MARINE Life

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Our Goal

To educate, inform, have fun and share our enjoyment of the marine world with likeminded people.

The Crew

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Where to Find Great Whites

A recent killer whale attack scared the sharks away from shark cage diving businesses at Neptune Island, leading to attempts to find other shark aggregations. In the process we have learned more about what white sharks do.

Source: Residency and Local Connectivity of White Sharks at Liguanea Island: A Second Aggregation Site in South Australia? RL Robbins et al; WA Fisheries

White sharks may roam far and wide but they also cluster around certain feeding areas for long periods. Eight sharks were detected at both Liguanea Island and the other known aggregation area in SA, the Neptune Islands and Dangerous Reef, demonstrating movement between these locations.

Neptune Island is a twin island group approximately 30 km south of the Eyre Peninsula, found in 60-100 m water depth. It supports a large New Zealand fur seal population (approximately 30,000 individuals). These likely provide a focal point for white sharks during migrations. White sharks regularly visit the Neptune Islands, remaining for periods averaging six days and extending up to 120 days.

Dangerous Reef, approximately 50 km northeast of the Neptune Islands, is known to be seasonally visited by white sharks and this is where tourist cage diving started in the 1980's and 90's. Dangerous Reef supports the largest population of breeding Australian sea lions in Australian waters with an estimated pup count of 709, as well as lots of penguins.

Liguanea Island lies 47 km to the southeast of the Neptune Islands group. Liguanea Island shares similar characteristics to the Neptune Islands group, and supports 3000 New Zealand fur seals.

Other satellite and acoustic tagging studies have demonstrated that individual white sharks travel extensively, often along corridors associated with the 60-120 m depth zone. Other aggregation areas have been identified and there are probably others yet to find. Juvenile white sharks in eastern Australia occupy two primary residency sites (Corner Inlet in Victoria, and Stockton Beach in New South Wales) for extended periods of time (an average of 70 days), and seasonally cycle between these areas over multiple years.

In Western Australia there are no currently known aggregations of white sharks. They seem to range from South Australia northwards to as far as the Pilbara coast. Throughout this area, these sharks are thought be unevenly distributed.

The media see the research somewhat differently. In South Australia, the Neptune Islands aggregation area and Liguanea and Dangerous Reef, have been dubbed by the local media as a "shark highway". They have linked it with a 2015 shark attack in Edithburg, Yorke Peninsula which is more like a distant country road, than a part of the "shark highway". A slightly closer link was made with attacks on surfers near Pt Lincoln. One source referring to it as a "nesting area", God help us if great whites ever learn how to fly.

Liguanea is close to the coast, but in an isolated offshore open ocean area distant from humans, don't cancel the Eyre Peninsula surfing holiday just yet.

White sharks breed slowly and only when they reach a large size. All the hysteria aside they are easily depleted from an area by netting, drum lining or entanglement in fishing gear. The research also shows that we can also see 'lots' of sharks in an area, where in fact we are probably just seeing the same shark repeatedly as they patrol their 'patch'.

Sydney Harbour's seahorse central

The sheltered bays of Sydney harbour offer protection from the wind and have some good shallow diving on sediment bottoms that are renowned for rare and interesting small marine life. Divers have recently been helping to monitor the health of the local marine life, particularly the iconic populations of White's seahorse.

Sydney can be a macro photographer's paradise except for the curses of all urban dive water activity spots, too many boats, heavy car traffic and the dreaded parking meter attendant. This all just heightens the sense of escape once you are in or on the water. Sites like Shiprock, Lilli Pilli, Camp Cove, Parsley Bay and Clifton Gardens can be dived or snorkelled in almost all weather conditions. They can experience very poor visibility if there has been heavy rain during the week, but otherwise they are a relaxing day out.

Parsley Bay is a shallow (5M- 12M) site near a swimming enclosure. The silty bottom is home to White's sea horses, moray eels, conger eels, pygmy leatherjackets, spider crabs and decorator crabs. Along the sandy bottom there is a wide variety of marine life, flathead, stingarees, cuttlefish, sole, flounder, numb rays, pipefish, lionfish, blue-ringed octopus, bream luderick, sand whiting, Sydney cardinalfish, striped dumpling squid octopus, old wife, morwong, Port Jackson sharks and surgeonfish. For variety, at 12M there are the remains of an old crane that seems to have been lost from a barge.

Recently, the Parsley Bay seahorses were audited. A total of 16 seahorses were counted — 11 female and five males. "Out of the 500-plus species of fish that live in Sydney Harbour, the seahorse is one of the best camouflaged," said John Sear, one of three eco divers involved in the count.

The numbers however are down from the previous survey. Thirty seahorses were living in Parsley Bay in July last year. "It is too early to say whether this is a normal fluctuation for this population or if there are other factors," Woollahra Council's senior sustainability officer Emma Hawkins said.

The Parsley Bay seahorses have been finding refuge in the nets due to declining seagrass in Sydney Harbour, Ms Hawkins said.

Eco diver Dave Thomas said he believed the lower count might be a result of recent rain events and fresh water moving down through the bay.

"This could mean the seahorses have moved off the netting down into deeper waters," he said.

"Or something else has happened, but we don't know."

Photo John Sear

Marine conservationist's hunger strike

Marine conservationist Nicole McLachlan said her hunger strike was all about raising awareness of the hundreds of sharks that are caught in the nets and drum lines every year.

In an interview given to Coastwatch she has stated "I started the hunger strike on Saturday 6th February, I will continue until my demands are met". Ms McLachlan said she was confident she would soon hear from the Queensland Government.

The demands were for a commitment of at least $16 million for non-lethal alternatives and to phase out all shark nets drum lines.

"This is something that I'm very passionate about and I don't think it will come to a stage where my health is compromised." It didn't thankfully, and after the initial flurry of media interest died, a Tweet on 16 February simply announced that the strike was over.

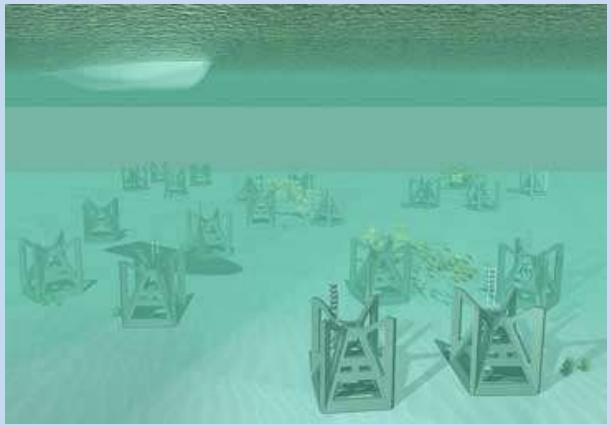
Bond University associate professor Daryl McPhee said the hunger strike was "irresponsible" Mr McPhee said. ",,, these sorts of stunts make it difficult for everybody to progress the issue".

A bit harsh perhaps if you can still remember when the blood use to rush everywhere. Assuming this wasn't just a calculated media stunt, I do share concerns about a program to promote respect for living beings that puts a young life at risk. I know Ghandi did it, but I don't see the issues as demanding martyrdom. There is a bit too much of that going around lately. If it works, I can see neo-nationalists, etc, doing the same thing.

It does get people talking, but perhaps about the wrong thing. I think there are less dramatic ways, run for Parliament, hold a rally. A more rational discourse based on compromises, as tediously slow as it can be, is a workable alternative.

Artificial Reef for Port Macquarie

In February, twenty concrete modules each weighing 23 tonnes and standing more than 5 metres tall were constructed in Newcastle and loaded onto a large barge which was towed more than 250 kilometres to the artificial reef site. Each module was expertly placed on the ocean floor at a depth of approximately 46 metres, 6.3km off the coast.



The purpose built reef will provide recreational anglers with access to new habitat and enhanced fishing opportunities.

The reef will feature 20 of Subcon's Australian designed *ReefTemple* modules, each weighing 23Te and standing up to 6.5m tall. The ReefTemples are designed to create complex, sustainable habitat that promotes the establishment of diverse marine ecosystems in otherwise sandy locations. The Subcon design uses a polymer fibre reinforced concrete.

Subcon also has reefs installed in Shoalhaven, Hervey Bay, Moreton Bay and has two projects underway off the Western Australian coast. Five reefs are planned for NSW.

The NSW DPI's offshore artificial reefs modules are designed to have a minimum design-life of 30 years. Each module deflects currents around them to create eddies and upwelling's. All artificial reef modules are designed to withstand a 1 in 100 year storm event which, for example, off the Sydney coast can produce ocean swells in excess of 15m.

The debate about whether they provide more fishing habitat, or merely attract fish so that they can be more rapidly depleted will continue.

Scientists Explore Bremer Bay canyon

One of the Southern Hemisphere's biggest seasonal populations of killer whales or orcas have begun congregating at the Bremer Bay canyon in Western Australia.

The undersea Bremer Canyon lies 70 kilometres off the coast of Bremer Bay, which lies east of Albany.

During a six-week period in summer a cold, saline current flows from the Antarctic Circle, filling the canyon and pushing nutrients to the surface.

This attracts all sorts of marine life, including killer whales, sharks, dolphins, sperm whales and giant squid.

The area also gives off traces of hydrocarbons and it is hoped to have the area protected from oil and gas exploration. Acoustic surveys have been conducted in the past. WA Minister for Tourism Kim Hames said it was important the canyon be preserved.

"This is something that you wouldn't see in many places around the world, so we need to take an opportunity like this and work out how we can preserve it and make sure everyone else knows about it," he said.

The area is a great place to study usually hard to see blue whales, killer whales, blue sharks and white sharks.

