



Mapping Coral Bleaching Events

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What Are Corals?

- Sessile Animals
- Hundreds of thousands of coral 'polyps'
- Feed on zooplankton and small fish
- Symbiotic relationship with zooxanthellae
 - Give corals their color!



CORAL BLEACHING

Have you ever wondered how a coral becomes bleached?

HEALTHY CORAL

1 Coral and algae depend on each other to survive.



Corals have a symbiotic relationship with microscopic algae called zooxanthellae that live in their tissues. These algae are the coral's primary food source and give them their color.

STRESSED CORAL

2 If stressed, algae leaves the coral.



When the symbiotic relationship becomes stressed due to increased ocean temperature or pollution, the algae leave the coral's tissue.

BLEACHED CORAL

3 Coral is left bleached and vulnerable.



Without the algae, the coral loses its major source of food, turns white or very pale, and is more susceptible to disease.

WHAT CAUSES CORAL BLEACHING?



Change in ocean temperature

Increased ocean temperature caused by climate change is the leading cause of coral bleaching.



Runoff and pollution

Storm generated precipitation can rapidly dilute ocean water and runoff can carry pollutants — these can bleach near-shore corals.



Overexposure to sunlight

When temperatures are high, high solar irradiance contributes to bleaching in shallow-water corals.



Extreme low tides

Exposure to the air during extreme low tides can cause bleaching in shallow corals.



NOAA's Coral Reef Conservation Program
<http://coralreef.noaa.gov/>

Databases Sourced

- [Coral Bleaching Data - WorldFish Dataverse](#)
 - Excel file from Harvard Dataverse - Over 6,000 entries which include dates, latitude and longitude, bleaching details (severity, mortality), coral species and more

ID	REGION	SUBREGION	COUNTRY	LOCATION	LAT	LONG	MONTH	YEAR	DEPTH	SEVERITY_CODE	BLEACHING_SEVERITY	CORAL_FAMILY	CORAL_SPECIES
1	Americas	Eastern Caribbean	Netherlands Antilles		5.542	125.221		1998			3 HIGH		
2	Asia	Southeast Asia	Philippines		13.302	121.553		1998			3 HIGH		
3	Asia	Southeast Asia	Philippines		12.312	122.196		1998			3 HIGH		
4	Asia	Southeast Asia	Philippines		12.15	122.211		1998			3 HIGH		
5	Asia	Southeast Asia	Philippines		12.367	122.196		1998			3 HIGH		
6	Asia	Southeast Asia	Philippines		9.76	123.74		1998			3 HIGH		
7	Asia	Southeast Asia	Philippines	Panlacan Island	9.43333	123.95		1999			1 Low		
8	Asia	Southeast Asia	Philippines	Balicasag Island	9.51667	123.68333		1999			2 Medium		
9	Asia	Southeast Asia	Philippines	Sumilon Island	9.4	123.36667		1999			2 Medium		
10	Asia	Southeast Asia	Philippines	Apo Island	9.08333	123.36667		1999			2 Medium		
11	Asia	Southeast Asia	Malaysia	Palau Payar	6.05	100.04	6	1998			3 HIGH		Acropora spp. massive
12	Asia	Southeast Asia	Malaysia	Palau Payar	6.05	100.04	9	1998			3 HIGH		Acropora spp. massive
13	Asia	Southeast Asia	Malaysia	Palau Payar	6.05	100.04	12	1998			3 HIGH		Acropora spp. massive
14	Americas	U.S. Caribbean	Florida (USA)	Florida Keys	24.5342	-81.5811	8	1997			2 Medium		Sea anemones
15	Americas	Mesoamerica	Mexico	mouth into Gulf of California	23.4303	-109.3849	8	1997			2 Medium		Brain sponges (associated with the reef)
16	Americas	U.S. Caribbean	Florida (USA)	Florida Keys	24.5557	-81.5112	9	1997			3 HIGH		
17	Australia	Australia and Papua New Guinea	Torres Strait & Great Barrier Reef	Palm Island, GBR	-18.7691	146.6505	2	1998			2 Medium		
18	Australia	Australia and Papua New Guinea	Torres Strait & Great Barrier Reef	Great Barrier Reef	-17.8847	146.5938	2	1998			3 HIGH		
19	Australia	Australia and Papua New Guinea	Australia	Bundaberg, southernmost point	-24.925	152.5015	2	1998			2 Medium		
20	Australia	Australia and Papua New Guinea	Australia	Byron Bay (28.37 S)	-28.7001	153.6209	2	1998			1 Low		
21	Americas	Southern Tropical America	Ecuador	Wenman Island nr Galapagos Archipelago	0.2732	-91.6261	2	1998			3 HIGH		
22	Australia	Australia and Papua New Guinea	Torres Strait & Great Barrier Reef	GBF (central)	-18.5253	147.1444	2	1998			2 Medium		
23	Australia	Australia and Papua New Guinea	Torres Strait & Great Barrier Reef	Great Barrier Reef (23.5 S)	-20.7693	151.0437	2	1998			2 Medium		
24	Australia	Australia and Papua New Guinea	Australia	Bundaberg	-24.8362	152.4829	3	1998			3 HIGH		
25	Americas	Southern Tropical America	Brazil	Seba's O, Brazil	-16.9939	-39.1432	3	1998			1 Low		
26	Africa	Eastern Africa	Tanzania	Mnazi Bay, Tanzania	-10.3477	40.3384	5	1998			2 Medium		
27	Asia	Southeast Asia	Indonesia	Barat National Park, Bali	-8.1979	114.4281		1998			3 HIGH		
28	Pacific	Southwest Pacific	Samoa	Palolo Deep, nr Apia, Western Samoa	-13.8231	-171.7261	3	1998			3 HIGH	Acroporidae	staghorn acropora
29	Pacific	Micronesia	American Samoa	American Samoa	-14.3247	-170.6968	3	1998			2 Medium		



