MARINE Life

Feb March 2018

Our Goal

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

The Crew

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Cover photo, *CSIRO*

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Contact us: marinelifetassie@gmail.com

Albatross Chicks Love Jelly

Source Mercury Pictures: JULIE McINNES

Jellyfish are a major source of food for black browed albatrosses.

IMAS researcher Julie McInnes collected black browed albatross droppings from breeding sites throughout the southern hemisphere. The idea was to find out what they are eating.

Past studies of albatross diets relied largely on regurgitated stomach contents. These found that jellyfish made up only 5% of the bird's diet.

"Jellyfish have traditionally been regarded as an unlikely food source due to their poor nutritional value…", she said.

This study found jellyfish are a common prey of black-browed albatrosses and the closely related Campbell albatross.

"… jellyfish were present at seven of the eight sites sampled and in 37 per cent of the scats tested, comprising 20 per cent of the DNA sequences identified. Adult albatrosses were also feeding jellyfish to their chicks.

"We were surprised because we had expected adults would prefer fish to low energy-value jellyfish when feeding their offspring," she said.

Animal-Human Diseases

Diseases tend to be specific to certain species and don't readily jump to a new host. That might be changing.

http://www.whoi.edu/oceanus/feature/sea-life-is-accumulating-pathogens

A recent Woods Hole survey of seabirds, marine mammals, and sharks on the U.S. East Coast has revealed that marine wildlife contains a wide variety of disease-causing microbes. Some are types that have that have developed resistance to antibiotics and several that can be transmitted to humans.

There is no evidence that the disease agents in marine animals are affecting the health of people. But it raised questions:

- Are more marine animals acquiring disease-causing microbes from human, agricultural, and medical waste?
- Can marine life act as carriers for infectious diseases?
- Can marine animals ingesting antibiotics serve as incubators for antibiotic-resistance genes?

The researchers found relatively common microbes known to be transferable from animals to humans, *Brucella*, *Crytopsporidium,* and *Giardia*—which cause symptoms that include high fever, severe headaches, chills, muscle aches, vomiting, and diarrhoea.

Together they found nearly 100 types of disease-causing agents in their specimens.

Infection in humans usually requires a bite or other direct exposure, and people have developed immunities to many such organisms, but it is one of the many reasons to leave beached wild animals, like seals, well alone.

Even more surprising to the researchers was the high degree of antibiotic-resistant bacteria in the ocean. 73 percent of the animals they tested had at least one antibiotic-resistant bacterium; more than 50 percent of the animals sampled had bacteria resistant to two or more antibiotics.

One porpoise showed resistance to 15 out of 20 antibiotics tested.

These common ocean diseases might be linked to animal strandings and mass kills. A parasite detected in eider ducks that had died in large numbers on Massachusetts beaches was also found in stranded harp and harbor seals.

Christmas Island red crab migration

Source: ABC North West WA

Migration of millions of male and female crabs are triggered by the coming of the annual monsoonal rains. They make their way down to the beach to dig, mate and then spawn.

Migration of the red crabs begins in October to November, during the island's annual wet season, but is also dictated by the phase of the moon, with the female crabs needing to deposit fertilised eggs into the ocean during the last quarter of the lunar phase.

Red crabs aren't deterred by many obstacles and readily use the land bridge installed over the main road of the island.

Photo: Yvonne McKenzie)

Dr Olivier, a Hobart-based filmmaker will soon have a new documentary out on the drama and challenges that red crabs have in their quest to reproduce.

"Males and females walk all the way down to the coast and they have their first dip to rehydrate.

"It's been the dry season, and they've been eating leaves in the forest there, but they haven't had much direct contact with water."

Male red crabs dig burrows, mate with a female, then take off back up into the hills.

The females stay in the burrow for a couple of weeks until the next moon phase. That triggers a great spawning of eggs that are released into the ocean.

Larvae then grow into baby red crabs out in the ocean.

In February, there will be another mass migration event of baby red crabs emerging from the ocean.

If they make it through the rough oceanic conditions, on the right tides, the life cycle continues.

The new doco is due out in a year or two.