Blue sharks are currently being tagged to see if they deliberately follow killer whales, "We want to see how closely related they are to the killer whales, maybe they're following the pod to scavenge off the prey they have killed," she said.

Curtin University PhD candidate Bec Wellard has been monitoring the acoustics of killer whales. "Killer whales in the northern hemisphere have different dialects per family group so I'm interested in different dialects here in the Australian region," she said.

For more info about the research and the tours you can go on, see http://whales-australia.com.au/bremer-killer-whales/

Carbon Update

Warning - Take this article with a handful of Prozac

World's oceans absorbed as much heat in last 18 years as in previous 130, US study finds

The oceans have soaked up as much heat from global warming over the last two decades as during the preceding 130 years, a study by US scientists has found. A third of the recent build up occurred at depths of 700 metres or greater. Oceans have absorbed more than 90% of the excess heat generated by man-made greenhouse gases.

While this accelerated absorption has helped keep human habitats cooler, in the long run it could be a ticking time bomb that disrupts weather and climate globally, the scientists warned.

This may explain a pause or "hiatus" in warming observed at the sea surface since the end of the 20th century, the study said. Some had interpreted this as a slowdown in warming overall.

The ocean's ability to absorb surplus heat is not unlimited, and "certainly not a cure for climate change," Mr Shepherd said.

At current rates, Earth is on track for warming of about three degrees Celsius by the end of the century.

Ocean acidification slowing coral reef growth

It has been reported that 25 percent of carbon dioxide released into the atmosphere as the result of human activities – including the burning of fossil fuels - is absorbed by the ocean. There, the chemistry of seawater becomes more acidic and corrosive to coral reefs, shellfish, and other marine life. This process is known as 'ocean acidification'.

Fieldwork at the One Tree Island Research Station has provided new evidence ocean acidification resulting from carbon dioxide emissions is already slowing coral reef growth. Coral reefs are particularly vulnerable to the ocean acidification process, because reef architecture is built by the accretion of calcium carbonate, called calcification, which becomes increasingly difficult as acid concentrations increase and the surrounding water's pH decreases.

"We manipulated the current conditions of seawater by scooping 15,000 litres of water into a tank similar in shape to a large inflatable pool. We then pumped the water onto the reef, measuring the difference in response between present-day water and pre-industrial conditions."

For the first time field-based research has found a link between ocean acidification and coral reef growth. Previous findings have been based on laboratory experiments.

The researchers found calcification rates under these manipulated pre-industrial conditions were higher than today. Scientists predict reefs could switch from carbonate calcification to dissolution within the century due to this acidification process.

Previous studies have demonstrated large-scale declines in coral reefs over recent decades. Work from another team led by Professor Caldeira found rates of reef calcification were 40 percent lower in 2008 and 2009 than during the same season in 1975 and 1976. However, it has been hard to pinpoint exactly how much of the decline is due to acidification and how much is caused by other anthropogenic stressors like ocean warming, pollution, and over-fishing.

Increasing the alkalinity of ocean water around coral reefs has been proposed as a geoengineering measure to save shallow marine ecosystems. These results show this idea could be effective. However,

the practicality of implementing such measures would be almost impossible at all but the smallest scales.

"The only real, lasting way to protect coral reefs is to make deep cuts in our carbon dioxide emissions," Professor Caldeira said.

Ocean acidification deforms coral

Ocean acidification could lead to smaller, more porous and malformed skeletons in coral recruits by 2100

"New coral recruits are only about 1 mm in diameter and so they are more vulnerable to stressors like predation, overgrowth and damage from storms" "They need to be able to build robust skeletons and do this quickly, in order for them to move out of these small and vulnerable size classes. Unfortunately, ocean acidification is making this task more difficult."

Scientists mimicked the oceanic conditions predicted to occur under a 'business-as-usual' emissions scenario. Coral recruits were unable to build normal skeletons under acidified conditions."

"Not only did we record reduced overall skeletal deposition, but we also observed a number of deformities in the skeletons grown under high CO2. These ranged from gaps, fractures and disrupted symmetry to large sections of missing skeleton. We also saw deep pitting and a corroded-looking skeletal surface in the high CO2 corals."

"One encouraging and surprising finding was that elevated temperature didn't seem to exacerbate the effects of high CO2. Instead we saw the opposite effect, with elevated temperature having a mitigative effect under acidified conditions. But we think this response will only be seen in sub-tropical and temperate corals such as those used in this study, which were from the sub-tropical Houtman Abrolhos Islands."

These tiny animals are essential for replenishing the reef after disturbances.

Baby fish may get lost in silent oceans as carbon dioxide rises

Under acidification levels predicted for the end of the century, fish larvae hearing will be affected. They may cease to respond to the sounds that present-day species use to orient themselves. Ocean acidification is already known to affect processes such as smell.

PhD student Tullio Rossi went to a naturally occurring carbon dioxide vent near White Island in New Zealand. There ocean acidification levels are similar to those predicted for the end of the century.

"We recorded the soundscape around the vent, then compared the loudness and composition of sounds with control sites a few hundred metres away." The area around the vent was much quieter, the team found.

The researchers studied the impact of increased carbon dioxide levels on settlement-stage mulloway (*Argyrosomus japonicas*), a common temperate fish species. They found that the 25- to 28-day-old larvae that had been exposed to higher carbon dioxide concentrations deliberately avoided present-day acoustic habitat cues recorded near White Island, while fish reared in present-day carbon dioxide levels responded positively.

Sharks' hunting ability declines as waters warm

Good news! Some might say. As climate change warms our waters, sharks will have increasing trouble catching food.

University of Adelaide laboratory experiments have been studying Port Jackson sharks. Large tanks were filled with natural habitat and prey. Warmer water and high CO2 made them hatch more quickly but also increased the sharks' energy requirement. It also reduced their ability to locate food through olfaction (smelling). These effects led to marked reductions in growth rates of sharks.

"With a reduced ability to hunt, sharks will no longer be able to exert the same top-down control over the marine food webs, which is essential for maintaining healthy ocean ecosystems."

Port Jackson is a bottom-feeding shark that primarily relies on its ability to smell to find food. Under higher CO2, the sharks took a much longer time to find their food, or didn't even bother trying, resulting in considerably smaller sharks.

Arsenic in NSW sea snails

Scientists at Southern Cross University are investigating high levels of arsenic and lead found in sea snails off the New South Wales north coast.

The research project has focussed on whelks, which eat other small sea creatures. Findings have varied enormously, depending on the location. "It's actually 200 times higher at Coffs Harbour than it is at Flat Rock in Ballina," Associate Professor Benkendorff said.

Previous banana farming used some arsenic for some anti-fungal treatment of bananas. It was commonly used to combat weeds. "They all used it to keep the weeds out of tomatoes and whatever vegetables they were growing."

Associate Professor Benkendorff said "I don't think it's a cause for immediate concern, but the whelks could be used as bio-indicators of pollution in the environment," she said.

"…we might be able to monitor in the whelks and see if we get changes over time."

Coral Bleaching - How bad was it?

With conditions only now starting to cool as the summer ends, severe damage has been caused to inshore norther GBR reefs. "Extreme" bleaching has been reported along a 1,000kilometre stretch between Lizard Island, north of Cairns, and the Torres Strait as harsh sunlight and hot, still water turns the reefs white.

Photos Andrew Furber

The Great Barrier Reef Marine Park Authority (GBRMPA) said sea surface temperatures spiked up to 2.5 degrees Celsius above average over summer.

The worst coral bleaching since 2002 has hit Lizard Island the majority of the reef flat surrounding the island was showing signs of bleaching.

"A lot of that hot water on top of the reef flat is just staying there and cooking the coral." A spokesperson from the local research station said. Mr Vail also said the island's reef flat was more vulnerable to bleaching, but he had witnessed signs of bleaching in other parts of the reef in the past month too.

"These corals that are bleaching have survived two big cyclone impacts in the last couple of years and a crown-of-thorns outbreak. "You wonder how much more they can take."

Professor Terry Hughes from the ARC Centre said there was growing evidence the worst of the bleaching had hit north of the World Heritage Area. "We've just had a boat come back from a week off Townsville, where researchers saw mild to moderate bleaching, and there wasn't much to see at Heron Island," Professor Hughes said.

"There's a strong north-south gradient in the bleaching. Cloud cover from ex-Tropical Cyclone Winston has provided some protection further south. It is likely the worst is over, for now.

The GBRMPA said the bleaching on the Great Barrier Reef was much less severe than what had occurred across the Pacific during the current global bleaching event.

It said it would work with other scientists to ramp up field surveys and coral monitoring over the next few weeks.

Queensland Environment Minister Steven Miles said reports of coral bleaching were a call to action.

"The bleaching is clear evidence we must aim for a rapid reduction in carbon emissions to reduce global warming," Dr Miles said.

Federal Environment Minister Greg Hunt took a flight over Lizard Island to view the bleaching event. But Mr Hunt said it was not as bad as first thought. "It is not as severe at this stage as 1998 or 2002, which were both El Nino-related events, it is however, in the northern parts a cause for concern,"' Mr Hunt said.

"The reef is 2,300 kilometres long and the bottom three-quarters is in strong condition, but as we head north, it becomes increasingly prone to bleaching".

The University of Queensland's Global Change Institute surveyed 40 sites in the far northern section of the reef and again in 2014, following Tropical Cyclone Ita. The Federal Government will now fund another survey of the same sites in September this year.

Good News from the Capricorn-Bunker Group

Late in 2015 the RV "Cape Ferguson" docked with new survey information from the southern Great Barrier Reef. In short the reef looks like it is on the mend after a couple of large cyclones in recent years.

