

IN SEARCH OF A HEALTHY OCEAN ECOSYSTEM



From left to right, the photographs above are courtesy of Rebecca Hale and Enric Sala.

When Enric Sala was a boy, he loved to watch French ocean explorer Jacques Cousteau on television. Cousteau showed the world spectacular underwater animals and scenery. Sala dreamed of one day being part of Cousteau's crew and visiting amazing underwater worlds himself. He pursued his passion for the ocean, becoming a marine ecologist, and eventually a professor at the Scripps Institution of Oceanography in La Jolla, California. Soon, though, he became frustrated. His academic research seemed to be documenting all of the ways the future of the ocean was threatened, without doing anything to protect it. Sala wanted to find a way to defend the world's oceans, so he left his job and partnered with National Geographic to create the Pristine Seas project.

Asking Geo-Inquiry Questions

Sala was already well aware of various ways the ocean was being damaged, including overfishing, pollution, and sea temperature rise. The ocean was becoming more acidic as a result of absorbing carbon dioxide from the atmosphere, and invasive species were harming the balance of the food web in the ocean. Given all these threats, Sala wanted to know: Is there

any healthy ocean left? The Pristine Seas project would seek to answer this question.

This initial question led to more: What is a healthy ocean? Where are the last wild places in the ocean? What does a complete, undamaged marine ecosystem look like? What are the key threats to these areas, and how can they be addressed? Who controls these pristine waters, and how can those leaders be convinced that the waters are worth protecting?

Sala developed a plan to find the answers: (1) Identify and explore the last wild places in the ocean. (2) Collect data, video, and photography in order to tell the story of a healthy marine ecosystem. (3) Work with key leaders to protect healthy waters and share what is learned, so the world understands the value of these places and takes action to protect them.

Collecting and Analyzing Data

Sala and his team started by researching the oceans around the world, looking for expansive areas largely undisturbed by human influences. They then organized expeditions to each site.

One selected location was the Galápagos Islands (Archipiélago de Colón), an archipelago comprised of 19 islands located approximately 600 miles (~1000 km) off the coast of Ecuador in the Pacific Ocean. Charles Darwin explored these unique islands in 1835, which inspired his theory of evolution by natural selection. A marine reserve partially protected some of the waters around the islands. Sala hoped that with new information about the marine ecosystem of the Galápagos and compelling images to complement the data, he could convince decision-makers in Ecuador, the country to whom the islands belong, to further preserve these waters.

One key measure of a healthy ecosystem is its biomass, an estimation of the total weight of the living organisms in an ecosystem. In the Galápagos, Sala and his team used divers and cameras to document the marine life and measure biomass. They focused mainly on the waters around the two most remote islands, Darwin and Wolf. In some cases they counted fishes via diver transects, in which scientists swim along a path that is a specific length and width, estimating numbers and sizes for all fishes found within those transects. They also used quadrants, in which scientists measure a quadrat on the ocean floor and then count and measure all the species within that box. By repeating these processes in different locations, they could use the data to estimate biomass for larger areas.

To explore areas offshore that were too deep for divers, Sala's team used a submersible, a small vehicle designed to operate underwater, and a drop camera, a high-definition camera enclosed in a glass sphere. In each case, they identified and counted the species they saw and documented new species formerly unknown to science. The researchers also used animal tagging to gather data about marine life. For instance, they tagged and tracked sharks using satellites to determine their travel patterns and plotted their locations on maps.

Organizing and Analyzing the Data

After the expedition, each part of the research team was responsible for analyzing its own data. Geographic information system (GIS) data gathered during the dives, combined with animal tracking information, helped scientists visualize which areas to protect. Then the chief scientist compiled the results to create a picture of what was learned. They found that the area around the Galápagos has the largest biomass of fish ever recorded, and it consists mostly of sharks. Despite their large numbers, comparisons to past research indicate the shark population in the Galápagos is declining. The numbers of other

large predators, such as grouper and snapper, are also declining, largely because of overfishing.