Photo: Yvonne McKenzie

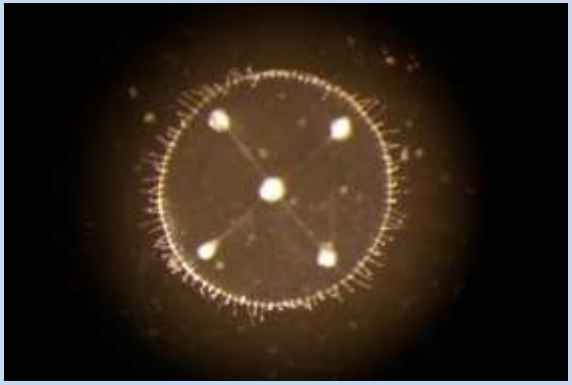
Lisa’s jelly adventures

Source ABC, all Photos Lisa-Ann Gershwin

Dr Lisa-Ann Gershwin finds new jellyfish everywhere, even fishing for new species from Hobart's docks.

While the waters around Tasmania are too cold for many of the larger, more well-known jellyfish, there are still plenty of tiny ones to keep expert Lisa-ann Gershwin very busy. "A couple of weeks ago we were out here and we found three new species in about 10 minutes of sampling," Dr Gershwin said.

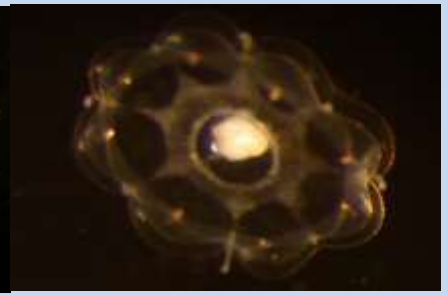
Dr Gershwin really loves her work and has discovered and classified more than 200 species. Using a clear plastic bowl, small spoons from airline catering and an eyedropper, Dr Gershwin carefully looks through her catch of microscopic creatures to spot any jellyfish. Most of the tiny jellyfish in the Derwent have to be put under a microscope to be seen, "We look for things that are pulsing because that's a dead giveaway, but we also look for anything that's kind of circular.



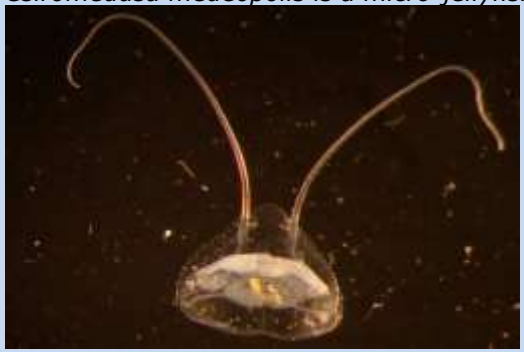
Obelia

On a recent fishing trip with the ABC Lisa pulled up Obelia, a common type of micro-jellyfish found in the Derwent.

Dr Gershwin's passion for all things jellyfish is shared with the public through the Jellyfish App, a mobile program that helps people identify different species and includes a way to contact Dr Gershwin directly.



Left: The micro-jellyfish Sphaeronectes tasmanica. Right: Csiromedusa medeopolis is a micro-jellyfish named after the CSIRO.



Solmundella

A new species of ectopleura

China and Australian Maritime History

One invisible part of the early maritime history of Australia is the role of China and Chinese seamen.

China had once been a great sea power with a fleet of 3,500 ships and had conducted many foreign voyages of exploration. By the sixteenth century it was facing new threats on land and retreated from the costs of owning a large fleet. In 1525 the emperor ordered the destruction of all oceangoing ships. Almost at the same time Europeans had perfected ocean-going sailing ships and were keen to monopolise trade with China, which previously went overland to the Middle East via the Silk Road.

With the arrival of European ships off the Chinese coast competing local ocean-going vessels were largely driven from the sea. The Chinese people continued to be international seafarers, but in other people's vessels as more lowly members of the crew. By 1826, one paper noted the arrival in Antwerp of a Chinese owned ship with a Chinese crew as "remarkable". In 1848, Captain Kellett sailed a Chinese coastal junk to Britain, to charge admission on it as a curio. The crew were told where they were going only after they had lost sight of land. The "odd looking crew" became part of the exhibit.

From white settlement Australia had a close relationship with the British East India Company. Their fleet often relied on Indian, and sometime Chinese, crewmen. Ships trading in tea, often traversed the globe via Australia, or brought supplies of tea here. Immigrant ships from China were also frequent visitors in the 1850s to 1870s. In the later nineteenth and early 20th century, Chinese crews were commonly encountered on trading steamers, particularly vessels operating from Hong Kong and Singapore.