Reefs in this sector were recently characterised by their relatively low coral cover resulting from large storms in 2008 and Severe Tropical Cyclone Hamish, which passed some 100km to the east of the Capricorn-Bunker reef complex in March 2009. There has been a remarkable recovery since surveys in 2012. Coral cover has increased on six of the survey reefs in this sector (Boult, Broomfield, Fairfax, Hoskyn, Lady Musgrave, North) while remaining stable on Erskine. This is despite the impact of COTS outbreaks on Lady Musgrave Island Reef and Fairfax Reef in recent years as well as Severe Tropical Cyclone Marcia that tracked inland down the coast some 100km to the east of the sector in February 2015. On some reefs the recovery is remarkable and Broomfield Reef and North Reef showed the highest coral cover recorded since they were first surveyed in 1986 and 1991 respectively. No bleaching of hard corals was recorded during manta tow surveys of reefs in this sector in 2016.

This good news has to be tempered by the knowledge that the full impact of this year's heat wave is still to be felt.

On the down side a recent crown-of-thorns (COTS) outbreak has left a trail of old dead corals on the back of Fairfax Reef and the back of Lady Musgrave Island Reef.

Mounds of old dead corals can be seen in many locations. There is no longer an active outbreak on Fairfax Reef or an incipient outbreak on Lady Musgrave Island Reef.

In contrast to the back reef, the front and flanks of Lady Musgrave Island Reef show marked recovery in coral cover that was decimated through storm damage some years ago (in particular Severe Cyclone Hamish in 2009).

Coral cover on Capricorn-Bunker reefs had increased or remained at levels similar to those recorded during previous surveys in 2014 when hard coral cover on the majority of survey reefs was showing the first signs of recovery from declines due to the cyclones. Severe Tropical Cyclone Marcia crossed the coast some 130km to the north of the Capricorn-Bunker Group in February 2015 but appears to have had little impact. Coral cover on Credlin Reef in the Pompey sector was moderate and still recovering from the impacts of Severe Tropical Cyclone Hamish and a number of prior disturbance events.

Crown-of-thorns starfish (COTS) populations on a number of reefs in the Capricorn-Bunker sector in 2014 have declined to below outbreak levels. On all reefs surveyed, signs of coral disease, counts of Drupella spp. and coral bleaching were generally below those seen previously.

A general theme amongst corals in this sector of the GBR was the remarkable recovery in coral cover from storm damage in recent years.

On many reefs in this sector the high coral cover has meant that competition for space between corals is now intense. Here in this picture a number of tabulate Acropora spp. hard corals jostle amongst each other. The coral in the small gap at the top left appears to have lost out.

Scuba searches on the intensive survey sites found signs of white syndrome disease and scars due to unknown causes on all reefs in this sector, but at unexceptional levels compared to those recorded in previous surveys. Similar unexceptional levels of brown band disease were recorded from all reefs except for Hoskyn Island Reef. Signs of black band disease, though recorded in manta tow surveys of two reefs (Broomfield and Boult), were absent from the intensive survey sites. Skeletal Eroding Band disease was rare, being recorded at low levels from two reefs: Erskine Island and Masthead Island.

Coral cover on Credlin Reef in the Pompey Sector is in the early stage of recovery from multiple disturbances including COTS, cyclones and coral bleaching. Coral cover on Credlin Reef suffered for over a decade from a number of impacts including Cyclone Justin (1997) COTS (2000 to 2006) coral bleaching (2002) and Severe Tropical Cyclone Hamish (2009). Surveys in 2016 indicate some clear signs of recovery on this reef and coral cover was moderate (10-20%). This was despite Severe Tropical Cyclone Marcia passing 90 km to the east of the reef in February 2015.

Fremantle is a meteorological tsunamis hotspot

Meteotsunamis are waves caused by moving atmospheric pressure disturbances, such as cold fronts and thunderstorms.

UWA Oceanographer and lead author Professor Pattiaratchi said the research team discovered 25 meteotsunami events had occurred off the coast of Fremantle in 2014, compared to less than 10 events occurring across the rest of Australia in the same year. The number was also high compared to activity in other parts of the world.

"Although most of the events were relatively small, several had wave heights of more than half a metre" Two events resulted in ships breaking moorings inside the Fremantle Port, and caused a large cargo ship to hit the Fremantle Bridge, resulting in it being closed for two weeks." A meteotsunami in June 2012 contributed to the highest ever water level recorded in Fremantle in more than 115 years and widespread flooding along Riverside Drive and the Kwinana Freeway.

Professor Pattiaratchi said meteotsunamis reaching a metre in height were becoming more common along the coast between Geraldton and Esperance.

Better understanding of meteotsunami activity in WA will allow us to prepare for and respond to natural disasters.

Disease hits Seafood Industry

Its been a bad year for seafood with health scares closing fisheries and shellfish farms in South East Australia.

Paralytic shellfish toxins (PST) have been recorded in shellfish from Victoria, South Australia, New South Wales and Tasmania.

Paralytic shellfish poisoning (PSP) is a public health risk worldwide, whenever seafood accumulates toxins produced by microalgae. Mussels, clams, oysters and scallops pose a particularly high risk. Algae responsible for causing PSP include several species of the genus *Alexandrium, Pyrodinium bahamense, and Gymnodinium catenatum. G. catenatum* was introduced into Tasmanian waters around 1973.

In August this year, elevated levels of paralytic shellfish toxins were found in shellfish on a marine farm in Mercury Passage. Concerns that poisoned shellfish would be eaten by crayfish also led to the closure of part of that fishery from Wineglass Bay to Marion Bay. The big fear was that ill customers might lead to the closure of the lucrative Asian live export market.

As widespread as the outbreak was it isn't really "news" to anyone. Period blooms of toxic dinoflaggelates have been causing shellfish industry closures for decades. Institute for Marine and Antarctic Studies Professor in Aquatic Botany Gustaaf Hallegraeff is a key researcher in this area. ‘‘We have been aware of such a problem in other areas of Tasmania, in the Derwent and the Huon estuaries we’ve seen dinoflagellates that have produced very similar toxins and we’ve seen that since the late 1980s. Recurrent blooms form in the Huon River, D’Entrecasteaux Channel, and the Derwent River in autumn and occasionally spring, particularly after calm weather and when water temperatures are above 14°C.

The real news is the strength and frequency of more recent outbreaks and that new species are blooming and causing problems in new locations. ‘‘Something has changed and this organism is becoming more abundant and starting to cause problems and that’s not completely resolved yet.’’

"Something changed around last year, or the year before, that made [the algae] very successful," Professor Hallegraeff said.

"It will now end up in the bottom sediment and will germinate from that, so we certainly expect that we will have to deal with this problem for years to come."

Professor Hallegraeff said mussels were most prone to accumulating the toxins, oysters were more selective, with the toxins also appearing in scallops roe, and in the gut of rock lobsters.

PST causes neurological signs and symptoms from 15 minutes to 12 hours after consuming contaminated shellfish, although usually within 2 hours. Symptoms begin with tingling and numbness around the mouth and face, progressing to the extremities. This is followed by dizziness, nausea, headache, vomiting, vertigo, a floating sensation, weakness, and muscular incoordination. In severe cases paralysis, difficulty in breathing leading to respiratory failure, and even death can occur. Only one severe poisoning occurred in 2011 when a farm worker ignored health warnings. Only a few anecdotal cases were reported following the consumption of mussels during extensive blooms of *G. catenatum* in 1986 and 1993.

The Tasmanian outbreak of the toxic dinoflagellate *Alexandrium* algae during October 2012 was unprecedented and affected more than 200 kilometres of Tasmania's coastline. Prior to 2012, there had been one *Alexandrium catenella* bloom in the aquaculture zone on Tasmania's east coast. The related *Alexandrium tamarense* responsible for the 2012 contamination had not previously been identified in bloom proportions in the region.

There were no confirmed cases of illness linked to the outbreak and more than 10,000 tonnes of potentially affected mussels were recalled from around Australia and overseas.

Mussels are very exposed to these blooms and it may be that markets overseas will begin to dry up. The more resistant Pacific Oysters have had another shock which recently caused further closures. Pacific Oyster Mortality syndrome has also become a problem and has been blamed on a virus.

It was first detected on an oyster lease in Lower Pittwater in southern Tasmania. Later testing found it was prevalent all up the East Coast but other areas experienced no mortalities.

A different toxin produced by a different sort of algae has recently affected mussels in a previously disease free farm. "DST [Diarrhetic Shellfish Toxin] is produced by naturally occurring algae and may cause diarrhoea, stomach pain, nausea and vomiting.

Industry rep Neil Stump said that there were, "… strange things going on in relation to how … disease seems to be behaving in different areas."

Strange days indeed.

Where do Baby Crayfish Come From?

Several species of rock lobster are commercially harvested in different regions of Australia, including the western (Panulirus cygnus), southern (Jasus edwardsii), and eastern (Jasus verreauxi) rock lobster, as well as a number of tropical species in northern Australia. Declining recruitment in the major fisheries is a big environmental, social and economic issue

The WA catch of western rock lobster is 5500 tons per annum. The catch is oddly based on juvenile fish as western crayfish move offshore into deeper water to breed, creating its own management challenges. Eastern species tend not to do this and are fished as adults. Fishing of the eastern rock lobster species is relatively limited as this is not as productive species as the others.

The southern rock lobster, is an important resource for South Australia, Victoria and Tasmania. The combined catch is approximately 4,500 tonnes with a beach price of nearly $150 million. Over 650 fishers operate out of mainly rural coastal towns and the industry makes an important contribution to the socio-economic fabric of these towns. Over 20,000 recreational licenses issued annually in southern Australia for the recreational harvest of lobsters by diving and potting (except Victoria).

