

Ocean acidification left the Nisbet family no choice.

Carbon dioxide from fossil-fuel emissions had turned seawater in Willapa Bay along Washington's coast so lethal that slippery young Pacific oysters stopped growing. The same corrosive ocean water got sucked into an Oregon hatchery and routinely killed larvae the family bought as oyster seed.

So the Nisbets became the closest thing the world has seen to ocean-acidification refugees. They took out loans and spent \$1 million and [moved half their production](#) 3,000 miles away.

“I was afraid for everything we'd built,” Goose Point Oyster Co. founder Dave Nisbet said of the hatchery, which opened last year. “We had to do something. We had to figure this thing out, or we'd be out of business.”

Oysters started dying by the billions along the Northwest coast in 2005, and have been struggling ever since. When scientists cautiously [linked the deaths](#) to plummeting ocean pH in 2008 and 2009, few outside the West Coast's \$110 million industry believed it.



Oysters from the Nisbets' Hawaii hatchery are almost ready to be shipped to Willapa Bay and planted. When corrosive water off Washington rises to the surface, many oysters die before reaching this age.



Ed Jones, manager at the Taylor Shellfish Hatchery in Hood Canal's Dabob Bay, pries open an oyster. Ocean acidification is believed to have killed billions of oysters in Northwest waters since 2005.

By the time scientists confirmed it early last year, the region's several hundred oyster growers had become a global harbinger — the first tangible sign anywhere in the world that ocean acidification already was walloping marine life and hurting people.

Worried oystermen testified before Congress. A few hit the road to speak at science conferences. Journalists visited the tidelands from Australia, Europe and Korea. Washington Gov. Chris Gregoire established [a task force](#) of ocean acidification experts, who sought ways to fight this global problem locally.

But the eight years of turmoil the Nisbet family endured trying to outrun their corroding tides offered them a unique perch from which to view debate over CO₂ emissions.

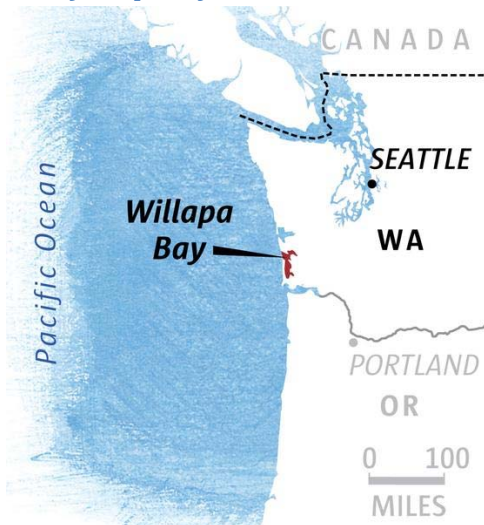
And the world's earliest victims of shifting ocean chemistry fear humanity still doesn't get it.

"I don't care if you think it's the fault of humans or not," Nisbet said. "If you want to keep your head in the sand, that's up to you. But the rest of us need to get it together because we're not out of the woods yet on this thing."



A Goose Point Oyster Co. employee harvests fresh oysters at dawn on the Nisbet family's tidelands in Willapa Bay. The Nisbets struggled to make ends meet in recent years as ocean acidification wiped out oyster reproduction in the bay and along the coast.

Shellfish 'pretty much all we have'



To understand why the Nisbets landed in Hawaii, you first have to understand Willapa Bay.

At low tide on a crisp dawn, Dave Nisbet's daughter, 27-year-old Kathleen Nisbet, bundled in fleece and Gore-Tex, steps from a skiff onto the glittering tide flats. Even at eight months pregnant, she is agile as a cat after decades of sloshing through mud in hip boots.

All around, employees scoop fresh shellfish from the surf and pile it in bins. Nisbet watches the harvest for a while, jokes with workers in Spanish, then clambers back into the boat.

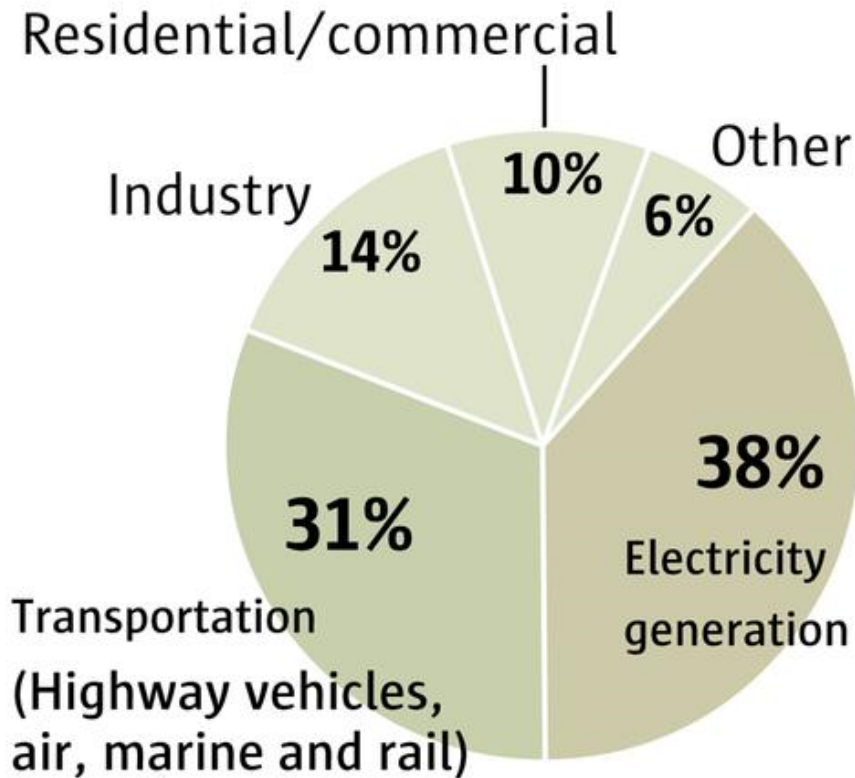
"I'm always happy to get out here," she whispers. "I never tire of it."

The Nisbets were relative newcomers to shellfish.