Chinese crewmembers were not an uncommon sight in Australian harbours, but Chinese crews are almost never mentioned in the news. All the shipping intelligence was focussed on the exploits of European officers. Chinese crew members get a mention when there was some mishap, or the unfortunate seamen landed in court.

The Drug Trade and the wreck of the "Ly-ee-moon"

Background History

By the end of the eighteenth century, the British had largely driven out competing Portuguese and Dutch traders from the Chinese coast. The British then developed a huge trade in tea. Tea was brought to Europe from China and drinking it became a British institution. However, the Chinese did not want any European goods in return, and demanded that they be paid in silver. By 1800, the East India Company was buying 23 million pounds of tea per year at a cost of 3.6 million pounds of silver. Europe was being drained of 'hard currency'.

Opium has always been a recreational drug in China. Britain had conquered India, a suitable supplier. It wasn't long before European ships began dumping cheap opium into China. New fast sailing vessels called clipper ships, built with narrow decks, large sail areas, and multiple masts, appeared in the Pacific in the 1830s. They could bring fresh tea to Western markets much faster and were ideal for smuggling opium.

On the eve of the first Opium War, the British were shipping some 40,000 chests of opium to China annually. By this date, it was estimated that there were probably around ten million opium smokers in China, two million of them addicts. Prohibition was tried, but the vast sums to be made meant official corruption was rife. Soon 30% of officials were users. The army was also riddled with opium abusers and even the Daoguang emperor was an addict. It was easy money, and some missionaries opposing the opium trade also relied on it for funds.

An 'untouchable', the tough and thoroughly honest official Lin Zexu was appointed in 1839 to stamp out the epidemic. He is still a hero in China today.

In 1839, the Chinese government confiscated and destroyed more than 20,000 chests or 1400 tons of opium. British warships destroyed a Chinese drug blockade of the Pearl River. In 1840, a stronger British fleet arrived and occupied Canton.

Qing Imperial forces were weak and disorganised. Lin Zexu was an official, not a great general. He rated his enemies navy poorly, "Once within the harbor, their vessels become unwieldy. They can scarcely move in shallow waters or near sand bars". The East India Company lent the Royal Navy a single new iron paddle steamer warship. It could sail in any wind and tide and rapidly demolished the wind-bound Chinese fleet.

The Chinese expected their numbers to prevail on land, "besides guns, the barbarian soldiers do not know how to use fists or swords. Also their legs are firmly bound with cloth, and consequently it is extremely inconvenient for them to stretch". Instead, the Western armies mowed down the Chinese ranks with artillery and firearms, weapons the Chinese had invented but failed to fully develop. The British captured Nanjing and the Chinese asked for a truce.

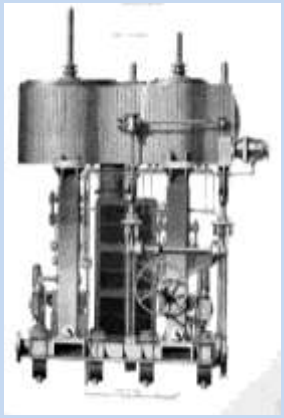
China was required to pay Britain a large indemnity, cede Hong Kong Island, and increase the number of open trade ports. Other Western countries quickly demanded similar privileges. It was a bit like a Colombian drug cartel conquering part of your country and forcing you to pay for the privilege. Internal unrest followed, further weakening the central government. In 1856, 'gunboat diplomacy' was tried again. British and French troops quickly captured Canton and Tientsin. In a new one-sided treaty, the importation of opium was legalized. The Chinese subsequently refused to ratify the treaties, but by 1860 further defeats forced the Chinese government to finally agree.

The Chinese have never forgotten the Opium Wars, when Western powers forced them at gun point to take drug shipments. It humiliated China and caused a drug epidemic. It still colours China's view of the West. In the West, it is a shameful episode in our history and you will have to look pretty hard to find any detailed information about it. But there is one relic of this period on the Australian coast.

The Ly-ee-moon

One NSW shipwreck is a reminder of a forgotten era in our history that still haunts modern-day relations with China

The astronomical tea and opium profits made by big merchant houses like Dent & Co. led to orders for increasingly advanced and fast new ships. Efficiency was less important than speed and the new, big, auxiliary steamers fitted the bill for opium trading. The 991 gross ton iron paddle steamer "Ly-ee-moon" was named after an anchorage near Hong Kong, and means "Carp Passage". She was built in 1859, by Thames Iron Works, Orchard Yard, Blackwall in the U.K. (Incidentally, the yard's football team was West Ham United, and they still play in the company's old colours). She was finished just as the Opium Wars were winding up.



