How could something as simple as a rubber band impact ocean conservation?

At the Our Ocean Conference in 2016, The Ocean Foundation made a commitment through the International Ocean Acidification Initiative to train 50 scientists around the world to monitor ocean acidification (OA).

In 2017, we committed to expand our initiative by training policymakers, and, in 2018, we committed to building OA resilience in the seafood sector. Since making that first Our Ocean commitment we have seen incredible success, but with a few surprises along the way.

OA is the rapid and unprecedented decrease in the ocean's pH due to CO2 emissions. As the ocean becomes more acidic, animals like shellfish and coral struggle to form their shells and skeletons. The chemosensory systems of sharks, salmon, and clownfish go haywire. Entire food webs and ecosystems are expected to change, and possibly even collapse.

Complicating things, OA varies regionally and over time. This makes local data absolutely necessary for island and coastal communities to make management decisions.

To measure OA, you need to collect water samples and preserve them so that the chemistry doesn't change between collecting the sample on a boat and analysing it in the lab. A key ingredient to this preservation? Thick rubber bands. The "standard operating procedure" requires that you use a pyrex glass bottle to take the sample, seal it using grease that prevents gasses from escaping the bottle, snap on a plastic clip that locks the bottle stopper in place, and wrap it with a thick rubber band that keeps everything together.

Photo by Dr. Andrew Dickson

Of all the things needed to measure OA, ranging from sophisticated sensors to specialised pH probes, rubber bands didn't strike me as particularly vital, until I got a Skype call from Dr Yashvin Neehaul, a researcher at the Mauritius Oceanographic Institute.

I had recently helped him set up an OA monitoring system. "Alexis," he said, "I can't find the rubber bands we need in Mauritius. They only sell the thin ones. I've run out, so we can't collect samples anymore."

Image from The Ocean Foundation

It turned out that he wasn't the only one with this problem. Carla Edworthy, our partner in South Africa, had the same issue. So now, two monitoring programmes were on hold, all because of rubber bands.

Knowing that something so small could hold everything up put a new spin on what I already knew: while some countries can easily monitor the ocean, other countries cannot. Why?

Because monitoring systems are designed in the most well-resourced labs in the world, where everything from specialised electronics to simple things such as – you guessed it – rubber bands, are readily available.

In 2016, a standard OA monitoring system cost at least $300,000 USD, with sensors requiring annual maintenance in California and hard-to-repair analysis equipment.

To Carla, or Yashvin, such a system had no realistic application for them. Just mailing a sensor to California would cost them thousands and could take months to clear customs. At The Ocean Foundation we recognised the need to build something that would work for them, and for all scientists in island and coastal countries where the risks of OA are simply too big to ignore.

Image from The Ocean Foundation

TOF Program Officer Alexis Valauri-Orton and Program Associate Alexandra Puritz work with Logenix International to review the contents of a GOA-ON in a Box kit before it is shipped to Ecuador

With a team, including the International Atomic Energy Agency's OA Coordination Centre, and experts like Dr Andrew Dickson of the Scripps Institution of Oceanography and Dr Chris Sabine of the University of Hawaii, we built the Global OA Observing Network (GOA-ON) in a box – a kit designed to monitor OA in places with limited resources. All you need is seawater and electricity, and the box takes care of the rest.

The Ocean Foundation has procured and shipped 17 boxes to 16 countries, at an individual cost of $20,000 USD – less than 10 per cent the cost of previous systems. Each box contains everything scientists need to:

- Collect and preserve water samples (yes, including rubber bands!)
- Analyse samples for pH and alkalinity
- Measure the pH, temperature, and salinity of the water continuously using low-cost sensors
- Upload and analyse their data

For each box we put together, The Ocean Foundation orders 49 items from 12 vendors. A shipping logistics company helps us package those items and navigate the months-long process of obtaining customs clearance to ship the boxes to their final destination.

Image from The Ocean Foundation

Dr. Yashvin Neehaul records data using the GOA-ON in a Box kit

Since making our commitment at the Our Ocean Conference just three years ago, we have helped establish permanent monitoring programmes in some of the countries most vulnerable to OA.

In Fiji, Dr Katy Soapi is studying how mangrove restoration affects the chemistry of a bay. In Jamaica, Marcia Creary Ford is characterising the chemistry of the island nation for the first time. In Mexico, Dr Cecilia Chapa Balcorta is measuring chemistry off the coast of Oaxaca, a site which she thinks might have the most extreme acidification in the country. But what about in South Africa and Mauritius? Did Carla and Yashvin ever collect another sample?

As luck would have it, both were heading to Monaco for training. A local colleague of mine was also attending. With a click, I ordered a few boxes of rubber bands to her apartment. She took them with her in her suitcase, handed off the rubber bands, and Carla and Yashvin were back in business. An extra supply of rubber bands has now become a new key ingredient in our kits.