Native Americans along the coast relied on shellfish for thousands of years. After settlers overfished local oysters, shipping them by schooner to San Francisco during the Gold Rush,

farmers started raising bivalves here like crops. Now the industry in this shallow estuary and Puget Sound employs about 3,200 people and produces one-quarter of the nation's oysters.

U.S. human sources of carbon dioxide



Source: U.S. EPA

Mark Nowlin / The Seattle Times

Kathleen's parents bought 10 acres of tidelands near Bay Center in 1975 and started growing their own, which Dave sold from the back of his truck. Sometimes Kathleen came along.

She sipped a baby bottle and ate cookies while riding the dredge with her father. She packed boxes and labeled jars with her mother, Maureen Nisbet, and piloted a skiff by herself at age 10 through lonely channels. She keeps a cluster of shells on her desk at the family processing plant to store business cards and office supplies.

"Willapa is about oyster and clam farming," she said. "It's pretty much all we have."

Her parents built their business over decades, one market at a time. They eventually pieced together 500 acres of tidelands and hired 70 people.

For a long time, business was good — until, overnight, it suddenly wasn't.



A worker strains tens of thousands of tiny young oysters through a sieve at a hatchery in Hawaii owned by Washington's Goose Point Oyster Co.

Dramatic crash

It's hard to imagine now how far CO₂ was from anyone's mind when the oysters crashed.



A handful of healthy oyster seed from Goose Point Oyster Co.'s Hawaiian hatchery takes root on an adult oyster shell. When young oysters reach this age, they are strong enough to withstand the Northwest's increasingly corrosive waters — at least for now.

In 2005, when no young oysters survived in Willapa Bay at all, farmers blamed the vagaries of nature. After two more years with essentially no reproduction, panic set in. Then things got worse.

By 2008, oysters were dying at Oregon's Whiskey Creek Hatchery, which draws water directly from the Pacific Ocean. The next year, it [struck a Taylor Shellfish hatchery](#) outside Quilcene, which gets its water from Hood Canal. Owners initially suspected bacteria, *Vibrio tubiashii*. But shellfish died even when it wasn't present.

Willapa farming is centered on the nonnative Pacific oyster, which was introduced from Japan in the 1920s. Some farms raise them in the wild, but that's so complex most buy oyster seed from hatcheries to get things started.

The hatcheries spawn adult oysters, producing eggs and then larvae that grow tiny shells. When the creatures settle on a hard surface — usually an old oyster shell — these young mollusks get plopped into the bay and moved around for years until they fatten up.

Only a handful of hatcheries supply West Coast farmers, including Whiskey Creek and Taylor Shellfish, which sells seed only after meeting its own needs. So each spring, Kathleen's parents put an order in with Whiskey Creek until the mid-2000s, when that option vanished.

“I do not think people understand the seriousness of the problem. Ocean acidification ... has the potential to be a real catastrophe.”

David Stick Hatchery manager

“The hatchery had a long waiting list of customers and no seed, and we had a small window of time to get it into the bay,” Dave Nisbet recalled. “They had nothing.”

Whiskey Creek hatchery closed for weeks at a stretch. Production at Taylor Shellfish was off more than 60 percent. And more than just regular customers needed help.

With wild oysters not growing at all, suddenly hundreds of growers needed shellfish larvae. The entire industry was on the brink. Oyster growers from Olympia to Grays Harbor worried that in a few years' time they would not be able to bring shellfish to market.

Nisbet made frantic calls, but could not find another source. He worked closely with Whiskey Creek, but owners there were stumped. Nisbet knew his business was in trouble.

“It's like any other farm,” Dave Nisbet said. “If you don't plant seed, sooner or later you don't have crops. And there wasn't enough seed to go around.”

In 2008, Kathleen Nisbet fretted about the prospect of laying off people her family had employed since she'd been in diapers. She feared that years of bad or no production could become the



new normal. Second-generation oyster farmer Kathleen Nisbet gets shuttled at sunrise from the Goose Point Oyster Co. processing plant in Bay Center, Pacific County, to the oyster flats of Willapa Bay.

“It was really tough, as a second generation, to come in knowing the struggles we were going to have,” she said. “It’s really hard on a business when you’ve built something for the past 30 years and you have to take your business and basically cut it in half.”

But unless the family found a solution, they soon would have nothing to sell.

And no one, anywhere, could tell them what was wrong.

“I thought, ‘What are we going to do?’ ” Dave said.

Then the oyster growers met the oceanographers.

Corrosive waters rise to surface

Dick Feely, with the National Oceanic and Atmospheric Administration, had measured ocean chemistry for more than 30 years and by the early 2000s was noting a dramatic change off the West Coast.

Low pH water naturally occurred hundreds of feet down, where colder water held more CO₂. But that corrosive water was rising swiftly, getting ever closer to the surface where most of the marine life humans care about lived.

So in 2007, Feely organized a crew of scientists. They measured and tracked that water from Canada to Mexico.

“What surprised us was we actually saw these very corrosive waters for the very first time get to the surface in Northern California,” he said.

That hadn’t been expected for 50 to 100 years. And that wasn’t the worst of it.

Because of the way the ocean circulates, the corrosive water that surfaces off Washington, California and Oregon is the result of CO₂ that entered the sea decades earlier. Even if emissions get halted immediately, West Coast sea chemistry — unlike the oceans at large — would worsen for several decades before plateauing.

It would take 30 to 50 years before the worst of it reached the surface. Oregon State University scientist Burke Hales once compared that phenomenon to the Unabomber mailing a package to the future. The dynamite had a delayed fuse.

Feely [published his findings](#) in 2008. Shellfish growers took note. Some recalled earlier studies that predicted juvenile oysters would someday prove particularly sensitive to acidification. The oyster farmers invited Feely to their annual conference.

Feely explained that when north winds blew, deep ocean water was drawn right to the beach, which meant this newly corrosive water probably got sucked into the hatchery. That same water also flowed into the Strait of Juan de Fuca and made its way to Hood Canal.

The oyster industry pleaded with Congress, which supplied money for new equipment. Over several years, the hatcheries tested their water using high-tech pH sensors. When the pH was low, it was very low and baby oysters died within two days. By drawing water only when the pH was normal, shellfish production got back on track.

“They told us it was like turning on headlights on a car — it was so clear what was going on,” Feely said.