Sala's research found that protecting marine life not only helps preserve the ecosystem, it benefits the local economy. In 2005, he coauthored a report for the Galápagos National Park showing that sharks are more valuable for tourism than for fishing. Locally, a dead shark is worth about \$200 to a fisherman, but a living shark brings in about \$5 million over the course of its lifetime through tourism.

Creating the Geo-Inquiry Story

Telling the story of what lies below the ocean's surface and why it is worth protecting depends on compelling images and good data. The Pristine Seas expeditions include expert underwater photographers and videographers who work with the scientific team, producers, and editors to craft an effective story. Before the Galápagos expedition, team members did advance research to understand what species of plants and animals were important to the local culture and to commerce in the area. During the expedition, the film crew focused on those species, knowing they would be a critical part of the story. They also featured charismatic creatures such as sharks, rays, seals, and whales. Throughout the expedition, the film crew was in close contact with video producers, exchanging ideas about which photos and videos were the best, in preparation for creating documentaries and other visuals about the area.

During the expedition, researchers shared details about their work on social media, posting photos and updates on blogs, Facebook, Twitter, and Instagram. This enabled anyone around the world to virtually participate in the expedition. Sala and other team members were also interviewed for newspaper and magazine articles, podcasts, and radio and television programs. The findings of the expedition were shared with the expert scientific community in peer-reviewed articles.

Taking Action

In the waters around Darwin, the most remote Galápagos island, Sala and his team found an ecosystem as pristine as one can be in modern times. It was like a time machine showing the oceans of the past. Sala knew that to convince others to protect this place, he needed to share what he had learned with local leaders and the world.

It is difficult to inspire people to protect what they have never seen. Political leaders usually do not have the time to travel to the remote Pristine Seas project sites. The Galápagos expedition was fortunate. Ecuador's ministers of tourism and the environment were able to join the expedition and see firsthand the robust ecosystem. Then, in February 2016, Sala met with Ecuador's president, Rafael Correa, to discuss the importance of protecting the Galápagos waters. Much of the area was already a marine reserve, but fishing was still allowed. Sala's research added to discussions already underway about rezoning the marine reserve to create "no-take" zones – areas where no fishing is allowed. One month later, Ecuador's president signed a decree creating a 15,000 square mile (approximately 39,000 square km) marine sanctuary around Darwin and Wolf Islands, which prohibits fishing in a third of the Galápagos Marine Reserve.

To garner the support of the local community, the Pristine Seas team created a documentary film in Spanish, which premiered in the Galápagos Islands in September 2016, showing the spectacular waters around the islands and encouraging their protection. To inspire worldwide support for the Pristine Seas project and for ocean protection, the team premiered the same documentary film in English in Washington, D.C., in September 2016, and on the National Geographic WILD television channel in January 2017.

Currently, about 3 percent of the world's oceans are in marine reserves. The United Nations set a goal of protecting 10 percent of the world's marine and coastal areas by 2020. Some scientists think that is not enough, estimating that more than 30 percent needs to be protected from overfishing, oil and gas drilling, and other invasive human activities to maintain ocean health.

Pristine Seas Continues to Take Action

When asked what he has accomplished so far with the Pristine Seas project, Sala says the main achievement is that it has inspired leaders to protect these places. By June 2017, twenty-three expeditions were complete, and thirteen protected areas have been created, totaling 1.7 million square miles (nearly 4.4 million square kilometers). The project has provided a window into the ocean's history and a legacy for the future.



Map of the Galápagos Islands highlighting the existing Marine Reserve and the resulting new protections around Wolf and Darwin Islands.

Map courtesy of NG Staff: Charles Preppernau. Source: Ministerio del Ambiente, Gobierno Nacional de la República del Ecuador.

The content in this document is accurate as of June 30, 2017.