With three masts and sails, and a coal powered steam engine she could achieve 17 knots and was regarded as the fastest ship ever built in Britain at the time. She was used in Chinese waters, openly ferrying cargoes of opium to China.

She was later sold in April 1863 to Japanese owners and renamed Taihei Maru. They fitted her out very elegantly. In 1872, the ship was rammed when at anchor in Hong Kong Harbour and she sank. Refloated, the Ly-ee-Moon was repaired and sailed back to England using her sails. Here, she was fitted with new engines and converted to a screw ship.

The ship came to Australia in the late 1877 for service on Pacific Island runs. During a refit at Pyrmont, Sydney, in 1878 she caught fire and was scuttled to extinguish the fire, then she was refloated and refitted again.

In 1886, she left Melbourne with passengers and general cargo. A navigation error put her hard onto the rocks off Green Cape and within 10 minutes she had canted over and was starting to break up. As the bow of the steamer tore off, it took the saloon and 30 passengers with it. A small boy was the only survivor having got through a porthole so he could reach the surface. Found unconscious, he was given mouth to mouth resuscitation and recovered. The ship's Third Officer attempting to save one of the female passengers, took her in his arms and leapt in to the sea. After almost making it to the reef, she was struck by timber wreckage and killed. Of the passengers killed, a notable loss was Saint Mary MacKillop's mother.

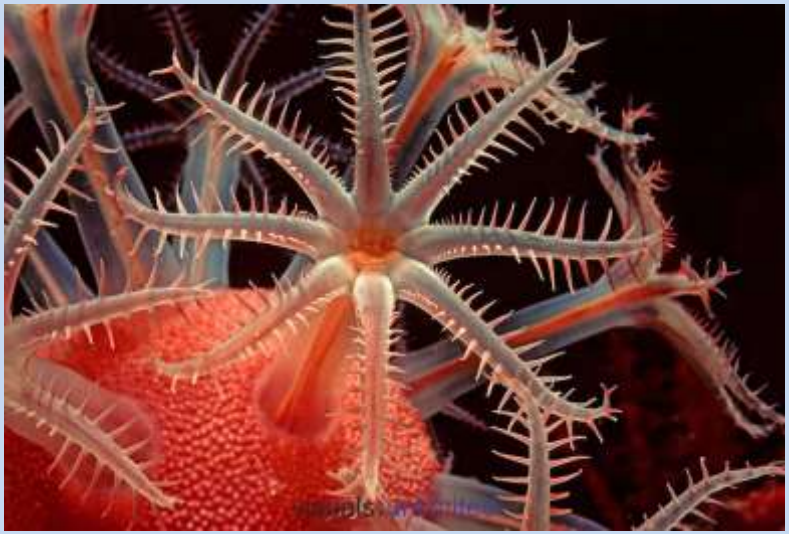
Only a few of the passengers made it to the shore alive.

Today the wreck is broken up and lying in two sections close to the shore directly under the lighthouse. There is scattered ironwork lying on the high tide line that marks the wreck. Exceptionally calm weather is required to dive the area.

Researchers find deep-water mushroom corals

Source ABC News Photo:CSIRO, visuals unlimited

Researchers have discovered found a huge community of deep-water mushroom corals at the Ningaloo Marine Park off the Western Australia coast.



Deep Sea mushroom coral polyps up close

Doctor Russ Babcock from the CSIRO said while the mushroom corals had been reported in other areas, including the Great Barrier Reef, this appeared to be the largest community of its kind. "It's over 2.5 kilometres long and 100 metres wide and we estimate there are as many as 12 million of these little corals living shoulder-to-shoulder on the reef," he said.

The corals sit about 40 metres below the surface and live unattached, feeding off sunlight and plankton.

Not as striking as the corals normally found at Ningaloo Reef, the species plays a vital role in the survival of the entire system.

The discovery has been made possible using a $125,000 robot called Starbug. It could go to a maximum depth of 100 metres.

"It will swim under the water at the depth you want it to, it will take photos of things as you tell it to and it does this by itself completely so we don't have to put divers in the water," Mr Forcey said.

