Great Barrier Reef – ABC Catalyst activity

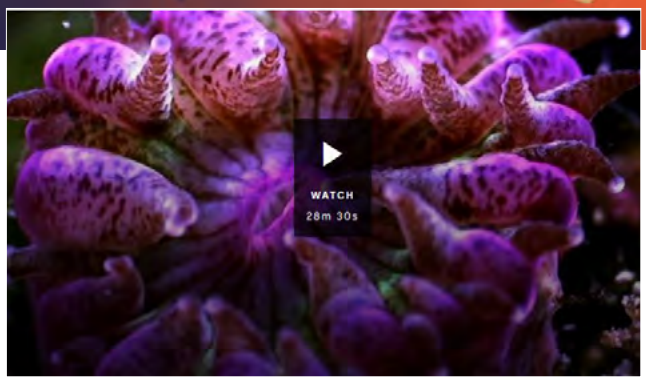
Bleached coral, Acoropora sp. Source: https://upload.wikimedia.org/wikipedia/commons/4/47/Bleached_coral%2C_Acoropora_sp.jpg

Justin Mahoney, Geography Teacher,
All Saints' College Maitland, St Mary's Campus

Introduction

"This summer, large parts of the Great Barrier Reef saw the hottest sea temperatures and the most severe coral bleaching ever recorded – so before the next impact hits, scientists are racing against time to understand the demise of reefs and the prospects for their recovery. Catalyst explores the lethal threat of bleaching to the Great Barrier Reef, and the challenges we all face to protect this global treasure."
Catalyst: Coral Bleaching 2016

Catalyst



View the Catalyst program "Coral Bleaching" using the following weblink.
https://www.abc.net.au/catalyst/coral-bleaching/11016946#:~:text=Early%20in%202016%2C%20high%20sea,effort%20to%20map%20what%20happened.&text=We%20flew%20over%20nearly%201%2C200,of%20the%20Great%20Barrier%20Reef.

Complete the activities on the following pages

Key technical geography terms used in the program

- **Symbiotically** or **symbiosis** – refers to two organisms living together and providing nutrients to each other in a positive way. In the GBR, a key symbiotic process is the co-dependent relationship between coral polyps and algae zooxanthellae.
- **Symbiodinium** or **symbionts** – algae that sustains coral life. Sometimes called zooxanthellae.
- **Photosynthesis** – process by which plants and some bacteria use the energy from sunlight to produce glucose from carbon dioxide and water.
- **Pulsed inflation** – occurs when coral expels their algae symbionts through repeated convulsions.

Find a version of the following activity in the Edition 3 Supplement

1. The process of coral bleaching

- A_____, p_____ or m_____? Coral is a mix of all three – an upside down jellyfish called a p_____ that embeds plant cells in its flesh and builds solar power cities from limestone.
- To survive, coral needs a key partner, a_____. Microscopic single-cell algae of the genus **Symbiodinium**. Coral takes the algae from the water to live symbiotically inside its own cells. That's how the polyp gets its colour. It's a positive relationship – the algae, or symbionts, receive s_____ and carbon dioxide from their host. In return, the coral obtains most of its nutrition from s_____that the algae make through photosynthesis. But there's a catch – this solar-powered partnership depends on temperature to work. So what happens when water warms up? Over a week, QUT researcher Brett Lewis increased the water temperature by 4 degrees, to peak at 32 degrees Celsius.
- Mushroom corals – a large solitary type that don't build reefs, expelled their algal symbionts with repeated convulsions, known as pulsed i_____. Some of the largest expansions seen were 3_____% the size of the actual original tissue.
- As clouds of algae are pumped into the water, the coral loses its c_____ and becomes pale. Corals are known for doing this to get rid of s_____, but to get rid of algae in this way has not been seen before.
- That's the reaction of just one coral in a lab. This is what happens on the scale of a reef. Early in 2016, high sea temperatures over many weeks caused mass bleaching in parts of the Great Barrier Reef.
- _____%-plus of GBR's corals bleached, because when that level of bleaching occurs, you're looking at _____% or more mortality.
- Bleaching doesn't usually kill them outright but if the algae aren't replaced, the coral slowly s_____. When healthy, each square centimetre of coral tissue is packed with around _____ million algal cells.
- In previous bleaching events, they've seen algal symbionts reduce to about _____ – a tenfold decrease. This time in samples from the northern reefs, they found barely any left at all.

2. When bleaching happens, what's going on inside the coral?

- The algae actually go into hyperdrive, to some extent. So with all that heat, all that _____, they become over-reactive and therefore the coral doesn't like that so they essentially just _____ them out of their tissues.
- Above _____ degrees, the algae start to lose their ability to convert solar energy. That energy has to go somewhere and ends up creating reactive forms of o_____n, like peroxide and bleach, inside the coral cells. The very light a coral needs for growth becomes poisonous.
- 6 months, 12 months down the track, higher levels of d_____e can occur. Once the health of the coral is compromised, bacteria and other microbes cause _____.
- This lesion will move up to ____mm to _____mm a day. In some areas, it can be seen to move centimetres a day. And so some corals that have been infected with these lesions will be dead within weeks.
- For corals to recover, they don't just have to take up their symbionts again, they have to repair their t_____, they have to fight off these i_____ and then they have to select that one microbe that they need to survive.
- Some corals didn't die slowly of starvation because they'd lost the symbiont, they actually cooked over a period of just a week or two because the temperatures in the northern Barrier Reef were so extreme.
- The average sea surface temperatures in summer 2015-2016 were the highest ever recorded.
- This year, we saw some locations well over _____ degrees Celsius warmer than they would usually experience in the hottest time of year.
- It takes 10 to _____ years for the fastest-growing corals to bounce back after a severe disturbance, like a bleaching event or a cyclone.
- Severe Tropical Cyclone _____ was the strongest to hit the South Pacific in recorded history. When it struck Fiji in February 2016, it came eventually to the coast of Queensland as a _____ depression and it sat around the bottom half of the Great Barrier Reef for a period of several weeks. It brought the temperature down by about _____ degrees centigrade. So the Barrier Reef was saved, the southern half, by the vagaries of that cyclone coming along.

