Hi everyone,

I’ll jump right into to it and explain a little background about this project and why I chose to further analyze it. This project's aim is to analyze some of the causes of coral bleaching in Australia's Great Barrier Reef while highlighting the abundance of coral species in relevance to other species, as well as exploring the catalysts in our changing environment which aid the process of coral bleaching.

I decided to report on this because of my interests in Geography, Maps, GIS, and nature documentaries, specifically inspired by David Attenborough and his BBC series, and find it very interesting that the great barrier reef is one of the 7 wonders of the underwater world.

NEXT SLIDE

So what is coral bleaching? For those who are unfamiliar, coral bleaching is defined when corals are stressed by changes in conditions such as temperature, light, or nutrients, they expel the symbiotic algae living in their tissues, causing them to turn completely white.

NEXT SLIDE

The main factor that we’ll explore in this project is global warming, however we’ll break that down Into a few different categories and analyze the affects each has on the demise of the coral ecosystem.

We’ll look at data from specific weather events, changing water temperatures, ocean acidification, and pollution.

NEXT SLIDE

First however I want to show a brief overview of how relevant coral actually is to other species that we associate with abundance like mammals, plants, bird, reptiles, etc.

There’s about 22-25 hundred coral species on earth today, serving a very specific function to one of the most diverse ecosystems in the world.

NEXT SLIDE

Coral are being threatened however, and as we explore some of the reasons why in this project, the International Union for the Conservation of Nature reports that 33% of coral are facing extinction today, and as you can see here about 250 coral species are in threat of extinction.

NEXT SLIDE

So now we take a look at worldwide bleaching events from 1980-2015, broken down by severe to moderate bleaching, if more than 30% of the reef is damaged it is considered severe. The first mass bleaching event occurred in 1998, with just about 50% of corals being damaged. However I’m going to focus my data around the years 2015-2017, because that’s when the next mass bleaching events happened, and they happened in back to back years causing extreme damage to the reef and scientist were worried about if it were able to be recovered or not, and most regeneration efforts happened around this time.

NEXT SLIDE

This is just a quick look at the same data as above just broken down by region, Australasia and other areas in the pacific as a whole, Australasia is defined by Australia, New Zealand and neighboring islands, and the interesting takeaway here is that in 2010 Australia took a significant amount more of severe damage than other areas in the pacific like Indonesia and the Philippines who also have an abundance of corals, which could have been an indication that in just a few years later the back to back bleaching events would occur.

NEXT SLIDE

The first catalyst we’ll cover is weather events. The El Niño–Southern Oscillation (ENSO) is a natural climate event that affects surface water temperatures in the eastern Pacific Ocean. It transitions between the El Niño part of the cycle, which is the warm phase, and the La Niña which is the cool phase.

Bleaching is usually worse in El Niño years when waters become warmer. In the chart we see the number of bleaching events, colored by the phase of the ENSO cycle at the time. El Niño years are shown in blue; La Niña in orange; and moderate years between these transitions in green.

And you can see that from 1980 to about 2000, warmer waters kind of dominated the cycle, and it changes from about 2000 to 2010, and if this chart kept going you can see the warmer cycle picks back up again heavily in 2015 for the mass bleaching events. Notice as well the massive spike in 1998 when the first mass bleaching event occurred and destroyed 50% of corals, that was due to the warmer cycle of the ENSO storm.

NEXT SLIDE

Moving on to our next catalyst of changing water temperatures, this slide is just a quick visual to show that average sea surface temperature has been rising steadily over time for a very long time. Very slightly, but it’s happening. This data is from 2021, from the US National Oceanic and Atmospheric Administration.

NEXT SLIDE

This is showing the worlds 4 major Atmospheric Admins records for ocean heat temperature, you can see these are reports from Australia, China, Japan, and the US. Measuring ocean heat is a little different than surface temperature at least to my knowledge, as this is the top 700 meters of the water, and is measured in Joules instead of Fahrenheit, but it has been steadily rising, nonetheless.

NEXT SLIDE

lastly for changing water temperatures, or water related data, ocean acidity relates to the amount of carbon dioxide dissolved in the water, which we’ll cover pollution here in a second, this study was conducted by the University of South Florida, and The University of Hawaii in 2021, and it’s very clear to see that as ph levels decrease over time, c02 increase.

NEXT SLIDE

Now with all these changes to the water and to the reef, I thought it would be interesting take a look at which species were affected by this the most, and as corals harbor and abundance of fish species, I wanted to find out if Australia made the list of countries that are in danger of losing any of their fish population, and if so how many. And sure enough, they have about 125 endangered fish species and they’re really not that far behind some of the leaders like Mexico and Tanzania.

NEXT SLIDE

This is just a quick representation of the same data of threatened fish, I wanted to plug in to Tableau and explore a little bit with this heat map, I thought the interactivity of the tableau map wasn’t as revealing as the actual image, where if you hovered over a country it only showed the total of species threatened, so I decided to go with a visual that was a little more striking and conveyed the same information a lot clearer. I thought it was quite interesting that the western horn of Africa in Cameroon are on the list, but countries like Papau New Guinea which shares a border with Indonesia isn’t on the list, considering Indonesia is third on the endangered fish list and Cameroon is way further down.

NEXT SLIDE

Finally our last catalyst we’ll cover is Pollution, just because it is the main factor for global warming and rising sea temperatures.

This is by far the most disturbing data that I’ve collected over this project, and in just a very short amount of time since we’ve invented and started producing plastic, we are now at about 380 million tons, and by 2020 it’s projected to hit around 400 billion tons of plastic produced worldwide. This is significant because as plastic finds it’s way to the oceans, it breakdown into microplastics which destroy animals and ecosystems.

NEXT SLIDE

Looking at the top countries who pollute the most, this slide breaks down the carbon budget by the top 3 pollutants which is oil, gas, and coal. And a carbon budget is basically the amount of co2 a country is permitted to emit every year by the powers that be. And I thought this was interesting because as people are trying to move away from coal production, you can see China is very much still using it and emitting it.

NEXT SLIDE

And finally I thought it would be interesting to see if anyone has gone over their allotted budget in 2017, and so the chart on the left is the total budget a country is allowed to emit, and with China’s massive production industry they’re allowed just under 10,000 tons of C02, way more than any other country, and you can see in the chart on the right, their total emissions for that year were a little over 10,000 tons. Everyone else pretty much stayed right within their limit.

And that’s it, aside from a few references.