Databases Sourced

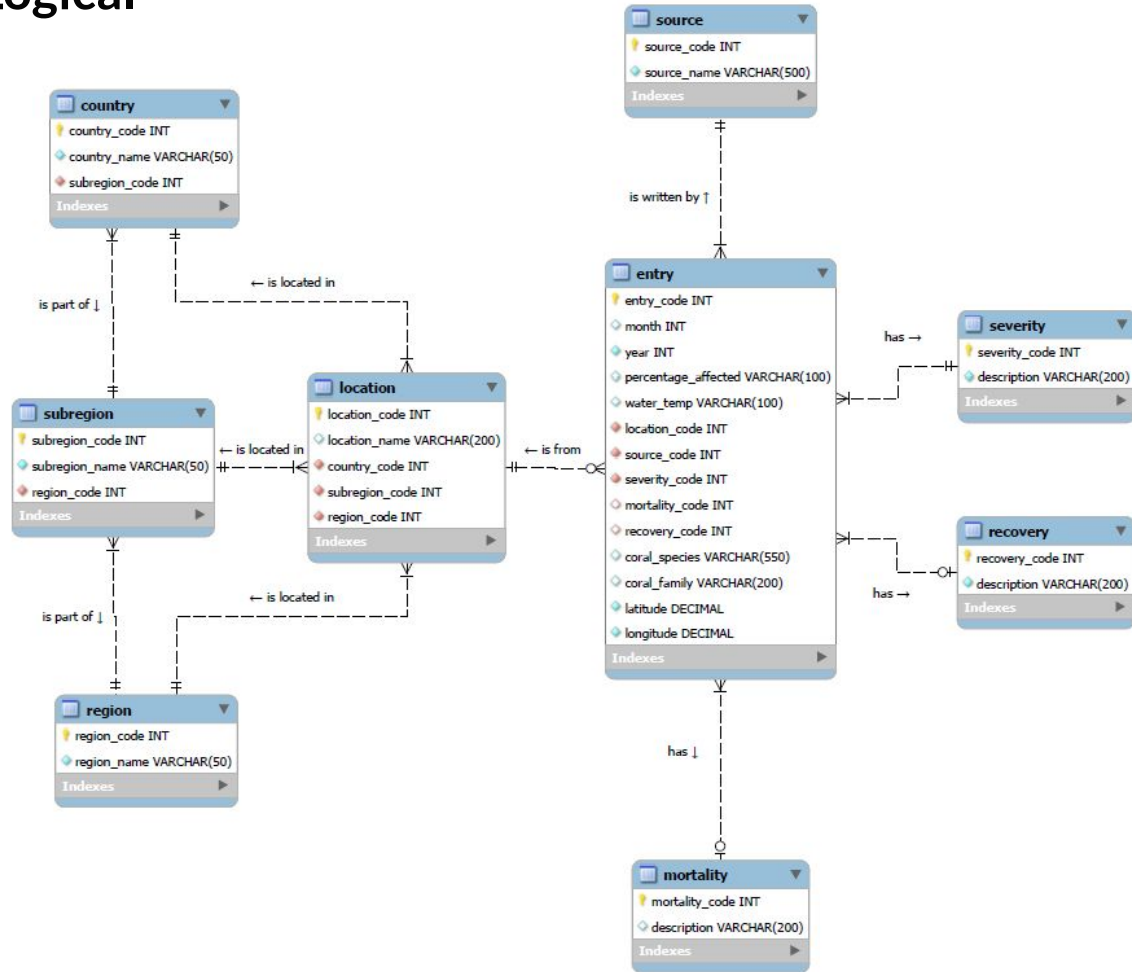
- Not the cleanest dataset
 - Included inconsistencies in data type
 - Survey area/type, water temperature, mortality, bleaching duration
 - Misspelling of locations and species
 - Lack of data for some entries
 - Location, species, severity/mortality, percent affected, recovery