Watching whales safely

Source: ABC Radio Hobart

Photo: *Birds Eye View Ningaloo*

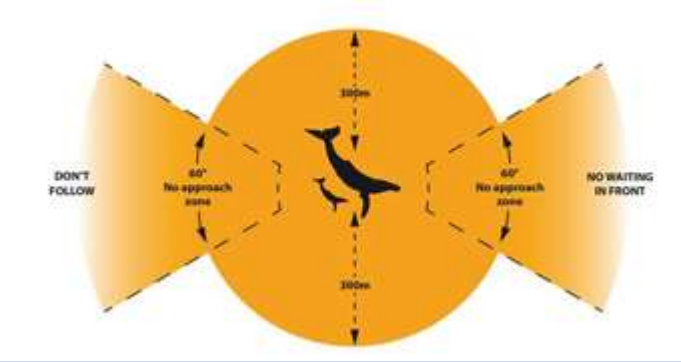
Seeing a whale up close is exciting, but is it dangerous for you and the animal?

When a southern right whale swam up the River Derwent recently, people jumped in their boats, paddleboards and kayaks to get a closer look. Some admitted they got closer than whale-watching guidelines recommend, but thought no harm had been done.

The Australian National Guidelines for Whale and Dolphin Watching 2017 was designed to provide a best-practice guide for commercial operators and the public, but it does not override local legislation which can vary state to state.

Allowable vessels should not get closer than 100 metres to an adult whale and not approach it from in front or behind them. Allowable vessels include motorised, paddle and sail craft such as motorboats, yachts, kayaks, canoes, surf skis and inflatable crafts.

For whales with calves, allowable vessels should not get closer than 300 metres and not approach from in front or behind the mother or calf.



Personal motorised watercraft, including jet skis, underwater scooters, parasails, remotely operated craft (drones), wing-in-ground effect craft and hovercraft *[damn there goes that idea]* should not get closer than 300 metres to any whale or dolphin.

The death of a fisherman in Canada earlier this year demonstrated how unpredictable the animals can be; the man died after the whale flipped its tail after he had untangled it from fishing nets.

A mother whale with a calf should be given extra space and caution as they will be protective and more aggressive to anything they perceive as a threat.

Extra noise from vessels, drones and excited humans adds audio clutter to the whales' world and could potentially put them in danger.

Despite the risks, scientists still wanted to encourage people to enjoy whale watching in an appropriate way.

Rare Australian dolphins filmed by drones

A team of researchers based in the Dampier Archipelago off WA's Pilbara coast are filming the dolphins' movements.

Photo: (James Cook University: Isabel Beasley)

The Australian humpback dolphin population, officially classified in 2014, is spread throughout waters right across the north of Australia — from Shark Bay in Western Australia to the Queensland-New South Wales border. Recently it has also been found in PNG.

Not only has vision captured via drone helped count pod sizes, Dr Brown said they had also witnessed the animals socialising, foraging and resting.

"The humpback dolphins around the Dampier Archipelago also appear to be slightly less shy than in some other areas and that might be because of quite a lot of boat traffic in the area, they're quite used to boats being around," Dr Brown said.

Tim Hunt has studied the Australian humpback dolphin population off the North West Cape near Exmouth, "In WA waters, less than 1 per cent of the distribution of humpback dolphins has been surveyed adequately enough to assess their abundance," Mr Hunt said.

"Estimates across Australia say there are fewer than 10,000 mature individuals, there isn't enough information to appropriately give them a conservation status listing, "But there is strong evidence to suggest that based on what we do know they would be listed as threatened."

Photo:(James Cook University: Isabel Beasley)

Barren Beauty - Heard Island WHA

Source AAD

Penetratingly cold, rainy and windy, covered in ice, mostly devoid of greenery and circled my huge seas. No place is more remote and wild.

Heard Island is about 4100 kilometres south west of Perth and about 1000 kilometres north of Antarctica, through some of the roughest seas on the planet. It takes around 10 days, depending on the weather, to get to Heard Island by ship from Fremantle. The French territory Îles Kerguelen is the closest land and is about 450 kilometres to the north west.

Heard Island and the McDonald Islands have Australia's only active volcanoes, its highest mountain, and its only glaciers. Big Ben is the active volcano that makes up most of Heard Island. It is about 2,750 metres high at the summit (Mawson Peak), making it the highest Australian mountain. Volcanic activity at McDonald Island has caused the island to double in size in recent years. It also offers large penguin, seal and seabird colonies.

The island is uninhabited and has only been intermittently visited by sealers and scientists.

The islands provide a rare terrestrial home in the Southern Ocean for plants. Vegetation covers lowland coastal areas at low elevations. Simple plants like mosses and lichens dominate the greener parts of the landscape. There are no introduced plants, and even pests like rats have failed to establish in the harsh conditions.