It wasn't until 2012 that Feely and a team from Oregon State University [finally showed with certainty](#) that acidification had caused the problem. Early this summer OSU professor George Waldbusser demonstrated precisely how.

The oysters were not dissolving. They were dying because the corrosive water forced the young animals to [use too much energy](#). Acidification had robbed the water of important minerals, so the oysters worked far harder to extract what they needed to build their shells.

Waldbusser still is not entirely sure why acidification has not yet hit other oyster species. It could be because other species, such as the native Olympic, have evolved to be more adaptable to high CO₂, or because they rear larvae differently, or because they spawn at a time of year when corrosive water is less common. It could also be that acidification is just not quite bad enough yet to do them harm.

Either way, by then, the Nisbets had moved on. They had experimented with growing oysters in Hawaii and now had their own hatchery outside Hilo.



Manager David Stick outside Hawaiian Shellfish, the hatchery started near Hilo by Goose Point Oyster Co. It draws water from an underground saltwater aquifer rather than directly from the ocean.

Small fixes, big worries

David Stick opened a spigot from a tub that resembled an aboveground pool. He let water wash over a fine mesh screen. It was a muggy Hawaii morning and the Nisbets' hatchery manager was straining oyster larvae. Featured comments:

“What can I, as an individual with no money nor power, do to help stop this? I can reduce my energy use as far as possible. Apart from the online stuff I'm pretty low CO₂. I can reduce, reuse, and recycle. (I need to get better at that.) But what else can I do?” — [DanBC](#)

“We never talk about giving up our GAS-POWERED vehicles. If we don't change our ways we can't whine about the consequences.” — [Debrah Jordan](#)

When the tiny bivalves are big enough to produce shells, Stick mails them back to Washington. There, Kathleen's crew plants them in the bay.

Instead of relying on the increasingly corrosive Northwest coast, the family built a hatchery that drew on something else — a warm, underground, saltwater aquifer. That water source is not likely to be affected by ocean chemistry changes for many decades, if at all.

But that doesn't mean there's nothing more to fear.

For now, no one else has taken as dramatic a step as the Nisbets. The Northwest industry is getting around the problem. Hatcheries have changed the timing of when they draw in water. Scientists installed ocean monitors that give hatchery owners a few days notice that conditions will be poor for rearing larvae.

Growers are crushing up shells and adding chemicals to the water to make it less corrosive. Shellfish geneticists are working to breed new strains of oysters that are more resistant to low pH water. But no one thinks any of that will work forever.



Hatchery worker Brian Koval transfers algae from a beaker to a larger vessel in the Nisbets' oyster hatchery in Hawaii.

“I do not think people understand the seriousness of the problem,” Stick said. “Ocean acidification is going to be a game-changer. It has the potential to be a real catastrophe.”

At the moment, the problem only strikes oysters at the very early stages of their development, within the first week or so of life. Once they have built shell and are placed back on the tide flats, they tend to deal better with sea chemistry changes.

But how long will that be the case? How would they respond to changes in the food web?

“The algae is changing,” Stick said. “The food source that everything depends on is changing. Will things adapt? We don’t know. We’ve never had to face anything like this before.”

An urgency to educate

With one young son, and a baby on the way, it’s been impossible for Kathleen not to think about her own next generation.

“Thank God my dad took a proactive measure to protect me,” she said. “If he wouldn’t have done that, I would suffer and my son would suffer.”

She thinks a lot about the need for school curricula and other efforts to get kids and adults thinking and learning about changing sea chemistry.

“I don’t think that our government is recognizing that ocean acidification exists,” she said. “I don’t think society understands the impacts it has. They think ocean acidification ... no big deal, it’s a huge ocean.”

But the reality is, over the next decade, the world will have to make progress tackling this issue.

“We’re living proof,” Nisbet said. “If you ignore it, it’s only going to get worse. Plain and simple: It will get worse.”

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“Sea Change” was produced, in part, with funding from the [Pulitzer Center on Crisis Reporting](#). This article was published September 12, 2013.

<http://www.scientificamerican.com/citizen-science/project.cfm?id=creek-watch>

SCIENTIFIC AMERICAN™

Courtesy of IBM Research

More Science

Creek Watch

[Creek Watch](#) is a free iPhone application designed to help citizen scientists monitor the health of their local watershed. Whenever passing by a waterway, citizen scientists can spend a few seconds using the Creek Watch application to snap a picture and report how much water and trash they see. IBM, which created the app, aggregates the data and share it with water control boards to help them track pollution and manage water resources.

The Creek Watch App uses four pieces of data to help watershed groups, agencies and scientists track pollution, manage water resources, and plan environmental programs:

The amount of water: empty, some or full.

The rate of flow: still, moving slowly or moving fast.

The amount of trash: none, some (a few pieces), or a lot (10 or more pieces).

A picture of the waterway.

Creek Watch is a project developed at IBM Research - Almaden in consultation with the California State Water Resources Control Board's Clean Water Team.

Project Details

- PRINCIPAL SCIENTIST: N/A
- SCIENTIST AFFILIATION: IBM Research - Almaden
- DATES: Ongoing
- PROJECT TYPE: Fieldwork
- COST: Free
- GRADE LEVEL: All Ages
- TIME COMMITMENT: Variable
- **HOW TO JOIN:**

Download the [Creek Watch app](#) from the iTunes store.

The iPhone application is now available free on the iTunes store, so you can get started contributing data!



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Creek Watch **Explore your watershed**

Showing data from:



On 1/14/2014 At 1:40 PM

The waterway:

- had some water
- was still
- had no trash

Creek Watch is an iPhone application that enables you to help monitor the health of your local watershed. Whenever you pass by a waterway, spend a few seconds using the Creek Watch application to snap a picture and report how much water and trash you see. We aggregate the data and share it with water control boards to help them track pollution and manage water resources. You can use the map on the left to explore the data that people have contributed, or see recent contributions as a [table](#).

The Creek Watch App uses four pieces of data:

The amount of water: empty, some, or full.

1. The rate of flow: still, moving slowly, or moving fast.
2. The amount of trash: none, some (a few pieces), or a lot (10 or more pieces).
3. A picture of the waterway.