While the might be an important industry we would like to know a lot more about them than we do. Little is known about the oceanic larval phase of crayfish. The number of new 'recruits' to the fishery varies a lot from year to year and place to place. We aren't sure exactly why.

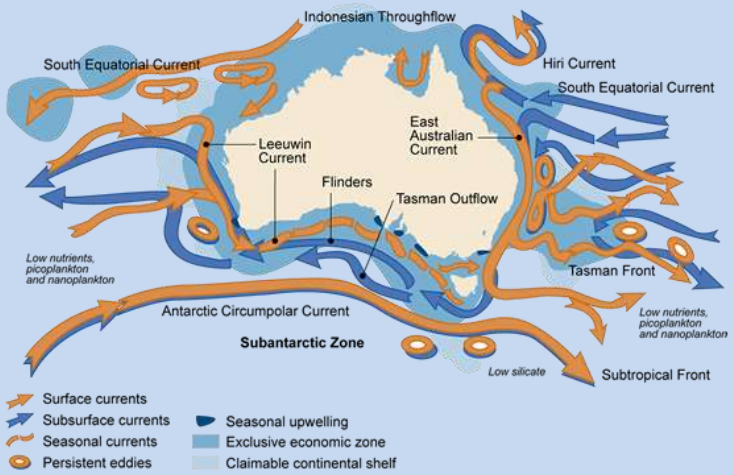
Southern rock lobster fisheries in particular are showing signs of long-term decline.

Southern rock lobster eggs hatch into larvae (phyllosoma) with a very long oceanic phase estimated to last from 9 to 24 months. This should allow them to travel vast distances on the current if need be to find a suitable reef to settle on. Out on the continental shelf edge far offshore, they catch small worms and other plankton to try and 'fatten up'. Some studies have shown that a few end up in the wrong areas for feeding and settlement, and up to a third or more might starve. They also need to avoid patches of water that are full of predators and may favour certain upwelling eddies, that fish tend to avoid.

If they get the right amount of food and escape other predators, these phyllosoma moult to the last larval stage known as the puerulus and head towards coastal reefs. They seem to dive up and down in the water column until they catch a shoreward current. These currents probably vary in strength and direction at certain times of the year and from year to year in different areas. There the larvae settle on a reef as a 25-millimetre lobster.

With the exception of southwest Western Australia, all regions receive more small crayfish from outside their own boundaries than from the local coastline.

With most currents moving from east to west across southern Australia, WA tends to provide plenty of crayfish larvae to the eastern states. When their fishery is overworked or there are issues with factors such as sea temperature, everyone suffers to a degree.



Eddies and currents in offshore waters over much of southern Australia serve to isolate some larvae from the dominant easterly flow. While the south-eastern regions of South Australia were expected to be big sources of crayfish for Tasmania, they don't show up from there in larvae collectors. Computer models don't yet provide complete answers as to why.

Modelling suggests that recruits in north-eastern Tasmania are primarily sourced from eggs derived from eastern Tasmania. Further south on the south east Tasmanian coast, larvae are often sourced from the south-western and western regions of Tasmania and as far afield as south-eastern South Australia.

Eastern Victoria and northwest (NW) Tasmania are predicted to make the lowest contribution to crayfish settlement across the range of the fishery.

Sea temperature is important to settlement, recruitment and growth rates of lobsters. Modelling for eastern Tasmania show that climate change will lead to continued declines in larval settlement. Initial gains in biomass, through increased growth rates in warmer seas won't compensate for this longer-term decline in the settlement of 'baby' lobster. The extension of the range of a second less fertile lobster species into Tasmania (the eastern rock lobster) won't lead to as productive a fishery. Warming waters also favour the NSW black urchin which is destroying crayfish habitat.

'Herpes-like virus' impacts GBR

A virus similar to herpes is one of several strains that could infect coral after it had been bleached.

Photos Andrew Furber

Mucus leaking from coral near Heron Island on the southern Great Barrier Reef, as it bleaches

"What we were surprised to see is just how much there was — the tissue was quite damaged and so there was a lot of viral infection that had taken over in the tissue."

During the experiment, the research team exposed an area of coral on the Great Barrier Reef to high levels of ultraviolet light, heavy rain and high temperatures.

After a few days, it began to lose colour and researchers found "virus-like particles" which belonged to the herpes virus family.

"… they're more susceptible to being overrun with different kinds of bacteria and different kinds of viruses."

"… the next step in the research is to see the corals that are surviving a bleaching event and they get this infection, how much longer can they survive?

"Does it impact whether they can get through that bleaching event and recover or does it make them more susceptible to things like algal overgrowth?"

New Manta Ray Research

Photo Kathy Townsend

Project Manta was founded in 2007 to investigate the population biology and ecology of manta rays in eastern Australia.

They have often been based at Lady Eliot Island resort on the southern Barrier Reef. Lady Elliot Island is an important aggregations sites and is integral to the important research undertaken by Project Manta, manta rays can be seen all year around but aggregate by hundreds during the winter months.

The reef manta, *Manta alfredi*, is known to aggregate at several locations along the eastern Australian coast but their distribution, movement and biology is not well understood..

One of the key methods is photo-identification. Professional and recreational divers provide photographs and sighting information of manta rays. New funds have allowed Project Manta to expand its research into West Australian and Northern Territory waters.

Asia Armstrong's work on Project Manta focuses on the ray's feeding environment and prey availability—as well as seasonality in their reproduction. Amelia Armstrong will study the genetic structure of manta populations around Australia and into Indonesia. "Whilst we would like to deploy satellite tags on manta rays to improve our understanding of their movements, we require more information to know where best to target our research efforts," Asia Armstrong says. This information includes date, time, location, number, behaviour and photos of both the back and belly. April seems to be the most common time for sightings in Broome. To contribute sightings and photos to Project Manta email project.manta@uq.edu.au

Macquarie Island iconic species dying out

Old growth cushion plants and mosses on sub-Antarctic Macquarie Island are being decimated by climate change.

Source AAD

cushion plant (Azorella macquariensis) showing signs of dieback

Lying 1500 kilometres south of Hobart Macquarie Island is a rocky island almost permanently bathed in cool moist fog and cloud.

Just about everything on the island is ecologically important and many of its plants are unique to the island.

The large cushion plants, *Azorella macquariensis*, dotting the landscape are often hundreds of years old. Already they have survived plagues of rabbits brought in by early seafarers. These rabbits have recently been eradicated, but the ancient plants face a new menace. As the climate changes the island is getting windier and drier.

Dr Dana Bergstrom, said the dieback of the cushion plants and mosses is rapid, progressive and widespread across the island. "Over the past four decades the environment has altered dramatically from wet and misty to one subject to periods of drying." "We found that for 17 years in a row there was not enough water available to the plants," Dr Bergstrom said. "Additionally, between 1967 and 2011, there has been uniform increases in sunshine hours, wind speed and water loss from the leaves of the plants and soil despite overall increases in precipitation from storm events."

Between 2008 and 2013 the researchers found that 88% of the study areas had dieback present, often leaving a desert-like landscape. Australian Antarctic Division spatial ecologist, Dr Aleks Terauds, said, "The cushions really act as a refuge for a whole range of spiders, mites and other plants, in what can be a very inhospitable environment," Dr Terauds said.

The cushion plant has now been declared critically endangered. An insurance population of 54 irrigated plants has been set up on the island as a growth trial.

"This rapid ecosystem collapse on Macquarie Island is giving us a window into the potential impact of climate-induced environmental change on vulnerable ecosystems elsewhere."

To put this into perspective, the eradication of pests in 2012 has seen many other species of plant bounce back from the brink. The Macquarie Island cabbage *Stilbocarpa polaris* had almost disappeared from parts of the island. Now they are flourishing.

Five Islands Nature Reserve

Sources Tom Byron, Michael McFayden www.michaelmcfadyenscuba.info

The Five Islands Nature Reserve (FINR) is situated off the coast of Port Kembla near Wollongong, and includes Big Island No. 1 (Rabbit or Perkins Island), Big Island No. 2, Martin, Flinder's (Toothbrush) and Bass Islands.

It is a total of 26-hectare (64-acre) in size and lies between 0.5 and 3.5 kilometres (0.31 and 2.17 mi) offshore.

The vegetation communities of the Five Islands, and especially Big Island have been degraded because of previous human usage and the introduction of exotic species of animals and plants. The Parkyns family lived on the island for a number of years in the 19th Century. Big Island is the only relatively easily accessible island of FINR and was used for grazing. A major problem is the presence of Kikuyu grass on Big Island.

Species recorded as breeding on one or more islands of the reserve include the sooty oystercatcher, little penguin, wedge-tailed shearwater, short-tailed shearwater, crested tern, white-faced storm-petrel, silver gull, kelp gull and Australian pelican.

Reptiles present in the reserve include the eastern water skink, common garden skink, weasel skink and three-toed skink. Marine mammals are occasionally hauling-out in the area and there are often about 50 Australian fur seals on Martin Island.

Public access to FINR can be had from ramps at Port Kembla steelworks, but landings are restricted to protect breeding seabirds and their habitats

Flinder's (Toothbrush) Island

9-16M

The northern eastern tip of the island is home to the largest of the several caves on the island. The cave is wide and low and can be explored with a torch. It goes back about 20 metres into the island at 10 metres depth. There are small gorgonia fans to see and often rock cod. Try not to stir up the fine silt with your fins.

Nearby there are also some gutters in 9-14M about 20 Metres away from the shore. These gutters are often full of fish. The rocks are covered in kelp. Sea dragons can be found on the floor of these gutters in among the kelp.