The killing and rendering of elephant seals at Heard Island commenced in 1854/55 and oil production peaked in 1857/58. More than 50 visits were made to land gangs on the island. Following the near destruction of seals on the island by 1859, oil production continued until 1877. Up to this time more than 40

vessels, almost all from the north-eastern United States of America, had made over 100 voyages to the island.

The poor weather conditions at Heard Island and the lack of sheltered harbours along its coast meant that many vessels ran aground at the island, occasionally sinking in view of the sealing gangs that awaited their return.

Due to the persistently severe weather and sea conditions, human visits are limited to a science voyage about once in every 5 years.

Since 1855, there have been only approximately 240 shore-based visits to the island, and only two landings on McDonald Island (in 1971 and 1980). The first visitors were sealers.

The Australian National Antarctic Research Expedition (ANARE) station at Atlas Cove was operated from 1947 to 1955. The Australian Antarctic Division (AAD) has mounted over 30 program expeditions to the region.

A low number of private yachts and commercial tourist vessels have visited Heard Island. Other private expeditions have included brief visits by ham radio enthusiasts, private scientific groups and mountaineering parties.

Surveillance patrols by civilian and Australian Defence Force vessels and are aimed at enforcing fisheries legislation. The Australian Antarctic Division (AAD) generally maintains one or two refuges equipped with basic provisions.

The unique Heard Island sheathbill

Most of Heard is usually under glaciers. Like most of the glaciers worldwide, many of the glaciers at Heard Island have retreated dramatically over the last 50 years. Five years ago scientists found that the Brown Glacier had retreated by about 50 metres. Aerial footage suggests the glacier has retreated even further since.

This retreat corresponds with climate warming trends in the Southern Ocean.

The south eastern end of the island has an iconic long strip of land called "Elephant Spit". In the big seas and rising sea levels it is now an island no longer attached to the mainland.

The air temperature at Heard Island has increased by about one degree celsius in the last 50 years *[but its still damn cold]*.

West Australian Unique Animals

Seahorse, *Hippocampus subelongatus*

Sources Rudy Kuiter, Fishes of Aust, Aust Museum, Dave Harasti

This seahorse is only found in the subtropical and temperate waters of Western Australia, from Cape Leeuwin to Shark Bay. It is seen hiding among seaweed, sponges and sea squirts. Individuals congregate in the lower reaches of the Swan River during early summer when many crustaceans are spawning, providing food for their offspring. It is common in muddy and silty bays, and on jetty pylons and boat moorings at 1-25 m. The West Australian Seahorse is collected for the live aquarium trade.

RAINE ISLAND AND THE OLD STONE TOWER

By Steve Reynolds

On the outer edges of the Great Barrier Reef, Raine Island harbours the world's largest remaining population of green sea turtles, *Chelonia mydas*. Wikipedia describes Raine Island as "the largest and most important green sea turtle nesting area in the world, with up to 18,000 females nesting on the small coral sand cay in one season." The island was named in 1824 after Captain Thomas Raine, Captain of the *Surry* (or *Surrey*) who discovered it in 1815. The island is a vegetated coral cay "composed of a central core of phosphate rock surrounded by sand and extensive fringing reefs".

According to Wikipedia, "Surry, also known as Surrey, had an especially long career transporting convicts to Australia." Also according to Wikipedia, "Raine Island is a vegetated coral cay that is 32 hectares in total area and is situated, approximately 620 km north-northwest of Cairns in Queensland, Australia, about 120 km east-northeast of Cape Grenville, Cape York Peninsula". Also, "Raine Island is the site of the oldest European structure in tropical Australia, a stone beacon built in 1844". This 12m high 'stone beacon' is an old navigation tower built in 1844 under the order of the British Admiralty.

As described in the February 2018 issue of "Dive Log" magazine, the beacon is regarded as "the oldest European structure in the northern tropics of Australia". Twenty convicts were taken to Raine Island onboard HMS *Fly* to build the tower in 1844. Some were actual stonemasons, whilst others were simply labourers. The tower was built there to enable ship captains to approach the outer reef with confidence. The island was at the entrance to one of the safer passages through the outer reef. Stone from the phosphate rock was quarried and cut on the island to build the tower. Mortar was made from local shells and timber was scavenged from some of the many shipwrecks that occurred in the area, mostly in the 1800s. The HMS *Pandora* was one such wreck. It took them some four months to complete the work, under supervision of some soldiers from New South Wales. It seems that some of the convict builders carved their names into the tower's stonework.