This data helps watershed groups, agencies and scientists track pollution, manage water resources, and plan environmental programs. Creek Watch is a project developed at IBM Research - Almaden in consultation with the California State Water Resources Control Board's Clean Water Team.

<http://apps.seattletimes.com/reports/sea-change/2013/nov/2/can-sea-life-adapt/>

“Sea Change: Can sea life adapt?”

For a glimpse of how nature might — or might not — adapt to ocean acidification, scientists turn to the prickly “hedgehog of the sea.” Story by Craig Welch Photographs by Steve Ringman

"Sea Change" was produced, in part, with funding from the [Pulitzer Center on Crisis Reporting](#).



SANTA BARBARA, Calif. — The violet bottom-dwelling, prickly-backed spheres wiggling in the tank in Gretchen Hofmann’s lab aren’t really known for their speed.

But these lowly sea urchins adapt so quickly they’re helping answer a question that’s key to understanding ocean acidification:

As fossil-fuel emissions disrupt marine life, will evolution come to the rescue?

Like Darwin’s finches or Great Britain’s peppered moths, these hedgehogs of the sea increasingly embody nature’s stunning capacity for resilience.

A number of plants and animals threatened by souring seas, including some mussels, abalone, [rock oysters](#), [plankton](#) and even a few fish, appear likely — at least at first — to adjust or evolve.

But few seem as wired as these saltwater pincushions to come through the next several decades unscathed.

Yet work with urchins, as well as other species, suggests that acidification sooner or later may still push these and other marine organisms beyond what they can tolerate.

“Evolution can happen, and it can happen quickly,” said Hofmann, a marine biologist at the University of California, Santa Barbara (UCSB), who has studied urchins for years. “But concerns about extinctions are very real and very valid. Biology can bend, but eventually it will break.”

The oceans are absorbing a quarter of the carbon dioxide emitted by burning coal, oil and natural gas. That, researchers say, is causing sea chemistry to change faster than it has for tens of millions of years.

Which plants and animals can accommodate these more corrosive seas — and for how long — will depend on many factors, from where they live to their population sizes to the depth of stress they face from other forces, such as warming temperatures and pollution. Survival will vary species by species. Not everything will make it.

“This kind of change is not free; evolution is not a gentle sport,” said Stephen Palumbi, an evolutionary ecologist at Stanford University, who also works extensively with urchins. “When evolution happens, it’s because the unfit are dying. It’s pretty brutal.”

And that’s when things work well.



Commercial fisherman Bruce Steele, on the water off the coast of Santa Barbara, scouts for a place to dive for sea urchins. It was Steele who first brought concerns about acidification to urchin experts at the nearby university.



Steele cracks open an urchin and shows off the edible portion inside. Scientists recently found that urchins appear to have some capacity to adapt to acidification, but it's not clear how much that work will apply to other plants and animals.

'Terrifying' research

In the late 2000s, commercial urchin fisherman Bruce Steele feared things would not go so well. And for good reason.

Urchins graze on algae, drive out kelp and are eaten by sea otters, sunflower stars and humans. Steele, a scuba diver, had made his living since the 1970s scooping the spiny delicacies off the seafloor to sell to sushi restaurants as uni.

But when he read a research paper about acidification, he saw right away what it could mean for his business — and for the ocean he loved.

“When you start knocking out the very bottom of the food chain, it's incredibly terrifying,” Steele said. “But that's what the research is showing us.”

Increasing CO₂ not only makes oceans more corrosive, it reduces carbonate ions, which everything from scallops to crabs, coral and sea urchins need to build shells or skeletons.

So Steele dialed up Hofmann, his local university expert on spiky echinoderms.

“She thought it was a crank call or something, because ... I don't know,” Steele said. “I guess people figure a sea urchin diver's not going to be reading a whole bunch of science.”

Hofmann dismissed Steele at first, but quickly called back and started investigating his concerns. She exposed sea urchin larvae to high-CO₂ water and made a troubling discovery: Their bodies [often got smaller](#).

“Overall, their body size really matters in how well they swim and how much food they get,” Hofmann said. “So if you’re smaller, it’s really bad news if you’re a baby sea urchin in the water.”

But Hofmann noticed something else, too: Some larvae didn’t change at all.

“When we started raising our babies in the lab, we saw that some of them shrank,” Hofmann said. “But, in fact, some of them didn’t. There were some in there that didn’t respond the same way.”

Hofmann knew enough about genetics to know that distinction might prove important.

Signs of evolution

In the century after Charles Darwin returned from the Galapagos carrying birds with different-shaped beaks, these finches came to represent the power of natural selection. As the birds expanded to areas with new foods, variations in their genetic code allowed new traits to emerge.

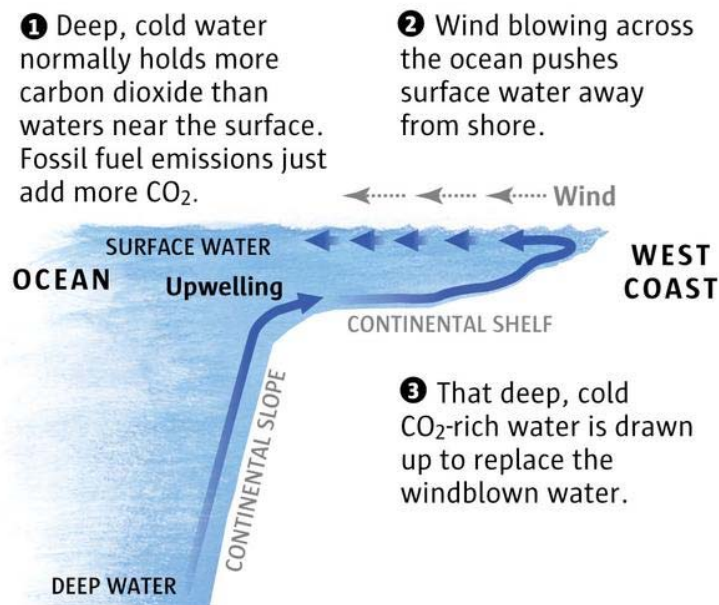
Such selection can be simple, elegant and fast. In Manchester, England, a common tree moth [evolved from mostly speckled ivory to black](#) in just decades. Soot from the Industrial Revolution had killed lichen and darkened local trees, which scientists believe allowed birds to more readily pick off the lighter insects. Once pollution was controlled, the tree trunks grew light again, and ivory-colored moths returned to dominance.