Another dive is located off the southern end of the island in 10 to 17 metres on a sloping bottom. To the south head there is a small drop off creating a two to three metres high wall. The reef here is composed of the pinkish rock that is common to the Wollongong and Shellharbour area. The wall is about 40 metres long. With smaller invertebrates in the sheltered rock crevices including sponges,

small sea fans and sea tulips and a thick kelp garden on the shallower sections.

Photo M. McFadyen

Pig (Bass) Island

24M-33M

This offers some exceptional diving. The reef on the northern and eastern sides drop gently along a rocky and boulder bottom and out to sand in depths up to 24M. The south eastern corner has a drop off from 18-24 metres at 34° 28' 04"E 150° 56' 41"S (AUS 66). It lies 30 or 40 metres from the shore. There are lots of sea tulips, sponges, gorgonia and lace corals. Fish life includes pomfret, nannygai, trevally, blue groper, combfish, wobbegong, ray eels, rays and yellowtail. Out in deeper waters on the seaward side there is poor anchoring but good invertebrate life for the macro photographer on a moderately good sponge garden. The fish life here is also very good. The southern coastline also offers some patchy boulder reef to explore.

Martin Is

30M

Head to the northern end of the island, to GPS Reading 34° 29' 43"E 150° 56' 19"S (AUS66). Anchor on the top of the reef in about 15 metres depth. There is a wall here down to 25 metres and a small gully. The wall is larger and supports more life in the deeper sections in 30 metres, and is about 5 metres high. There are colourful sponges, sea squirts, gorgonia, nudibranchs and other invertebrate life. Fishlife includes leatherjackets, combfish, Port Jackson sharks (Winter and Autumn), one-spot pullers, groper, pike and pomfret.

Martin Sponge Garden

27m

These sponge gardens are on the south side of the island where it is often quite exposed. This site features sponges and sea fans of many colours in 20-27M. The invertebrate life associated with the sponge garden includes lots of nudibranchs and sea spiders. It also has good fish life with schools of golden roughy and odd fish like the Eastern blue devil fish. The site has been compared favourably with the outstanding Stoney Creek site at Jervis Bay, but the sponge gardens here are much shallower and more accessible to newer divers.

Flinders Islet

18m

This is a shallow and relatively easy dive drifting along the eastern side of the island where there are gullies and small caves to explore. There are thick weed beds and lots of temperate reef fish species darting about. This is a relaxing second dive after a deeper first dive.

On the southern side there are shallow reefs and smaller sponge gardens

Tassie's Real Life Spider Man

Source: Georg Brenneis, Port Phillip Bay marine life guide

At a recent dive event at Eaglehawk Neck in Tasmania I bumped in to German scientist Georg Brenneis. He was working out of a galvanised "lab" at the back of the dive centre, surrounded by fish tanks full of sea spiders (pycnogonids). He is trying to learn more about the evolution of sea spiders by trying to isolate and examine their stem cells.

As good readers of "Marine Life", we must be annoyingly curious, so Steve and I barged in and said "hello". George was kind enough to show us around and discuss his work. Georg works for the German Science Foundation and Wellesley College Massachusetts, institutions that still believe that it is important to fund foundation studies into animals that you can't sell or eat. In fact, Georg regularly encounters Australians who seem surprised that he has the money to study something that probably won't lead to a cure for cancer, or discover the recipe for a new marine paint.

He has a bit of a love affair going on with sea spiders, doing his PhD on sea spider nervous systems and embryonic development. Tasmania is the perfect place for further study for the simple reason that it has lots of sea spiders and they are yellow and easily seen and collected in numbers big enough for genetic experiments.

They are found on patches of bryozoans (little bottom dwelling animals that look like plants) that persist year round in Tasmania. Georg collects them, then basically analyses them with scanning electron microscopy, fluorescent nucleic staining and bright-field stereomicroscopy, between lots of coffee.

Some of the genetic stuff involves the equivalent of putting them in a blender. I asked what they tasted like, but he has never tried.

Apparently. "the phylogenetic affinities of these bizarre arthropods have been a matter of continuous debate". Basically no-one is really sure what they evolved from. Arachnophobics, they aren't actually spiders but very early versions of arthropods that happen to be eight-legged. Forget webs and venom.

George is on a mission to narrow down the possibile forefathers of sea spiders with new techniques based on looking at the makeup of the stem cells of their nervous system.

"...arthropods provide a wealth of valuable characters that can be used for phylogenetic [evolutionary tree] inferences. In fact, the nervous system has been considered a particularly suitable organ in which to search for characters

to reconstruct evolutionary relationships'". I don't understand any of the detail, but go gett'em Georg.

He has also done a lot of analysis on how the eggs develop and hatch and how the larvae develop.

In his fish tanks, Georg has at least three species that superficially look similar, although we are finding more and more species the closer we look at apparently similar sea spiders. He has tanks full of "big yellow" ones, smaller ones, and ones with brown stripes on their legs. The yellow ones sit quietly on the bryozoans in the dark and don't move much, while the brown striped ones are pretty active, seek out the light, and cling to the mesh in a way that seems to say 'let me out'. Georg tried to find a 4th species, a transparent sea spider seen off Pirates Bay jetty at night, but unsurprisingly is a hard one to locate.

Georg showed us some sea spiders under the microscope. They have 4 eyes on a raised section on top of their head. A crab like set of claws is used to break up bryozoans and a proboscis then sucks out the contents. They don't have venom (as said in some publications) but Georg has seen them release a yellow cloud when disturbed, which is probably a chemical deterrent.

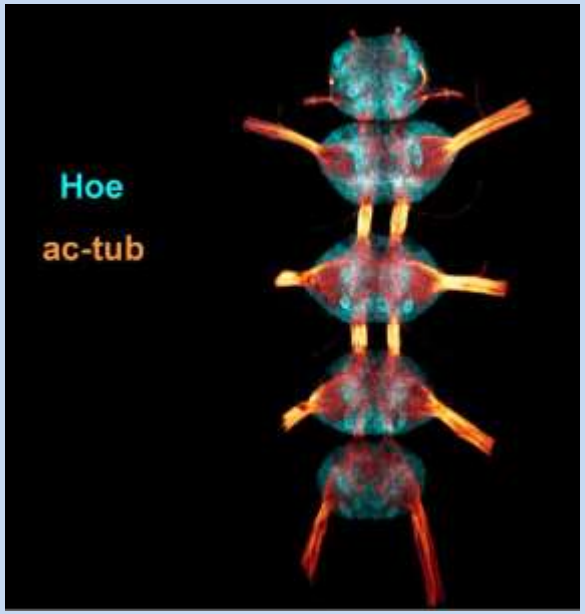
They have another set of smaller claws kept tucked under the body and used for grooming, removing all the growths that would otherwise cover the shell without that constant effort. The shell is thin and almost see-through, as sea spiders don't have organs for excretion or respiration, their 'skin' needs to be thin and permeable.

In the northern hemisphere some species live on hydrozoans that die off in winter, forcing sea spiders to move off into deeper water by unknown means. Tassie sea spiders are generally pretty "lazy" and don't disperse very much. If swept off their bryozoan patch they will 'swim' by alternately moving their legs, or will fold up their legs and plummet back to the bottom.

"Mummys" and "daddies" can be separated by the size of their legs, the females being able to produce eggs from each of its main legs. They then pass on all child-minding responsibility to the males. The males carry the eggs around dutifully, forgetting their grooming and looking pretty haggard by the time the eggs hatch and the young move away (some of you can sympathise with that surely).

The sea spider hatches into a minute free-living larva with a proboscis (snorkel mouth) and just three pairs of limbs. It heads off and gradually develops through various stages.

Georg also sent me some papers on the nervous system evolution of sea spiders and crustacea which I must confess was a bit over my head. It did have a cool picture of a sub-adult sea spider. Don't replicate this at home in your 3D printer. It might look like a new kind of Mattel Telly-tubbie, but this one is a swallowing hazard!



p.s. of you scroll up and down it appears to move, riveting

Volunteers Reveal Secret life of Penguins

Source Oxford University, AAD, penguinwatch.org

Launched in 2014, Penguin Watch, led by Oxford University scientists with input from the Australian Antarctic Division, asks the public to go online and count penguins in images taken by remote cameras monitoring nearly 100 colonies in Antarctica.

The results will help scientists to discover what penguins get up to over the winter, how climate change and human activity impact on how they breed and feed, and why some colonies and species are declining whilst others thrive.

So far more than 1.5 million online volunteers have clicked on 175,000 images of penguins and flagged up images showing strange or surprising behaviour. Over the coming year, with 500,000 new images for volunteers to look at and cameras that will take photos every minute during the breeding season, researchers hope to learn even more about the secret life of penguins.

'We hope these new cameras will reveal how often penguins feed their chicks and how long they have to go to sea to feed in different regions,' said lead researcher Dr Tom Hart of Oxford University's Department of Zoology. 'Until now, this has only been possible by putting GPS on penguins. The hope is that, by developing a non-invasive method, we can track penguins across the whole of the Southern Ocean without researchers needing to disturb them.'

Dr Hart. 'Time-lapse cameras have revolutionised our ability to collect data from a large number of sites simultaneously. Having many more sites monitored and comparing high- versus low-fished sites, for example, will enable us to work out which of these threats are causing changes to penguin populations and how we might mitigate them.'