The tower was originally topped with canvas. It was visible from some 13 or 14km away from the deck of approaching vessels, but it was never, ever lit it seems.

This image by Xanthe Rivett of the Silentworld Foundation shows the Raine Island beacon: -

Raine Island Beacon *(Taken by Xanthe Rivett, Silentworld Foundation) (Source: https://anmm.blog/2013/12/07/ferguson-reef-archaeology-expedition-25-november/)*

The webpage found at https://anmm.blog/2013/12/07/ferguson-reef-archaeology-expedition-25-november/ describes the tower as a "14-metre high stone navigational tower and shipwrecked sailors' refuge".

In his book titled "The Great Barrier Reef, James Woodford says that marine biologist Isobel Bennett described the tower as having been built to a "plan by the (HMS *Fly*'s) carpenter, a solid five-foot thick circular tower, 64 feet high ….. its walls of 'stone' being quarried out of the solid reef".

If the Great Barrier Reef is truly priceless, shouldn't we be charging people more to visit?

By Michael Vardon, Australian National University

The Great Barrier Reef is one of the world's finest natural wonders. It's also extraordinarily cheap to visit — perhaps too cheap.

While a visit to the reef can be part of an expensive holiday, the daily fee to enter the Great Barrier Reef Marine Park itself is a measly $6.50. In contrast, earlier this year I was lucky enough to visit Rwanda's mountain gorillas and paid a $US750 fee, and the charge has since been doubled to $US1,500.

To me, seeing the reef was better than visiting the gorillas. Personally, I would be happy to pay more to visit the Great Barrier Reef. Does this mean we're undervaluing our most important natural wonder?

And if we do ask visitors to pay a higher price, would it actually help the reef or simply harm tourism numbers?

Earlier this year Deloitte Access Economics valued the Great Barrier Reef at $56 billion "as an Australian economic, social and iconic asset", but was met with the retort that its true value is priceless.

The $56 billion estimate was based on surveys that measured "consumer surplus and non-use benefits". This common research technique involves asking people what they would be willing to pay to get a particular benefit.

For example, the entrance fee for the reef is $6.50 but if I am willing to pay $50 (say) that equates to a consumer surplus of $43.50. In other words, I am receiving $43.50 worth of value that I did not have to pay for.

I understand that some people instinctively object to the idea of trying to put monetary values on things like the Great Barrier Reef. But I think valuation helps, on balance, because it offers a way to assimilate environmental information into the economic processes through which most decisions are made.

Money makes the world go around, after all. However this should be done on the proviso that the valuation is systematic and based on sound environmental and economic data.

The process by which these values are calculated is called "environmental accounting", and estimates have to meet international standards known as the System of Environmental-Economic Accounting or SEEA in order to be valid.

This builds on the System of National Accounts (which among many other things gives us the GDP indicator). In this accounting, as in business accounting, the values recorded are exchange values — that is, what someone paid (or was likely to pay) for a good, service or asset. For assets that aren't regularly traded, this figure can be based on either previous sales or expected future income.

It does not use willingness-to-pay measures. The Deloitte report also estimated exchange values in line with accounting values,

with the Great Barrier Reef contributing $6.4 billion to the economy through tourism, fishing, recreation, and research and scientific management.

The Australian Bureau of Statistics has a huge amount of data on the Great Barrier Reef, covering the physical state of the reef and its surroundings, the economic activity occurring in the region, and more besides.

Unsurprisingly, tourism is the region's most valuable industry, contributing $3.8 billion in gross value added in 2015-16. That year the Marine Park had 2.3 million visitors, who together paid just under $9 million in park entry charges.

Ecosystem services are the contributions of the natural world to benefits enjoyed by people.

For example, farmers grow crops that are pollinated by insects and use nutrients found in the soil. These things are not explicitly paid for, but by examining economic transactions we can estimate their value.

Surprisingly, the value of ecosystem services used by tourism was $600 million — just half the value of the ecosystem services used by the agriculture industry.

The result is partly explained by the way things are valued. Agricultural products are bought and sold in markets, whereas the Great Barrier Reef is a public asset and the fee for visiting it is set by governments, not by a market. On these numbers, paying $6.50 to visit one of the great treasures of the world is a bargain indeed. But what does it mean for the reef itself?