Databases Sourced

- Wanted to have location stored in its own table
 - Made a new table with location information, removed duplicates, gave each an ID
 - Used VLOOKUP function to create a location FK ID in our original dataset

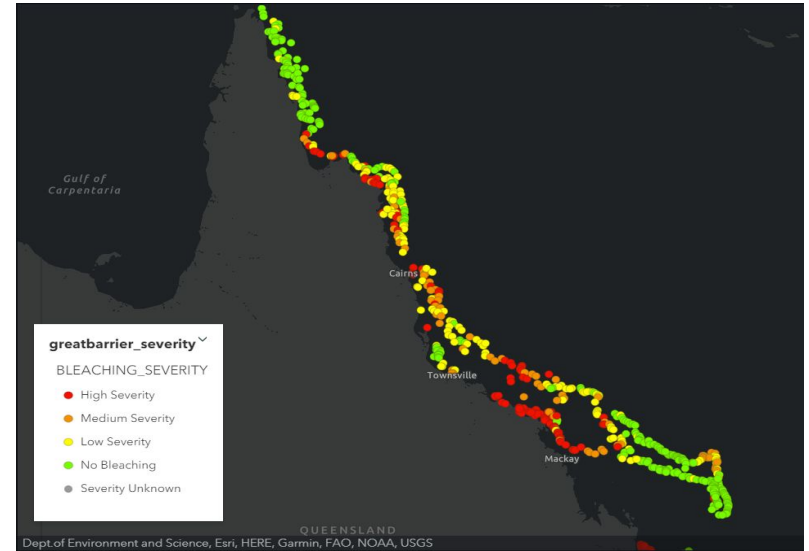
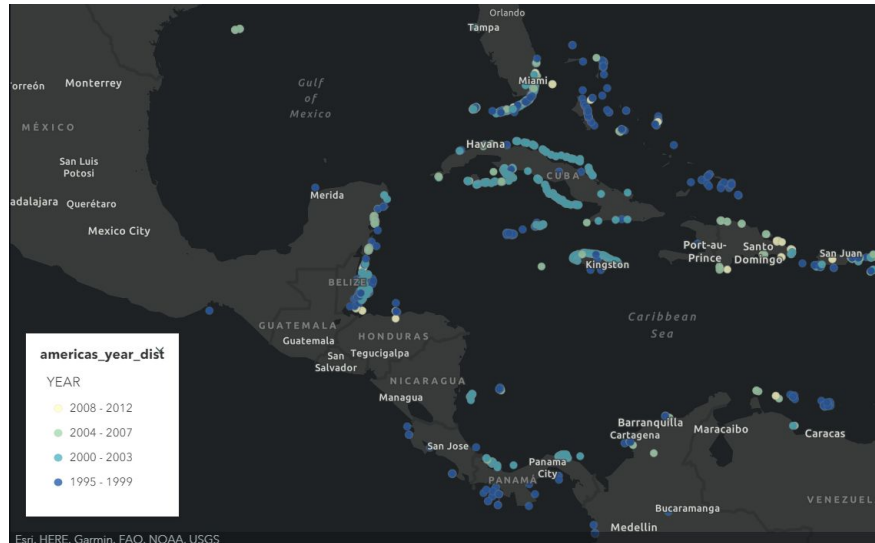
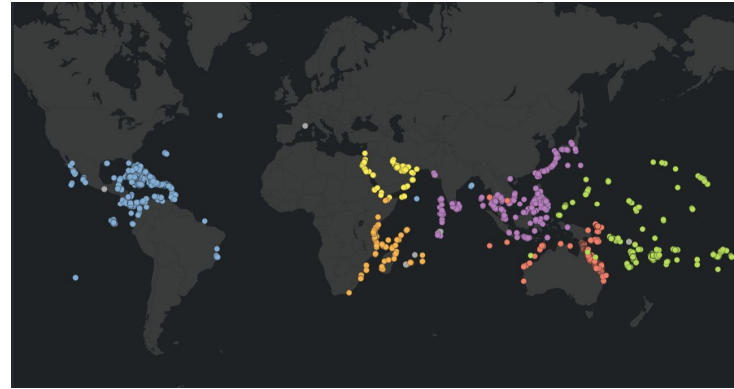
REGION	SUBREGION	COUNTRY	LOCATION	Location ID	Region ID FK	Subregion ID FK	Country IF FK
Americas	Eastern Caribbean	Netherlands Antilles		1	1	1	1
Asia	Southeast Asia	Philippines		2	2	2	2
Asia	Southeast Asia	Philippines	Pamilacan Island	3	2	2	2
Asia	Southeast Asia	Philippines	Balicasag Island	4	2	2	2
Asia	Southeast Asia	Philippines	Sumilon Island	5	2	2	2
Asia	Southeast Asia	Philippines	Apo Island	6	2	2	2
Asia	Southeast Asia	Malaysia	Pulau Payar	7	2	2	3
Americas	U.S. Caribbean	Florida (USA)	Florida Keys	8	1	3	4
Americas	Mesoamerica	Mexico	mouth into Gulf of California	9	1	4	5
Australia	Australia and Papua New Guinea	Torres Strait & Great Barrier Reef		10	3	5	6
Australia	Australia and Papua New Guinea	Torres Strait & Great Barrier Reef	Palm Island, GBR	11	3	5	6
Australia	Australia and Papua New Guinea	Torres Strait & Great Barrier Reef	Great Barrier Reef	12	3	5	6
Australia	Australia and Papua New Guinea	Australia	Bundaberg, southernmost point	13	3	5	7
Australia	Australia and Papua New Guinea	Australia	Byron Bay (28.37 S)	14	3	5	7
Americas	Southern Tropical America	Ecuador	Wenman Island nr Galapagos Archipelago	15	1	6	8

Conceptual/Logical Model



Mapping our Data

- <https://arcg.is/1Krfma0>



Looking Forward

- Cleaning of inconsistencies in data source
- Organizing comments on health of coral reefs surveyed
- Normalization efforts





Citations

<https://oceanservice.noaa.gov/facts/coral.html>

https://oceanservice.noaa.gov/facts/coral_bleach.html

<https://coralreef.noaa.gov/gallery/welcome.html>

<https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/KUVQKY>