- We now know that Symbiodinium has a broad range of g_____ diversity, in fact as many as 400–500 species. In fact, the deeper we go into the genetic variation, the more variability we find.
- The question is, will this genetic diversity be able to match the challenges of environmental change?
- To what extent can corals save themselves by selecting new symbionts, new solar panels if the old ones aren't up to scratch?
- There's emerging evidence that if they survive a bleaching event, some adult corals can then switch their algal s_____ to a tougher species.

3. Bringing all of the information together to write an essay paragraph on coral bleaching.

Sample essay question: Analyse ONE human impact on an ecosystem at risk

- **Analyse** = explore relationships and explain the implications (effects). Key phrases include "implications", "meaning", "resulting in", "event **x** has a relationship with event **y**", "leading to", "as a consequence". For this question, the relationships will be between the spheres.
- **Impact** = short and long term consequences of an event.
- **Human impact** = changes induced by people, such as global warming and associated coral bleaching.

In the space below, write a paragraph about the impacts of coral bleaching that addresses the above question.

Your paragraph must follow the TEEL structure and include at least five of these technical geography terms: ***Bleaching, Symbiodinium, symbionts, zooxanthellae, photosynthesis, pulsed inflation, natural stress, tropical cyclone, rain depression, genetic diversity, geomorphological/lithosphere, limestone exoskeleton, atmosphere, hydrological/hydrosphere, biogeographical/biosphere, Drupella, mushroom coral, instant mortality, turfing algae, resilience, vulnerability, elasticity.***

A B&W version of this activity with larger writing spaces can be found in the Edition 3 Supplement

THE NSW RIVERINA IS

... rice, fish farms, malted grains, water markets, bioenergy production, jujubes, **water management**, automated farming, tree nuts, **cotton ginning**, food processing, soil microbiome enhancement, farm financing, biochar, flavour and aroma extraction, **RAMSAR listed wetlands**, liquorice, farm management techniques for growing climatic variability, **regenerative farming techniques**, art deco period and vernacular architecture, organic farming systems, different types of business structures, automated farm management systems, vehicle guidance by satellite, **intermodal freight nodes**, vegetable/animal/aromatic oils, bankless irrigation channels, on-farm value adding, **transport logistics**, wine/whisky/cider/beer, pollination services, stud breeding of horses/working dogs/cattle/earthworms/sheep, **landforming**, cheesemaking, maize, sentinel animals, **The Murray Darling Basin Plan**, river biome restoration, factors in farm business decision making, livestock exchanges, **rural and environmental research**, emu farm, cherries, on-farm biosecurity, apricots, abattoirs, Wiradjuri language restoration, **Murrumbidgee River floodplain**, chocolate, designing product marketing campaigns, flower farming, **biocontrols of insect pests**, regional tourism, canola, **industry supply chains**, farm business succession, government regulation and compliance measures, prunes, solar farms, cold country berries, agricultural aircraft, apples, **on-farm irrigation design and engineering**, jojoba, export controls, farmer cooperatives, sunflowers, juicing and table citrus, ethnic diversity, **floodplains**, pomegranates, olives for table and oil, oats, phytosanitary measures, animal welfare, barley, **red gum forests**, rural health and welfare, Aboriginal histories and culture, industry associations and politics, **soil types and soil archives**, spelt, hay exports, **European carp controls**, market-oriented plant breeding, dairying, beeswax for nutraceuticals, poultry, **dryland broadacre farming**, woolbroking, farm waste disposal and utilization, animal nutrition and feeds production, rural engineering, **purpose-built and organic-growth towns**, grains quality management, sawmilling, rural skills training, historical phases from pre-invasion to market-based, fat lambs, farm machinery dealers, **regional population trends**, rural workforces, citrus export arrangements, farm forestry, **alpine to semi-arid vegetation communities** ...

RIPE FOR DISCOVERY

Agricultural Tours Riverina is your ticket to the Riverina Region of NSW.

We utilize the skills and networks of switched-on educators and industry specialists to write educational and technical itineraries for schools and other clients.

We can design a program to suit your educational needs.

Be ready to run your excursion as soon as circumstances permit.
We are fully insured, First Aid trained and equipped, and COVID-19 prepared.

AGRICULTURAL TOURS RIVERINA

Contact John for a free quote today.
Email: agtoursriv@gmail.com
Website: agriculturaltoursriverina.com.au

Agricultural Tours Riverina is a registered business unit of Education and Training Services and Projects Pty Limited (ACN 073141161), est. in 1996.