# CORAL REEFS THREATS AND ALLIES

*Continuing ideas for exploring the environment in the 2018 International Year of Reefs by Jeanie Clark*

**On the 28th September, central Sulawesi in Indonesia moved northwards, creating a human tragedy.**

This article will explore this event's geologic processes and environmental effects to support the 2018 *International Year of the Reef's* (IYoR) three aspects:
*"[1] the value of, and*
*[2] threats to, coral reefs and*
*[3] their associated ecosystems".*

It will use on-line videos and maps, involving Geographic and Science concepts and skills.

There's been many images from Sulawesi about what the earthquake and tsunami did to its urban landscapes, but none of coral reefs and their living things. So we'll start with reefs generally.

## Threats to reefs

The nature of reefs was covered in the last *Otherways* article in this series. So let's start by predicting what a quake and tsunami could do to any reef. Make two lists:

1 What could violent shaking do to a solid reef structure?

2 What could the power of water especially dragging debris back from the land do to fragile living corals? What about fish and plants living there?

Review and add to these lists from the damage shown by two tsunami events on coral reefs. To summarise, a tsunami's murky water drags off the land loose litter, dirt, building bits, clothing debris and liquid contaminants. These can get trapped on coral reefs. When debris covers corals, it can smother them... without sunlight they die .... living things depending on them die too or leave. Clearly tsunamis threaten reefs.

## A cracked jolting Earth

What causes earthquakes? When we look at Earth as a whole, it may come as a surprise to find that, not only is it cracked but it is also made of slowly moving pieces, called *tectonic plates*. For an overview of all parts and processes involved in this global movement, these are some useful videos:

- for younger students
- for more detailed explanations and
- for upper primary and older students

The late September quake locations are shown on the first map of this webpage. Find the fault line and where it goes through the sea, bay and Palu. Notice where the quakes were and how many occurred. A time-lapse of the movement at Palu is here. In which direction did the land move? Check this by finding the arrow on the map.

Where does this movement come from? The plate on which Australia sits is moving north... It is fast moving – about 7 cm north per year. This also has impacts here on anything based on GPS. Can you think of some examples? Check it here.

## A water bulldozer

Sometimes tsunamis follow earthquakes. This happens when an earthquake is under the seafloor making the water heave up and down. This starts a wave that moves away, rushing onto any land that it meets, bulldozing everything in its path. These processes are shown in

- video one
- video two
- video three


while general facts about tsunamis are here.

Where did the 28 September tsunami hit? The earthquake created a wave which raced over coastal, low-lying land, at the head of a bay, where Palu sits. But that was not all. A lot of Central Sulawesi's western coast was hit too. This map shows the area hit by the tsunami. Use the scale to measure how large this area is.

How can coastline shape – straight or in a bay – affect how waves move? Using plastic trays and some dirt to form land, make models of these landforms. Then add water to the same depth in each one. Now gently poke a finger in the water to start a gentle wave movement and see what paths it takes. (The wave should fan out in all directions from the starting point.) Make different sized waves and see if they act the same or differently. Can a tsunami be simulated? If you put some litter on the land, watch where a tsunami-size wave moves it to.

## How big?

Clearly waves can be of different sizes, as can quakes. While news shows their destructive power, science needs numbers so we can compare different events. The tsunami at Palu was about 6 m high. It came from a quake that measured 7.5 on the *Richter Scale*. What does this mean? Descriptors (levels, number, damage, frequency and examples) are available.

A '7' is a 'major' quake, capable of great damage over large areas.

This scale was invented by Charles Richter, an American, not surprisingly from a 'shaky' land - California. It is a relatively new measure- having been invented in 1935. Being a logarithmic (log) scale, every increase in level is ten times stronger than the last. You can see how log scales differ on the three measures above. On the left, they all start at 20 on a cm, inch and log ruler from top down. On the right, the log one has increased to 200, while the inch one reads 31 and the cm one 48. Log scales show quickly increasing numbers effectively. Printable log graph paper can be found online.

It is important to understand that a 'quake' is not just one jolt, but a series. This is shown well on this map of quakes on the 28 Sept on the Minahassa Peninsula, Central Sulawesi. Count the number of quakes then the number of 'major' ones. Work it out as a fraction of the total. Make a timeline story of these by using the map information on times and Richter scale measures. These times and measures could also be graphed on normal and log paper to compare how the two scales work.

## Reef ecosystems

News images of Palu and Donggala have not shown any corals, but tourist sites are more

likely to - if they are healthy tourist attractions. Take the virtual tour in the box below to see if there are any reefs in these two affected places. If you see a reef, count how many different corals are shown in the video. List all the fish species shown, and research their food – it must be there too. Did this reef seem healthy then?

"50 Reefs" identifies the top reefs in the world. They are shown on this map. Can you find the reef at Donggala there? Compare the tsunami area map with this map of Sulawesi to see if there were other reefs damaged by it. Does damage to reefs matter?

## Reef values

A tsunami survivor on Sumatra has been replacing his damaged coral reef with an artificial reef base and transplanted live corals. Why would he bother? Reefs are valued for biodiversity (and food) and aesthetics (and tourist dollars). They also protect from big waves by absorbing some of the wave energy passing over them, even in tsunamis.

Are there other values for Sulawesi's reefs? Yes, its corals can survive warmer temperatures than others which suffer coral bleaching. 50 Reefs says such reefs are valued not just for their survival in a warming climate and sea, but also for their potential to help repopulate reefs being lost elsewhere.

This UN Decade of Biodiversity (UNDB) has as its theme *"living in harmony with Nature"*. But reefs seem to be under great sudden threats of nature with quakes and tsunamis, on top of the slower human-induced threats of fishing, tourism, pollution, and climate warming. How can this theme's values apply to reefs? Reef environments are full of interconnections – an understanding needed for harmony. From that, we can think of long chain effects of how we live - 'act locally, think globally' (e.g. plastics disposal – kept out of stormwater, can't damage water places, e.g. reefs). Then look for something to support something/one doing good for nature e.g. on distant reefs. Coral Guardians (a French non-profit organisation) has "Adopt a coral", a program for donations to grow and replant coral to damaged reefs in Indonesia. (In the Caribbean, there is a similar "Adopt a coral" program for the Bonaire Reef).

So, a final value: as the IYoR raises awareness of reef ecosystem values and threats, it invites action towards *'living in harmony with Nature'*.



### Take a virtual tour of Palu and Donggala

Fly in over Palu Bay and its mountains . Then travel Palu's city streets to the bay (second half). Join its 2016 festival, to see Sulawesi clothes and dance at and some food and cooking.

At Donggala, visit the coastline, above and below water,.


**There are many different ways we can record our home ed lives, for the purposes of having material to draw on should we be selected for a VRQA review or for our own organisation and record keeping. It goes without saying that as a home educating family, you will rely on a calendar of some kind!**

One of my favourite tools is Google Calendar. Here, I'll briefly explain how I use it not only to manage my family's out-of-home activities, but also to provide easily accessible information that demonstrates 'regular and efficient instruction', which is what we must show in a review. This is not a tutorial on learning to use Google Calendar, but it is a relatively straightforward application to learn and there are numerous tutorials on YouTube.

## You will need:

- a Google account for yourself and other family members you wish to add or manage calendars for. You can create Google accounts for your children. To create an account, go to google.com and follow the sign-in/create an account links.

- a computer or device that has your Google account and calendar on it.