Volunteers will even get the chance to win a trip to Antarctica to see penguins. Everyone registered on the site taking part in this round of Penguin Watch can enter the draw to win a trip donated by project partner Quark Expeditions, as well as a host of smaller prizes.

http://www.penguinwatch.org/

The Last Grain Races

Today, square-rigged sailing ships no longer trade the oceans of the world. The First World War brought a brief revival as shipping was in short supply. However, by the 1930s, the grain trade from South Australia to Europe was the last enterprise in which square-riggers could engage with any hope of profit. This was only possible if the owner had a keen interest in reducing running costs. At the time of the last Great Grain races, these large sailing vessels were really dinosaurs, but they managed to survive because they could be purchased cheaply. The time taken to complete the epic voyage also meant that the grain had plenty of time to ripen before being unloaded on the other side of the world.

Gustav Erikson of Mariehamn, in the ethnically Swedish Aland Pro Orlun Islands off the coast of Finland, was the last man to own a great fleet of sailing ships. Erikson had to pay his crews as little as possible and he could not afford to insure ships. From Eric Newby's description, *He was respected and feared as a man over whose eyes no wool could be pulled by the masters whom he employed to sail his ships, and the tremors they felt were passed down to the newest joined apprentice. Of such stuff discipline is made. A now out-moded word, but sailing ships do not stay afloat and make fast passages at the pleasure of a committee of seamen.* Newby commented that he never met any foremast hand who liked 'Ploddy Gustav'.

The voyages from South Australian wheat ports on the Yorke Peninsula to Europe received much media coverage. In Britain, people bet on which ship would make the fastest voyage of the year, coining the expression ‘Grain Races’.

The fastest voyage was that of the Parma in 1933, which completed the passage in 83 days, the slowest took five and a half months.

Herzogin Cecilie

This ship was built in 1902 in Bremerhaven, Germany. She was one of the fastest windjammers ever built and one of the last: she once logged

21 knots. The trip around Cape Horn from Portland to The Lizard (England) was done in 1903 in only 106 days.

At the outbreak of World War I she was interned, returning to Germany in 1920, only to be given to France as reparations, and subsequently sold to Gustav Erikson of Mariehamn for £4250. As the freight rates for saltpeter had dropped after the war, Gustaf Erikson sent her to bring grain from Australia.

After "winning" four times prior to 1921, she again won the grain race four times in eleven trips from 1926 to 1936.

With Sven Erikson as her Captain and Elis Karlsson her First Mate, the ship left Port Lincoln in South Australia on 21 January 1935, with a cargo of wheat, and after taking a more southerly route than usual, reached Falmouth. *Herzogin Cecilie* was in dense fog, when, on 25 April 1936, she grounded on Ham Stone Rock. After parts of the cargo were unloaded, she was floating again, only to be towed to Starhole (Starehole) Bay near Salcombe UK. On 18 January 1939, the ship capsized and sank. The remains of the ship sit at a depth of 7 metres.

While 1939 was arguably the last Grain Race worthy of the name, commercial sailing ships still sailed the route after the war for two more years in 1948 and 1949. The windjammers *Passat* and *Pamir* left South Australia's Port Victoria on 28 May 1949 loaded with grain for Europe. They were the last commercial sailing ships to ply an international trade route, in the end at a financial loss.

Alan John Villiers

One of the great Australian adventurers of the twentieth century spent his life saving our maritime heritage.

Alan Villiers was a dreamer with a fascination for sailing ships. He left home at the age of 15 to go to sea, but the age of sail was in decline by the turn of the century. He managed to join the barque "Rothesay Bay" as an apprentice. When that job came to an end he was stranded in France without work. Alan lived in a concrete drain pipe with a Finnish comrade at Bassens on the outskirts of the Bordeaux docks. Eventually, he got a berth in the Finnish four-masted barque "Lawhill" owned in the Åland Islands. He fell from the rigging during a voyage and had to leave the sea due to injuries.

He arrived in Hobart and talked his way into a job as a journalist for the Hobart Mercury while he recovered. Hobart was a town full of maritime comings and goings that inspired his writing,

"Hobart, small though it was, had a lovely harbour to which strange ships sometimes came – great steamers*, with greenheart bows Sand slipways cut into their sterns, which were bound upon Antarctic whaling voyages ; big* steamers *in distress from the storms of the roaring forties; game little crayfishing schooners and, now and again, big* sailing ships *with timber from the Baltic."*

As Villiers recovered he was drawn to the Antarctic and signed on to the whaler "Sir James Clark Ross" in late 1923. Captivated by the scenery, he was also required to participate in the slaughter. "We had caught 228, most of them blues, the biggest over 100 feet long. These yielded 17,000 barrels of oil; we had hoped for at least 40,000, with luck

60,000." Then he was back at his writing desk, and began to write books of his nautical experiences.

In the 1920s, the world's windjammers were fading away, there were only about 20 left still under sail. They could only compete with steamers if little money was spent on crew wages or comforts. Villiers and his Tasmanian friend and fellow journalist, Ronald Walker, decided to make a documentary film to record the last of the great sailing ships before it was too late. Villiers sold his house to pay for the filming.

They went to South Australia and signed on with the "Grace Harwar" as ordinary seamen. This vessel was the last full-rigger in the Australian trade. Villiers thought the "Grace Harwar" was beautiful as the *"wind in her rigging called imperiously as she lay at the pier at Wallaroo"*. As Villiers stood on the dock, a wharf labourer warned *"Don't ship out in her! She's a killer."* More than 40 years old at the time, the ship was in bad shape.

They went ahead with it anyway, doing the usual work of a seaman while occasionally bringing out the camera to steal a few scenes. *"We had a Frenchman, a Londoner, four Australians, and the rest were Finns". "The Finns were all first-voyage boys, some deserters from other ships, the average age of our crew was about nineteen. They were strong and willing, which is a lot ; there was an entire absence of that old bickering spirit which was so evident in sail's heyday, when every fo'c'sle had its boss, its bloodshed, and its under-current of cliques and jealousies. We had no fight the whole voyage".*

In all other ways the voyage was harrowing. The ship was under-provisioned and the crew developed scurvy. The ship leaked excessively. A man was washed overboard. His friend Ron Walker was killed when he was hit by falling rigging. The second mate had a breakdown as a result. *"We saw black albatrosses and suffered terribly off the Horn in the dead of winter. We might have known these things would happen. We had thirteen in our crew - thirteen hands before the mast. I don't remember that we noticed it in Wallaroo before we left. We remembered about it well enough after."*

Villiers recorded the experience on 6000 feet of film and later in his book *By Way of Cape Horn*. The book is the real deal and well worth a read.

In 1931, Villiers became a partner in the four-masted barque "Parma". In 1932 he won the grain race between the ships of the trade, arriving in 103 days. In 1933, he made it in 83 days. Villiers went on to purchase the "*Georg Stage"*. Saving her from the scrapyard. Villiers renamed her the "Joseph Conrad" and voyaged the world with an amateur crew. He used the unique environment of the sea to build character and discipline in his young crew and helped form the modern concept of sail training. All these voyage inspired several books about life at sea.

In 1938 he began an examination of sailing culture in the Far East and spent 18 months on board the Arab dhow, "*The Triumph of Righteousness",* sailing to Zanzibar and back. He recorded his experience in *Sons of Sinbad*. The project ended prematurely due to the outbreak of the Second World War. Villiers served with distinction in the Royal Navy.

After the war he wrote books and helped with every start-up maritime museum, Hollywood sea epic, maritime restoration around the world.

Abyssal Plain

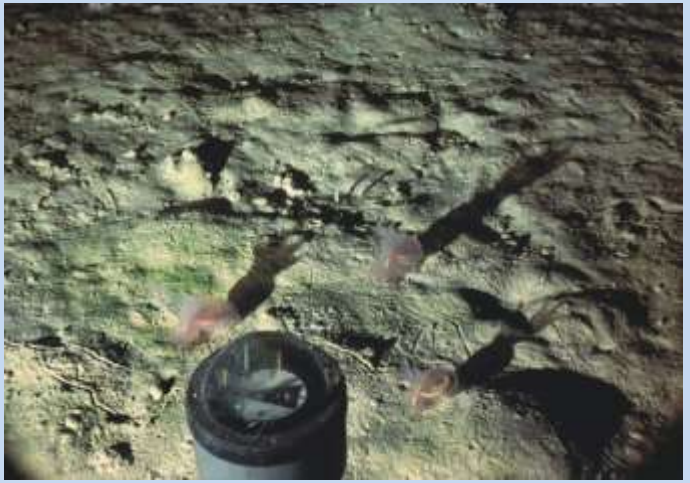
An abyssal plain is an underwater plain on the deep ocean floor, usually found at depths between 3000 and 6000 m. Abyssal plains cover more than 50% of the Earth's surface.

The larger plains are hundreds of kilometres wide and thousands of kilometres long. The plains are largest and most common in the Atlantic Ocean, less common in the Indian Ocean, and even rarer in the Pacific, where they occur mainly as the small, flat floors of marginal seas.

The plains are made up of sediment from the land that has slumped down in depressions in the seabed, smoothing out the bottom. Sediments can average one kilometre in thickness.

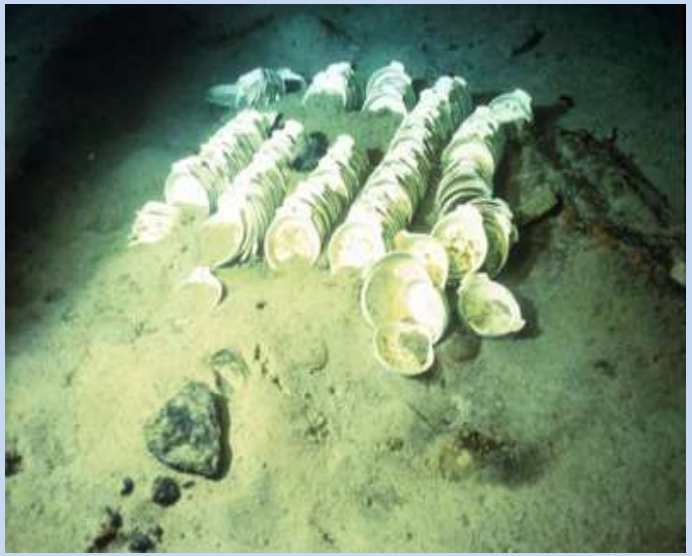
The coarser layers of sand and gravel are interspersed with fine-grained clay and the microscopic remains of organisms that have died and fallen to the seafloor. Abyssal Plains are underlain by oceanic crust of basalt, a dark colored volcanic rock rich in iron- and magnesium-silicate minerals. Fine-grained sediments accumulate at a millimetre to several centimetres every 1,000 years. Only a fraction of the 15 billion tons of clay, silt, sand, and gravel that is washed into the oceans each year reaches the abyssal plains.