Hofmann suspected variations in urchin DNA left some predisposed to handle acidified seas. Nature, quite by accident, had been preparing a long time for this very moment.

It was all about the water. Water chemistry close to shore is rarely static. Ocean CO₂ can vary with the time of day or the tides, when plants suck up CO₂ to grow, or when animals die and decay.

How ‘upwelling’ works

Winds in the Northwest and Northern California often bring CO₂-rich waters to shore, where many species vulnerable to ocean acidification live.



Mark Nowlin / The Seattle Times

The change is more pronounced in Northern California and the Pacific Northwest. When heavy winds blow along shore, deep, cold water that naturally holds more CO₂ suddenly wells up from the bottom and gets drawn toward the beach. That means some West Coast urchins have spent millions of years being exposed to high-CO₂ waters.

In fact, upwelling is part of the reason Northwest oyster larvae were among the world’s first-known victims of acidification. Because the water already was near the extreme edge of what oyster larvae can tolerate, when man-made acidification spiked it higher, that wiped out billions of shellfish.

So Hofmann and a colleague, UCSB evolutionary biologist Morgan Kelly, mated “wimpy” Southern California sea urchins — those experiencing less CO₂ exposure — with hardier males from northern upwelling zones.

The result: northern animals passed on genes [more resistant to acidified water](#).

“The progeny, the babies — the kids — of that father were much better at maintaining the size of their body and not succumbing to the stress of high-CO₂ water,” Hofmann said.

At the same time, Palumbi and other Stanford researchers reared urchins in water from Southern California and from high-CO₂ zones in Oregon. They found the frequency of some gene sequences [shifted in response](#) to growing up under higher CO₂.

Urchins, in both cases, were showing they could evolve.

“It was really kind of surprising, and a little bit on the hopeful side,” Hofmann said.

The very upwelling phenomenon that makes the Northwest an acidification hot spot could actually help some species get through it.

But which ones? And for how long?

“The truth is we don’t know,” Palumbi said. “The experiments don’t tell us how long it will take for them to reach their limit. And it doesn’t tell us the price they’ll pay.”

‘Against guardrails’

Animals affected by elevated CO₂ don’t always need to adapt. Sometimes new environmental stressors trigger a change in the way they or their offspring use the genes they have.

For example, baby clownfish born to parents reared in high-CO₂ water [seem to survive just fine](#), while juvenile clownfish simply placed in high-CO₂ water die more often.



Sea urchins have some capacity to adapt, but other species living in the same environment may be less tolerant of higher CO₂.+ Enlarge photo



Even though mussels live in a similar environment, and their populations turn over faster than urchins, research suggests they would adapt much more slowly.+ Enlarge photo

Parents produce kids that survive better in the environment they're going to face, said Australian scientist Gabrielle Miller, at James Cook University, who has studied this phenomenon. "But it's not a change in genetic makeup. It's not evolution."

There are, however, signs that some fish, too, might evolve in response to acidification. Scientist Philip Munday, also at James Cook University, recently exposed wild damselfish to CO₂ levels expected in coming decades. That water fouled up behavior for half the animals, leading many to die prematurely.

But, importantly, half the fish didn't seem to change at all, and they survived as well as normal, healthy fish. Does that mean that some of these Great Barrier Reef fish were genetically predisposed to dealing with higher CO₂? It's too soon to say.

"For some organisms, especially short-lived species, there is considerable opportunity for adaptation," Munday said.

But evolution does have limits. When scientists breed mice for size, they get bigger over successive generations until reaching a point where they can get no larger. So what happens if the driver of all this change is an environmental cue that just keeps worsening?

Not every species can adapt enough. And not all of those that can will do so at the same speed, even if they live in similarly variable environments, such as areas near shore.

When Kelly, in Santa Barbara, exposed a microscopic species of tide-pool plankton to higher temperatures expected in coming years, she found these copepods lived in such an isolated environment [they lacked genetic capacity](#) to adapt much at all.

When Jennifer Sunday, at Simon Fraser University in Vancouver, B.C., studied mussels, she found that they, like urchins, are exposed to wild swings in sea chemistry. But evidence suggested these fast-growing mussels [would still take far longer](#) than slow-growing, long-lived urchins to adapt to rising CO₂.

And that pace can matter a great deal.

While adaptation is under way, many creatures may die, which can shrink populations — sometimes substantially. The question is, how many individuals can each species afford to lose?

That's one reason scientists believe that organisms with enormous populations, like urchins, have the best shot.



Sea urchin diver Mike Kelly sits in the stern of fisherman Bruce Steele's boat as they motor to a new location along the California coast to dive for urchins.+ [Enlarge photo](#)

“Our results are less likely to apply to species that live in less variable environments — for instance, open-ocean fish,” Kelly said. “And our results are less likely to apply to species with small population sizes.”

Three other issues, however, remain concerning for those trying to predict the marine world's future. For starters, acidification and ocean warming will occur simultaneously.

“What happens if the individuals best able to tolerate high temperatures are the least tolerant to high CO₂?” Munday asked. “That could slow adaptation for either of those traits.”

Meanwhile, in 40 or 50 years, CO₂ in places like the Northwest will reach extremes even hardy animals like urchins have never experienced in their history. Scientists aren't certain adaptation will keep up.

“Eventually we're going to push things up against the guardrails of their tolerances and, pretty soon, they're going to go right over the cliff,” Hofmann said. “That's what's worrisome.”

Lastly, all these changes will take place at once, potentially leading many populations to struggle as their food — and their predators — do the same. It's tough to predict how that could upend relationships in the sea.

“The bottom line is we can't count on adaptation to erase the effects of ocean acidification,” said Kelly. “It's just not a panacea.”

But Palumbi, at Stanford, said it could buy the world time to address the problem.

“Frankly, it seems to me that we need to use that extra time,” he said.

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“Sea Change” was produced, in part, with funding from the [Pulitzer Center on Crisis Reporting](#). This article was published November 2, 2013.

