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# PLOS Science Wednesday: Hi reddit, I'm Ben Halpern and my PLOS ONE study investigates the health of the ocean of 220 coastal countries and territories worldwide – Ask Me Anything!

PLOSSCIENCEWEDNESDAY [R/SCIENCE](#)

Hi Reddit,

My name is Ben Halpern and I am a Professor at the Bren School of Environmental Science and Management at UC Santa Barbara and Director of the National Center for Ecological Analysis & Synthesis. My research focuses on a range of issues and questions related to effective and efficient protection and sustainable use of marine species and habitats.

My colleagues and I recently published an article titled [Drivers and implications of change in global ocean health in the past five years](#) in PLOS ONE. In this paper we report five years of annual assessment of the health of the ocean in all 220 coastal countries and territories around the world, tracking how 10 different broad goals are doing and what is driving changes in those goals. Most notably we found that many countries have improved their overall score by substantially increasing the amount of marine protected areas, while many other countries have seen scores decline due to unsustainable management of fisheries and other ocean resources.

I will be answering your questions at 1pm ET from the [ESA 2017 Annual Meeting](#) -- Ask Me Anything!

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Thanks for coming to talk with us!

My question is about the health of the Gulf of Mexico. To what extent do you still see significant damage from the Deepwater Horizon oil spill, or is it mostly better now? Also, I heard that some of the environmental damage was from chemicals used in attempts to clean up the spill. Is that true, and if so do we have better strategies for future spills?

[asbruckman](#)

This study was focused on assessing each country at the exclusive economic zone (EEZ) scale, so we did not specifically look at the Gulf of Mexico, instead the Gulf was wrapped into an overall single score for the United States. However, our team and others around the world are using the Index to assess ocean health at smaller, regional scales like Hawai'i, Mexico, the Baltic Sea, British Columbia, the US Northeast and more. See here for a map and more information on these regional efforts.

While we do not currently have a small scale project looking at the health of the Gulf of Mexico, we think this could be a very useful place to adapt and apply the Index to track how ocean health has changed over time and how well the system has recovered. There are currently some other indicator efforts underway that are not associated with the Ocean Health Index that may be able to tell you a bit more about how well the Gulf of Mexico is recovering. Here are a few links to these efforts below:

NOAA Integrated Ecosystem Assessment for the Gulf of Mexico:

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[http://www.aoml.noaa.gov/ocd/ocdweb/ESR\\_GOMIEA/](http://www.aoml.noaa.gov/ocd/ocdweb/ESR_GOMIEA/)

NOAA RESTORE Act Science Program indicator projects:  
<https://restoreactscienceprogram.noaa.gov/funded-projects>

Are there any trends in terms of which countries get high scores and which get low ones? Income? Amount of coastline? Relative importance of fishing industry?

[recentfish](#)

This question is at the heart of what we were trying to address with this paper and our continued research. We wanted to see how countries are doing today in terms of ocean health, how that has changed over the past five years, and what might be driving those changes (trends). We didn't do analyses specific to amount of coastline, relative importance of particular industries, or other similar potential correlates, but we did look at which aspects of ocean health were driving the changes in overall scores, and what types of management or action might have led to those changes.

We found two particularly interesting results with respect to this question. First, countries that have created marine protected areas (MPAs) saw their overall ocean health scores increase, sometimes by a lot (eg. if they created a lot of MPAs). Second, countries that were doing better five years ago tended to improve over the past five years, and countries that were doing worse tended to get worse. There are many possible factors that could influence this, but it is likely in part due to the political stability, economic status, strength of governance, and institutional resilience of countries that can influence how ocean resources are managed, used, and protected.

We have interactive graphics where you can explore some of these trends yourself: [http://ohi-science.nceas.ucsb.edu/plos\\_change\\_in\\_global\\_ocean\\_health](http://ohi-science.nceas.ucsb.edu/plos_change_in_global_ocean_health). This is linked from the website we made for the paper: <http://ohi-science.org/ohi-global>.

You did this for 220 countries and territories? I'm really curious how you're able to do that for less advanced countries or ones in political turmoil. How do you collect data from places like Madagascar or Somalia (both very much have political problems)? I'm genuinely curious, as I feel that has to be difficult!

Also, if you had to pick one indicator of overall ocean health to be the most important or representative, which would it be? (I don't know much about this to be honest, but ocean pH would be my guess.)

Thank you for the AMA!

[brownaj010](#)

Thanks for your question! It was a big effort to apply the Ocean Health Index to 220 regions globally. In order to do so we had to figure out how to find (or estimate) information for countries that are lacking in data, often referred to as "data-limited countries".

We use existing datasets collected at the country level and reported to groups like the UN and the World Bank, which is how we are able to report scores for 220 countries and territories, including Madagascar and Somalia. In instances where particular data are unavailable for a country or countries, we fill those gaps using a variety of statistical techniques, for example by estimating a missing data point for a country using neighboring countries' values, or with linear regression models for all countries with data.