The other minor components of abyssal plain sediment include wind-blown dust, volcanic ash, chemical precipitates, and occasional meteorite fragments. Abyssal plains are often littered with manganese nodules containing varying amounts of iron, nickel, cobalt, and copper. The nodules form by direct precipitation of minerals from the seawater onto a bone or rock fragment.



Abyssal plains were once thought to be stable and unchanging environments. *"The abyssal plain environment is not conducive to life as we know it; it is perpetually dark and very cold, and the food supply is sparse. The Hydrostatic pressure is enough to crush a person's body to the size of a soccer ball. Population densities are low owing to a harsh environment and scarcity of food""*

Instead there is high biodiversity, "one of the major biogeographic puzzles of our time". The abyssal seafloor can be unexpectedly dynamic. Nearly all species found in the abyss are rare. Most species have been recorded as one or two individuals from one or two sampling sites, even in large programs. One or a few species numerically dominate but can change quickly.

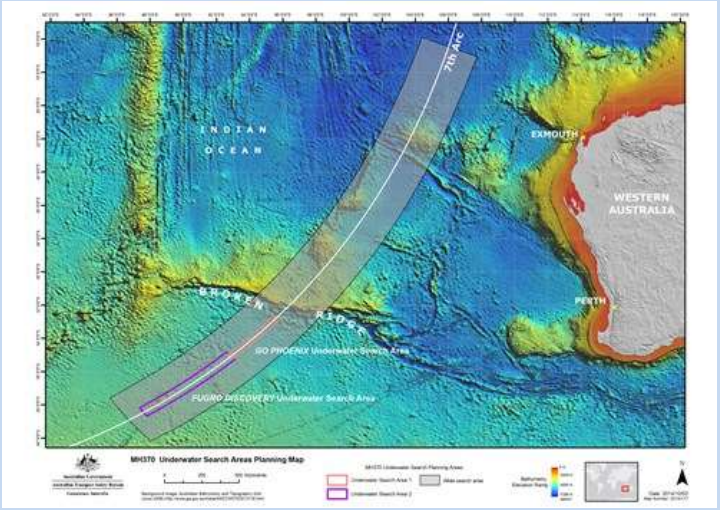


Industrial harvesting of manganese nodules may become a reality. The abyssal seafloor, which accounts for the largest area on the planet, may also warrant our close attention because biogeochemical cycles of the seafloor have a strong influence on the global climate and climate change.

The Search for MH370

On 8 March 2014, a Malaysian Boeing 777 disappeared from radar with 227 passengers and 12 crew on board. It was on its way from Kuala Lumpur to Beijing, but the evidence pointed to a strange change of course that brought it down the coast of Western Australia. What followed was one of the most detailed surveys of the deep waters of WA ever attempted.

Source ATSB



Data taken by the satellites that routinely criss-cross our globe were checked. After, a likely track of the aircraft was determined. The aircraft had travelled in almost completely the wrong direction, until running out of fuel six hours later well offshore from Perth. On 4 September 2015 a flaperon was found on La Réunion Island from MH370. The finding of the debris on La Réunion confirms the plane is lost in the southern Indian Ocean. Other likely pieces have been found along the southern African shore.

The Australian Transport Safety Bureau (ATSB) was asked to take the lead for the underwater search for MH370. All the available data could provide only a massively big arc as the search area for the final resting place of the aircraft and its passengers.

Before the underwater search could begin, we needed to accurately map the seafloor.

Bathymetric survey vessels spent months scanning with multibeam sonar pulled along the sea floor by a 10km armoured cable. The

resolution was too coarse to find the aircraft, but making sonar maps are needed to ensure the team does not crash its deep-water vehicles into ridges. Previous satellite maps only indicated the depth of the ocean.

They found a mountainous ridge that once formed the margin between two geological plates. These plates evolved and spread apart between 20 and 100 million years ago. There are extinct volcanoes, rugged ridges up to 300 metres high and trenches some 1,400 metres deep in this part of the search area.

Simon Boxall from the National Oceanography Centre said "Those 'bumps' on the sea floor in the flat, featureless plains to the south of Broken Ridge are each bigger than Ben Nevis.

"Five kilometres (3 miles) across and typically rising 1.5km (0.9 miles) from the sea floor. The terrain of the area around Broken Ridge makes the European Alps look like foothills," he said.

It has also revealed regions of harder and softer sea floor composition (sediment versus rock). This information has been useful in identifying and discriminating certain features, but also in providing a guide on the complexity of the sea floor for the underwater search.

Other deep sea search vehicles have sonar that can pick out odd lumps, cameras can then double check if that lump is wreckage or just a rock. An electronic nose can smell diluted aviation fuel in the water.

Some of the first high resolution data available in these areas, will be released to the public by Geoscience Australia. Scientists, can use it to gain a greater understanding of deep ocean geological interpretation, plate tectonic history, ocean currents and connectivity. It may also identity habitat where unique biological communities may exist.

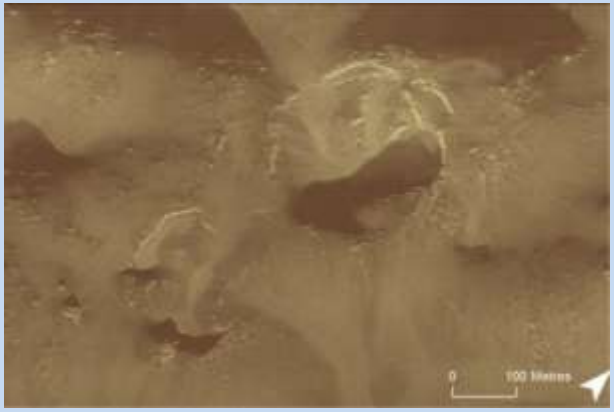
Despite this it sounds like we are still a long way off finding the missing plane, the area is vast and the task daunting. Recently the search area was expanded, but after that we are out of ideas and it is due to be called off in June.

What Happened?

Everything is conjecture at this stage but go to the ATSB site for news as the media reports have included some wild claims and conspiracy theorists abound. The track of the aircraft and its lack of response to signals seem to indicate that the aircraft crashed on autopilot when fuel was exhausted. No-one was steering, suggesting that the aircrew were dead or unconscious. A likely scenario is asphyxia due to smoke from an electrical fire, possibly in the cargo hold where there are clusters of wiring controlling systems like communications. The plane carried 440 pounds of lithium batteries aboard as cargo and these are known to be a fire risk and are no longer recommended as safe for airliner transport.

The dramatic initial course change is consistent with an attempt to divert to Georgetown in Penang, which was the closest suitable airfield. The plane drifted around on a new and bizarre heading before stabilising on autopilot. Constant system reboots resulted in automated messages being sent via satellite, and suggest the onboard computers were reacting to severe electrical system damage. In simulator tests, the fuel exhaustion of the right engine would have been followed by flameout of the left engine. The aircraft would have descended in a spiralling left turn. A steep final dive into the water would have created little surface debris.

It sounds like we are still a long way off finding the missing plane, the area is vast and the task daunting. Recently a towfish was lost from 1 of the 3 search vessels. The search area is continually being expanded, but after that we are out of ideas. The search will end in June. A little scientific knowledge might be all we can hope for.



Abyssal sediments

Glasshead Barreleye

Photo Adrian Flynn, Aust muesum

This is a side view of the head of a Glasshead Barreleye, a fish trawled from a depth of around 1000 m on the abyssal plain in the southern Tasman Sea, between Tasmania and New Zealand. They are also found off NSW. The translucent round structure is the primary eye. The fish also has ancillary mirror-organs that collect light from the side and below The fish essentially has 4 'eyes'. The barreleyes are an unusual family of deepsea fishes, most of which have upwardly-directed eyes. The eyes detect the silhouettes of prey swimming above.

Tackling Microplastics

Another project to begin soon will study the of impact marine microplastics in Western Australia, Indonesia and the Philippines. There are fears tiny pieces of plastic floating in the Indian Ocean could be affecting the reproductive health of manta rays and whale sharks. Although there is considerable knowledge about plastic pollution, comparatively little is understood about what happens when they degrade into tiny pieces smaller than five millimetres in diameter.

Researcher Ellie Germanov has embarked on a PhD project through Murdoch University to determine whether filter-feeding animals were being harmed by the presence of microplastics off the coast of Bali, beaches in the Philippines, and Coral Bay reefs in Western Australia. Ms Germanov said increasing levels of marine plastic debris were a global environmental problem, and the waters of South-East Asia were some of the worst affected areas on the planet.

Approximately 3.2 million tonnes of mismanaged plastic waste is being disposed of in Indonesia annually, with up to 40 per cent entering the marine environment. Some cosmetic products including toothpaste and facial scrubs contain tiny chemical plastic beads that are small enough to pass through filters, so millions ended up in the ocean. "So despite waste management perhaps being better in Australia, there are still microplastics entering the water from other sources."