<http://www.dailypost.co.uk/news/north-wales-news/tidal-power-plan-right-choice-4007416>

By [David Powell](#)

Tidal power plan is right choice for Conwy county coastline, says university expert

[23 May 2013 15:40](#)

£2.2billion investment in an electricity generating lagoon off Colwyn Bay could power 400,000 homes



st's Impression
project in Swansea

The Tidal

A CAMPAIGNER for tidal power says an electricity generating lagoon could be the right choice for Conwy's coast - with the right investment.

A company called Tidal Lagoon Power (TLP) is working to develop projects in Swansea and the Colwyn Bay area.

It has started economic viability and environmental work off the North Wales coast to determine whether to push ahead with a £2.2billion investment which it says could power 400,000 homes and create 2,500 construction jobs in Colwyn Bay alone.

TLP's chief executive Mark Shorrock is also working to bring a tidal turbine project to Swansea Bay that would provide power to 107,000 homes.

The Colwyn Bay scheme could work well, according to Swansea University expert Dr Ian Masters, of the school of engineering. Dr Masters, who is in a consortium of academics talking to TLP, said: "A lagoon in North Wales would generate electricity and it would be low carbon electricity. It's a very flat sea bed and there's good tidal range. Colwyn Bay is definitely the right place to do it."

Some schemes have a semi circular wall with a lagoon behind. As the tide passes through turbines in the wall it creates electricity to be cabled ashore.

Dr Masters added: "We're talking (in Colwyn Bay) about a relatively long but a relatively shallow wall. It's a win-win situation. We'd be protecting our coast from climate change as the sea level rises by putting this lagoon there, but you're also trying to mitigate climate change with low carbon energy. Rather than build sea defences at the shoreline you're building sea defences (with a lagoon) further out. Waves break at the entrance to the lagoon not on the shoreline."

Dr Masters said that, as the UK has a privatised electricity industry, projects need to be largely funded privately but banks may not lend over the 150-year periods tidal schemes can last.

"So for this project they're talking about in North Wales, 'What level of support do we need to give that project so it can be financed?' is one of the big questions about whether it will happen or not."

Tidal energy campaigner and Conwy Council chairman Dr Stuart Anderson, who has just returned with Cllr Liz Rowlands from a visit to a successful tidal barrage in La Rance in France, welcomed TLP's interest in North Wales but stressed that he is in talks with a different developer and that Llanddulas would be the ideal site.

"We are more than happy to welcome Mr Shorrocks as a partner but a regionally based renewable energy developer with ten years of experience has expressed interest in taking on a business plan for the Llanddulas scheme. He has now made his intentions clear to Conwy County Council officers, Welsh Government, Department of Energy and Climate Change and The Crown Estate. The latter

can give or withhold the seabed lease." The individual could start planning work in September.

The fact that a tidal scheme could cut erosion could be crucial in attracting funds.

Said Dr Anderson: "The coastal defence argument is so important. It's a gamechanger." He urged a company like Rolls Royce to take part., which has about 20% of its turnover in marine engineering work for Royal Navy submarines and others, to get involved. Clwyd West AM Darren Millar said North Wales has massive potential for tidal schemes which also protect coasts.

He said: "There is massive potential to generate tidal power schemes off the North Wales Coast and any schemes could also deliver flood protection benefits."

Beach erosion likely due to abnormally high tides - Hawaii News - Honolulu Star-Advertiser

StarAdvertiser.com

Beach erosion likely due to abnormally high tides

By Timothy Hurley

POSTED: 01:30 a.m. HST, Oct 17, 2013 LAST UPDATED: 02:43 a.m. HST, Oct 17, 2013



Unusually high tides may be largely responsible for recent episodes of severe erosion at Sunset Beach and Waikiki Beach, a coastal scientist said Wednesday.

Tides 3 to 6 inches higher than normal were recorded in Honolulu Harbor and at other National Oceanic and Atmospheric Administration gauges across the state over the past month, said Dolan Eversole, NOAA Sea Grant

Coastal Storms Program coordinator.

"A couple of inches of water can make all the difference," said Eversole, a coastal geologist.

He said the abnormally high tides are probably the result of regional "mesoscale eddy" effects — massive warm-water bulges that pass through the Hawaiian Islands in duration of weeks to months.

A similar warm-water eddy was identified by a University of Hawaii study as a major factor in severe erosion that mysteriously plagued the Kaanapali Alii Resort in West Maui in 2003.

"It was pretty dramatic," Eversole recalled, adding that sandbags were brought in to protect the hotel. "But just like this time, there were no giant swell events that you could put your finger on that caused the sand to disappear."

Eversole said Sea Grant agents across Hawaii are reporting few other recent abnormal erosion problem areas, which indicates that while higher water levels may not be the sole cause, they can exacerbate an existing erosion hot spot.

"It's not a trigger but a catalyst that can make a problem beach unravel fast," he said.

Meanwhile, city and state officials agreed Wednesday to move sand from in front of the Honolulu Police Department Waikiki Substation to build up the severely eroded stretch at Kuhio Beach.

City crews, working under the direction of state Department of Land and Natural Resources beach experts, will mobilize equipment this evening during low tide to remove debris and transfer at least enough sand to cover an exposed concrete foundation, officials said.

"It will be a temporary fix," said Jesse Broder Van Dyke, spokesman for Hono-lulu Mayor Kirk Caldwell.

"The next swell could erode the sand. But right now it doesn't look like it should for our tourists."

Kalakaua Avenue will be closed for 20 minutes between 11 a.m. and noon today while heavy equipment is moved next to the beach. Also, the makai lane of Kalakaua will be closed between 7:30 p.m. and 3:30 a.m. Friday.

A long-term solution is now under study, said DLNR spokeswoman Deborah Ward.

She noted that scientists also will be looking at the question of whether the removal of a couple of small groins during the 2012 Kuhio Beach sand replenishment project may have contributed to the recent erosion.

But that could take a few more seasons of data to figure out, Ward said.

At Sunset Beach, homeowners are talking with engineering firms about some kind of large-scale measure to slow the erosion threatening about 10 homes sitting dangerously close to a newly carved 20-foot beach cliff, officials said.