Most of the time we can get fairly good estimates of missing data, but regardless, missing data is a source of error. We have been working to clearly convey the uncertainty around OHI scores due to

missing data. For example, see our recent publication on this. (<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0160377>).

To your question about one indicator, we have defined ocean health as the ability of the oceans to sustain a range of benefits for people now and in the future. By this definition, we need a holistic framework to capture the full range of ecological, social, economic benefits we can enjoy from a healthy ocean, as well as the pressures and resilience that affect those benefits. Indeed, we hope that the Ocean Health Index will be used as that 'one' indicator (as a composite index).

Choosing a single indicator as particularly important or representative is both challenging and risks losing the holistic, comprehensive view. Certainly, individuals may place more importance on aspects of ocean health that impact them directly, for example a fishing job or a protected surf spot or a culturally iconic species. However, for OHI we prefer to focus on that larger picture.

That said, ocean pH is certainly an important factor in understanding ocean health. It is captured in the Ocean Health Index as one of the climate change pressures (in addition to sea surface temperature, sea level rise, and ultraviolet exposure) that reduce the ocean's ability to provide sustainable benefits in the long term.

Hi Ben, thanks for doing this AMA! My question relates specifically to the rapid decline of the Great Barrier Reef off the coast of Australia.

Are you or any of your colleagues aware of the current coral bleaching event, and if so, could you speculate as to what implications this event may have on marine life (and ocean life in general) in years to come.

A lot of misinformation seems to be spread in our media regarding this event, it would be great to gain some insight from an expert such as yourself.

[sessuna](#)

Yes, the bleaching events are very concerning. Coral reefs are important to ocean health for many reasons. They support local fisheries, they protect coastlines, they provide key habitat for an incredible diversity of species, they are culturally important places for many communities, and people harvest natural products from them, like shells and sponges. When coral reefs are lost from an area, the loss has profound implications for overall ocean health.

The New York Times just published an update to their [article](#) about the implications of a new climate report and role of Trump and US policymakers.

What advice do you have for ECRs on engaging policymakers in the US and globally on ecological issues such as climate change, marine protected areas, and the health of the environment in general?

[sarark](#)

There's no single set of best advice - it depends on whether you are interested in engaging in the science-policy interface.

Regardless, one universal piece of advice is to practice open science. This is key for good science and really helpful for policy makers if/when they need to understand how the science was done.

With the Ocean Health Index, we've found focusing on reproducibility and transparency makes us more efficient and lets others build directly and efficiently off of our science. And because communication is a big part of this, working openly has helped bring stakeholders together over ocean

health because they are able to see the data we are working and also how we are analyzing it and the decisions we are making along the way.

If you're interested in engaging directly in the policy arena, many professional societies (e.g., AAAS, ESA, AGU, etc.) have resources committed to helping do this - I would suggest reaching out to them to see how you can get involved. #ESA2017

I lived most of my adult life in Coastal South Carolina near the ACE Basin which comprises hundreds of thousands of acres of pristine maritime forests, marshes, and sea islands. Are there organizations working, and is there 'enough' effort, to ensure vital systems such as ACE Basin are protected for posterity?

[Eb73](#)

This study focuses on the global ocean and each coastal country and territory's exclusive economic zone (EEZ), meaning that the Ocean Health Index score for the United States includes all federal waters on the East, Gulf and West coasts, Hawai'i, and Alaska. At this scale it is difficult to use the index to understand what is happening at much smaller scales such as the ACE Basin.

But what is really exciting about the Ocean Health Index is that assessments can be done at much smaller scales to better track and monitor regional ocean areas. And this is a big part of our work: we are leading assessments and guiding others to lead their own assessments. OHI assessments are being done at regional scales in Hawai'i, Mexico, the Baltic Sea, British Columbia, the US Northeast and more. See here (<http://ohi-science.org/projects/ohi-assessments/>) for a map and more information on these regional efforts.

Is there is a particular coastal area that concerns you the most? What action can be taken to help prevent this from being in danger?

[dekker44](#)

Some of the largest decreases in scores during the past five years have been caused by declines in Arctic sea ice. Sea ice in particular provides protection from coastal erosion and habitat for key species, which can then influence other aspects of ocean health that are important to people. Loss of sea ice has resulted in decreased scores for many northern European countries. It is difficult to see how this issue can be solved without effective regulations to limit global CO2 emissions.

Much of Africa has performed poorly over the years, in particular due to political instability. Based on patterns we have observed in other countries, improvements to quality of life and political stability will likely improve ocean health. Obviously there are no easy solutions to those challenges, but improving conditions for people in countries can have important additional benefits to the health of the ocean.