Over the next four years Ms Germanov will measure the levels of microplastics in the feeding grounds of manta rays and whale sharks in the three countries, as well as examining materials in the guts of the animals. "The plastic can block up the digestive tracts reducing the ability to absorb nutrients, which may ability to reproduce and have population wide effects," she said.

Researchers had found a microplastics hot spot just near Ningaloo reef. Strong currents may sweep particles from as far away as South Africa. Biological samples taken in the study would be analysed at Murdoch University to establish if toxins such as pesticides and industrial chemicals were building up in the animals.

The Minister has recently threatened to ban microplastics from domestic products if they aren't voluntarily phased out. Industry seems happy to fall in line at this stage, with one spokesperson (apparently genuinely) stating that they didn't realise it was causing harm.

Creepy Skeleton Shrimps and other oddball Amphipods

These horrors of the deep go almost unnoticed

Sources, LOWRY, J.K., & P.B. BERENTS, 2005. Algal-tube dwelling amphipods in the genus Cerapus from Australia and Papua New Guinea, Ned De Loach Blennywatcher.com, Andrew Newton, Australian Museum, Planetanimalzone

Anyone diving out on mud at certain times of the year is bound to have swum over them, perhaps without even noticing. They breed faster than personal injury lawyers at a car accident, but are so small that often go unnoticed.

No-one would go swimming if these creatures were 5 metres long, but thankfully they are often only 5mm long. The observant diver who sees one will soon notice thousands of them. In suitable areas they cling to every spare millimetre of space on a seagrass stem or stick on the bottom, apparently fighting almost constantly with their near neighbours, by brandishing their fearsome claws.

There are believed to be at least 29 caprellid amphipod species in Australian waters, 14 in New South Wales, seven in Western Australia, three in Victoria, nine in Tasmania and two in inshore Queensland (living on hydroid and sediment at Lizard Island).

Caprellid amphipods are a type of crustaceans important as producers in marine ecosystems. They are common on algae, hydroids, bryozoans, sponges and seagrasses and are important prey for many coastal fish species. Recently, caprellids have been found to be useful indicators of marine pollution.

Some amphipods don't stay out in the open but live out of sight in burrows. Ischyrocerid amphipods in the genus *Cerapus* make little tubes of minute sand grains and detritus held together with amphipod silk, known as detrital-tubes. Three species elaborately 'pimp up' their parchment tube with pieces of cut algae and seagrasses. These species eat algae and the tubes are assumed to be camouflage. Australia has about 20 known *Cerapus* species (described and undescribed).

I note that Marine Life Reader and photographer Andrew Newton has been out in Port Philip Bay ambushing amphipods and discovering that little things can make some surprisingly large structures,

"How's this for weird. This 50cm high mound of sand was made by microscopic amphipods forming tubes in the sand. Looked like dunes made of dreadlocks."

These little amphipods, isopods and shrimp are a diverse and abundant and baby fish love to eat them.

Even the less iconic, hard to study and small cryptic species are worthy of research effort and some public interest.

Pennantfish

Source Australian museum, Qld museum Fishes of Australia

Alectis ciliaris

If you ever see a fish with long trailing fins, chances are it is a juvenile pennantfish. They are usually photographed at tropical resorts as they are found worldwide in tropical coastal waters. They have been recorded in Australia from Dunsborough, WA to Mallacoota, VIC and also at Lord Howe Island and Norfolk Island.

Related to pennantfish is the Diamond Trevally, *Alectis indica*. The adults are a bit boring, but juveniles of this species have long trailing filaments from their dorsal, anal and pelvic fins. The filaments gradually reduce as the fish grows.

Juvenile Diamond Trevally photographed in Cairns Marina by David and Brenda O'Brien.

The Diamond Trevally grows to about 150 cm in length and is also widespread throughout tropical and subtropical waters of Australia.

In Australia it is known from south-western Western Australia, around the tropical north of the country to the southern coast of New South Wales.

Individuals are sometimes seen swimming next to wharves and docks around the Sydney region.

There must be some drag and a speed penalty from having such large fins. Juvenile pennantfishes appear to mimic box jellyfish, perhaps to deter predatory fish that avoid contact with stingers.

Two species of *Alectis* are known from Australian waters. The Juvenile Diamond Trevally, *Alectis indica*, can be distinguished from the Pennantfish by the presence of filaments on the pelvic fins. The Adult Pennantfish has a more rounded upper head profile than the angular head of the Diamond Trevally.

Antarctic Sea Ice

How can the Planet warm and Antarctic Sea Ice stay normal or even grow? After three years of heavy sea ice, this year the sea ice in the Antarctic has bounced back to a normal coverage. At the same time the Arctic is a shrinking disaster in motion.

Sea ice differs between the Arctic and Antarctic. Although sea ice moves around the Arctic, it largely stays put in the colder latitudes and piles up into thick ridges. Arctic sea ice is often 2 to 3 meters thick while Antarctic ice is typically 1 to 2 meters thick. The thick northern ice tends to stay frozen longer during the summer, even though ocean currents draw warm Atlantic Ocean waters from the south. About half of the ice remains at the end of the summer melt season. The waters off the eastern coasts of Canada and Russia are affected by cold air moving off the land and ice can survive in more southerly latitudes than in the southern hemisphere. Several rivers in Russia and Canada provide fresh water which allows more ice growth in the Arctic than the Antarctic. Despite this the Arctic ice cap is rapidly disappearing. According to scientific measurements, both the thickness and extent of summer sea ice in the Arctic has shown a dramatic decline over the past thirty years. Climbing global temperature is the culprit.

The Antarctic is a land mass surrounded by open ocean and the forming sea ice can move freely with higher drift speeds This results in thinner ice, and less ice ridges. Ice freely floats northward into warmer waters and about 85% of Antarctic sea ice eventually melts.

In the Antarctic, the currents and winds tend to swirl around the continent without interruption, acting like a barricade to warmer air and water to the north. The maximum extent of the sea ice is roughly symmetrical, forming a circle around Antarctica. Antarctic sea ice isn't affected by rivers, but the air is moist and the ice tends to be covered by thicker snow.

Arctic and Antarctic sea ice extent varies wildly from year to year. The monthly average extent can vary by as much as 1 million square kilometres from the year-to-year.

Sea ice coverage around the Antarctic has been increasing in recent years. Scientists say this is due to a vortex of winds around the South Pole that have gradually strengthened since the 1970s. These winds are pushing and compressing ice into thick ridges that are slower to melt.

Scientists believe this year's strong El Niño event, had an impact on the behavior of the sea ice cover around Antarctica and caused it to return to a more normal coverage. El Niño causes higher sea level pressure, warmer air temperature and warmer sea surface temperature in the Amundsen, Bellingshausen and Weddell seas in west Antarctica that affect the sea ice distribution. "After three record high extent years, this year marks a return toward normalcy for Antarctic sea ice," said Walt Meier, a sea ice scientist at NASA's Goddard Space Flight Center. "There may be more high years in the future because of the large year-to-year variation in Antarctic extent, but such extremes are not near as substantial as in the Arctic, where the declining trend towards a new normal is continuing."

Gully erosion damaging farmland and the Great Barrier Reef

The Burdekin River alone annually pumps enough sediment into the Barrier Reef lagoon region to fill 'A line of dump trucks from Perth to Sydney and back again'. We will not meet recent commitments aimed at rescuing the Great Barrier Reef unless more is done.

Dr Andrew Brooks from the Australian Rivers Institute has stated that alluvial gully erosion, most typically on grazing land, was the largest land-use driven contributor of fine sediment to the reef.

Dr Katharina Fabricius, principal research scientist at the Australian Institute of Marine Science (AIMS) in Townsville, said sediment from the rivers cuts out light, reducing the amount of energy for coral. Coral bleaching, crown of thorns starfish and storms had all seen the Great Barrier Reef lose half of its coral cover over the past 30 years.

The Reef 2050 Plan sets an ambitious goal over the next decade of halving the amount of sediment flowing from key river catchments into the reef lagoon, and cutting nitrogen run-off by 80 per cent.

Dr Brooks said meeting the sediment goal will require at least 2,000 hectares of the most actively eroding gullies to be properly rehabilitated. Targeted treatment of highly active gullies can reduce erosion by 75 per cent, but the $5.5 million currently earmarked to address the problem is a fraction of the $100 million needed to start making any real difference.

"The traditional approach that government programs take to address these problems is to target small-scale things that farmers can do under their own steam...but what we've seen today is way beyond what individual graziers can deal with"."Just taking the cattle off won't slow [gully erosion] down a lot," Dr Brooks said.

Research by AIMS has found that fine sediment in reef waters can take up to half a year to disperse, which means its damaging effects can last much longer than previously thought.

Over the past four years, Dr Brooks and Dr Jeff Shellberg, also from Griffith University's Australian Rivers Institute, have field tested different approaches to halting gully erosion. Dr Brooks said the best performer was the plot which was treated with gypsum, compost and then seeded with native grasses. "It's quite expensive. To treat a whole hectare costs somewhere between $25,000 and $30,000, but that's what you've got to do to actually achieve the results we need to see.

"The reef's worth $6 billion a year to the tourist economy. We spend a billion dollars on a new section of freeway in south-east Queensland. I think the reef deserves that sort of funding specifically targeted at these sorts of problems."

The Federal Government has estimated that it and the Queensland Government will together invest more than $2 billion in reef management and research over the next decade.

Federal Environment Minister Greg Hunt said halving sediment loads to the reef was "not just a goal" for the Government, but a "fundamental task". When asked if he would commit more money to tackling gully erosion, Mr Hunt said there would be another round of discussions, without making commitments.