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<http://www.hawaiinewsnow.com/story/24344369/waikiki-diamond-head-reopens-for-fishing>

Waikiki-Diamond Head reopens for fishing

Posted: Jan 01, 2014 5:49 PM HST Updated: Jan 01, 2014 11:34 PM HST

By Rick Daysog - [email](#)



WAIKIKI (HawaiiNewsNow) -

It's open season off the shores of the Gold Coast.

After a one-year freeze, the state today reopened the Waikiki-Diamond Head area for fishing, attracting a big crowd of anglers and spear fishermen.

"Plenty fish, beautiful year 2014," said Aiea resident Bryce Cleaver.

"I caught Kumu, some tako, Papios, Menpachi some Uhus."

Many showed up the night before and camped in the Kaimana Beach parking lot.

"We came at like 3 o'clock in the morning and we stayed over night and went out at 6:30," said Taylor Tuia of Mililani.

Added Cleaver: "Oh yeah, this beach was crowded this morning, never seen it so crowded."

The state allows fishing in the area only on even-number years to protect the area from over fishing. The areas runs from the ewa side of the Waikiki Natatorium to the Diamond Head Lighthouse. The rest of Waikiki is off limits.

Officials with the state Department of Land and Natural Resources were out enforcing the fishing rules and found about a dozen people fishing on the wrong side of the border. About three of them were issued warnings.

Some spear fisherman said they like the one-year ban.

"(There's) no over fishing," said Kalihi resident Alvin Vargas.

"It gives a year to grow and stuff."

But others said fishing poses potential dangers for beach goers. They say the spear fishing is being conducted just a few feet away from swimmers and surfers and could lead to accidents.

"I think that they should ban it all together from Kaimana," said Diamond Head resident Yuko Kasai.

"The reason being is that this is a kid-friendly swimmer friendly beach and there are plenty of places for fisherman to fish."

The state has urged fishermen to operate with caution when fishing off of Waikiki. The area will remain open for fishing until the end of the year.

<http://www.civilbeat.com/voices/2014/01/09/20856-honolulu-is-not-neglecting-shoreline-development-issues/>

Honolulu Is Not 'Neglecting' Shoreline Development Issues

By George Atta 01/09/2014

I'd like to clarify a few points in Sophie Cocke's article, "[Honolulu Forgoes Federal Funds to Manage Coastal Development](#)" (Jan. 6, 2014), particularly her statement that the city's "inaction is part of a pattern of neglect when it comes to dealing with homes, businesses and infrastructure that are too close to the ocean."

Although we do not receive federal funds for the Coastal Zone Management program, this does not mean that we are not monitoring or handling coastal zone issues; it just means that we're doing it without federal funding. As I stated in the interview with Ms. Cocke, the Department of Planning and Permitting (DPP) has staff dedicated to the CZM issues (i.e., coastal flooding, erosion, and sea level rise), and applications are reviewed on a case-by-case basis. To conclude that the city is neglecting these issues is not true and unfair to the DPP staff involved in the CZM.

The primary reason building and zoning codes exist is for the health and safety of our residents. We at the DPP review each application to ensure that proposed projects will not have a negative impact on the applicant, as well as the public. This is true for homes and properties along the coastal shorelines.

What makes Honolulu different from the other counties is Honolulu has a lot more developed shorelines than the less-populated neighbor islands. We have many more miles of coastline where homes and buildings are within close proximity to the shore. In other counties, you'll find large stretches of open coastline with no structures. So to implement a blanket shoreline setback policy (i.e., 100 feet) would be very difficult here on Oahu because our coastlines are already developed.

In 1990, the Department of Land Utilization (DLU), predecessor to the DPP, proposed to amend the setback to 100 feet, but that was met with strong opposition from shoreline property owners, including the North Shore community. The proposal received little support and died in a City Council committee. But in 1994, the DLU was successful in convincing the Council to adopt a compromise of 60 feet for new development along the shoreline, although we would have preferred a greater setback. In fact, the DPP often recommends to property owners a bigger setback than is allowed, but the property owners have always told us that they want to build as close to the shoreline as legally allowed, and we have no choice but to grant the permit.

The article also stated that while the DPP turned down federal funds, we also are asking for increases in many of our permitting fees. The two are totally unrelated. The CZM federal funds would go to the hiring of one, possibly two, CZM staff members. The funds could not be used for anything else. And again, we already have staff assigned to CZM matters. The DPP is seeking a rate increase, which would be the first in more than 10 years, because we felt that with inflation and the rising cost of government, an increase was necessary. Many of the department's permit review and processing are now done free of charge. An example of this is when the DPP is the accepting agency for an environmental assessment or environmental impact statement. The estimated revenue generated by the proposed fee increases is between \$500,000 and \$1 million and will go to the city's general fund, not directly to the DPP.

While I appreciate Civil Beat's interest in this matter, I also want to be sure that the facts are presented.

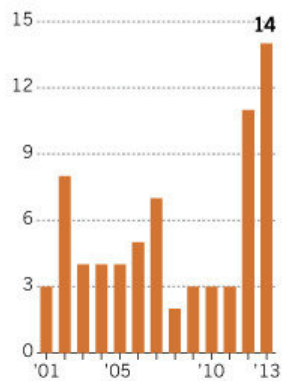
About the author: *George Atta is the director of the city Department of Planning and Permitting.*

Surge in shark attacks causes alarm in Hawaii

Tourists and business owners are worried about the increase in shark attacks off Maui the last two years. State officials and many residents say the threat is exaggerated.

Shark attacks

In 2013 Hawaii had a record number of shark attacks. Two in the waters off Makena State Park, Maui, resulted in fatalities.



Sources: Hawaii Division of Aquatic Resources, Hawaii Department of Land and Natural Resources

LORENA ELEBEE Los Angeles Times

By Maeve Reston January 14, 2014, 8:06 p.m. maeve.reston@latimes.com

MAKENA STATE PARK, Hawaii — After a record year of attacks across the Hawaii archipelago, sharks were not far from Colin Dececco's mind as the sun went down on the long white strip of sand here on a recent Sunday evening.

He and his daughter had had a close encounter with a reef shark while swimming around the rocky cove at the north end of Makena's Big Beach that morning. Now, watching a spear fisherman haul in his catch as they strolled by the same spot at sunset, they heard a splash at the edge of his net.

It was an 8-foot tiger shark, one of the most aggressive shark species in Hawaii's waters and the likely culprit for many of the 14 attacks in 2013, eight of which occurred around Maui, near Makena's beaches and elsewhere. Releasing his net, the fisherman took off running down the shoreline, shouting for swimmers to get out of the water.

"By then everyone was kind of running," Dececco said in an interview moments after he and his daughter had scrambled up the rocky cliff above the cove for a better view. "Tiger sharks — you don't play with them."

In a state where tourism drives the economy, the uptick in shark encounters has alarmed visitors and business owners alike. Both 2013 fatalities — a German snorkeler and a Washington state kayak fisherman — occurred in the waters near Makena State Park. But there are no permanent warning signs here on a coastline that boasts luxury hotels including the Four Seasons Resort Maui and the Waldorf Astoria's Grand Wailea.

For years, the state Department of Land and Natural Resources has posted signs and closed the beach immediately after an attack until noon the next day, if officials on helicopter and jet ski patrols believe the shark has left the vicinity. And for now, they see no need to change that policy.

"There is no pattern. There are spikes; there are lulls," said William Aila Jr., the department's chairman. But shortly after the German tourist died in August, the state agency announced a two-year, \$186,000 study by University of Hawaii researchers to determine whether tiger sharks spend more time in areas used for ocean recreation around Maui than the other islands.

So far, the increases in attacks in 2012 and 2013 — which followed three years in which there were just three shark attacks annually — do not appear to have affected tourism. More than 2.1 million people visited Maui last year, figures that Terryl Vencl, executive director of the Maui Visitors Bureau, said she had not seen since before the recession.

"I think people realize it is still a rare occurrence," Vencl said in an email.

There is no question, however, that many swimmers and snorkelers are adjusting their routines based on the location of encounters. No pattern has emerged linking the likelihood of an attack with the distance from shore: The kayak fisherman was 900 yards off Makena; the German snorkeler was 50 yards offshore. But a number of tourists said in interviews that they were not swimming out as far.

"I went in waist-deep, that was it," said Karen O'Brien, a 49-year-old tourist from Toronto. Last year, O'Brien snorkeled off Molokini, a small island off the southwest coast of Maui. But after reading that the kayak fisherman was attacked near Molokini, she said, "I wasn't interested."

Island native Lorraine Alesna, who has long fished at Makena Landing — a popular launching spot for kayakers and snorkelers — shook her head at the jet skiers, kite surfers and other tourists who zoomed into the waves without paying attention to pupping season for sharks (the winter months), or common-sense tips like avoiding turbid water that attracts them.

"People that come from the mainland have no respect for anything, neither the ocean nor the land," Alesna said. "We grew up knowing, by the elders, what we can and cannot do in certain times of the year."

Like many longtime residents and fishermen here, Alesna offers myriad theories for the rise in shark attacks. She questions whether the tsunami in Japan increased the level of radiation in the water, driving sharks closer to shore. (State officials say radiation levels are normal.) She argues that the recovery of the population of Hawaiian green sea turtles — protected under the Endangered Species Act since 1978 — is luring sharks closer to the beach, and she says it's time for officials to allow hunting the turtles again.

But Carl Meyer, a marine biologist leading the University of Hawaii study, said there was no evidence to support that theory, or many of the others he had heard. Turtles, for example, are just one part of the broad diet favored by tiger sharks, which are known as the "garbage cans" of the ocean. He also dismisses the frequently cited notion that there are more tiger sharks in the water and that they are hungrier than in past years.

One known fact, Meyer said, is that there are more kayak fisherman, kite surfers and paddle boarders than a few decades ago — and the study will look at whether tiger sharks are more prevalent in areas of Maui where those sports are most popular.

A [website](#) where people can track the movements of the sharks tagged by Meyer and his team has fascinated many tourists and other ocean visitors. Both the state and the university hope it will generate curiosity about sharks, rather than fear, in the midst of renewed debate over whether there should be a shark culling program, which would face fierce resistance among native Hawaiians who consider sharks to be a sacred protector.

The fact that there are very few shark attacks relative to how many millions of people are in the water is something of a credo here — from waiters to dive guides, locals are quick to point out that visitors are more likely to die in their cars on the way to the beach.

Minutes after the recent sighting of the 8-foot tiger shark off Big Beach, bolder swimmers were back in the water there and at adjacent Little Beach, a nude sunbathing spot where hundreds of people gather on Sunday nights for a drum circle.

Tadd Laton, a 20-year-old waiter who moved to Maui from San Jose, watched the night swimmers from the cliff overlooking the Little Beach drum circle. After the attacks, locals wouldn't be in those waves at night, Laton said, and he now follows that rule too.

Still, he says he refuses to be cowed. "Life could end at any moment," Laton said. "If I die from a shark attack, that would be a cool way to die." But, he added, "if I see one, I'm going to head right back to shore."

<http://seagrant.soest.hawaii.edu/unusually-high-tides-may-be-contributing-seasonal-coastal-erosion-hawaii>

By Dolan Eversole, NOAA Sea Grant Coastal Storms Program Coordinator, Pacific Islands Region

Recent [media reports highlighting coastal erosion](#) at Sunset Beach and Waikiki Beach, Oahu indicate the possible effect of unusual waves or tides as a contributing factor to the observed erosion. While there have not been any unusual wave or storm events that can be attributed to the erosion, we do observe unusually high tides in Honolulu Harbor. The National Oceanographic and Atmospheric Administration (NOAA) monitors and records the tides and has [recorded higher than predicted tides](#) in Honolulu Harbor (3-6 inches) higher from mid-September throughout the month of October, 2013. These unusually high tides are probably the result of regional [mesoscale eddie](#) effects (large warm water bulges that pass through the Hawaiian Islands in duration of weeks to months). The persistent high waters of the last month could be exacerbating coastal erosion and could be a major contributing factor to the observed unusual coastal erosion. Could this recent high water event be a glimpse into our near future in a world of higher sea levels?

[Read more in the Honolulu Star-Advertiser](#)

http://www.staradvertiser.com/newspremium/20131017_Beach_erosion_likely_due_to_abnormally_high_tides.html?i d=228138331&c=n