The reef is under pressure from many factors, including climate change, nutrient runoff, tourism impacts, and fishing. Managing the pressure requires resources, and it makes sense to ask those who use it to pay for it.

Increased funding to help manage these pressures would therefore be good. What's more, governments could conceivably also use natural resources to generate money to fund other public goods and services, such as roads, education, health, defence, and so on.

Before you protest at this idea, ask yourself: why should the Great Barrier Reef not be used to generate revenue for government? Other natural resources are used this way.

The federal and Queensland governments are pursuing economic benefits from the coal in the nearby Galilee Basin. If government revenue from the Great Barrier Reef were increased, it might reduce the need for revenue from elsewhere.

Environmental accounting offers a clear way to assess such trade-offs, and will hopefully lead to better decisions. To achieve this we will need:

- Regular environmental-economic accounts from trusted institutions like the ABS;
- Governments and business to incorporate this new accounting into their strategic planning and management (including, in the case of the Great Barrier Reef, assessing the likely revenue from increased marine park fees); and
- The public to use the accounts to hold our government and business leaders to account.

The last will no doubt make some uncomfortable, while the second will take some time. The first is already a reality.

I hope others take the time to understand and analyse the accounts already available, and that we get as much debate about managing the environment as we do about managing the economy.

Originally published in The Conversation

Low Isles Reef, palm-fringed holiday oasis

A frequently visited inshore area of the GBR is the Low Isles. It is close to Port Douglas and relatively easy to get to in the tourist yachts that offer regular services. It's a nice way to see the inner reef soft corals.

Photos Cairns Dive adventures, http://sailawayportdouglas.com, Calypso reef cruises, capeyorkaustralia.com

The Low Isles are a good holiday spot if you are prone to seasickness as it isn't far from port and there is good shelter for boats on the NW side of the reef. It isn't as packed and bustling as inshore places like Green Island.

It offers the usual services, glass bottomed boats, beach shelters, water activities, but even then it looks more like a postcard deserted isle than most places on the reef.

The isle is marked by a prominent 18 metre high lighthouse. The reef dries at low tide, particularly on the W & SW end and is good for reef walking. Low Isle is connected to the mangrove swamp on nearby Woody Isle by a low shingle reef.

It has been the site of research expeditions since the 1920s and has had an up and down track record as far as reef condition goes. In 1928, scientists observed coral bleaching affecting the shallows around the isle. On the plus side this reef was undamaged by crown-of-thorns starfish up to 1970.

Forty species of coral have been recorded with the Low Isles having unusually high species diversity for this area. Sediment levels are generally high everywhere inshore but here there is plenty to see In 1983 there was less than 5% hard coral cover and 50-90% soft coral cover in large beds. Any hard area which was not covered by hard or soft corals mostly was carpeted with

equally colourful encrusting zoanthid anemones. The most common corals were branching and tabular Acropora , small massive Porites, Goniastrea, other favids and Goniopora.

Since the early 1980s the reef provided very good diving. It also was also heavily used by reef walkers and snorkellers. On average, 75 tourists/day were visiting the reef on the small ferry "Martin Cash". Since then, the boats have gotten a lot bigger.

The reef was highly valued as a shell collecting site prior to the park being declared, which has affected shell numbers.

The general consensus is that its best days might be past. Until recently, it offered very good snorkelling on colourful soft coral gardens. Unfortunately, many of these have been damaged by recent bleaching events. Hopefully, that disturbance is only temporary.

One on-line comment seems to sum it up,

"I had done the same trip 6 years ago and I noted a significant difference in the state of the corals. Gone is the abundance of the colour, most of the coral looked brownish and colourless with only a few colourful spots in between. There are fish and turtles, so you still see a lot of wildlife, but it was very different to my first trip." It's in a protected sanctuary zone and hopefully one day it will come back to its former glory, although there are still plenty of things to see even now. No natural place ever completely dies, as much as we might try to kill it.

The loneliest bird in the world dies

A gannet dubbed the world's loneliest bird has died on a New Zealand island surrounded by his concrete companions.

The New Zealand Department of Conservation built a concrete gannet colony was on the island to encourage the birds to settle there. Encouraging seabirds to Mana Island is a major part of the restoration project there, as their burrows create ideal homes for lizards, tuatara and insects.

From 1998, after rats were eliminated, conservationists have attempted to restart a colony, using a false colony of birds made of concrete, and installing sound systems that make gannet sounds. A male gannet, nicknamed Nigel, arrived in 2013 and over the next five years courted one of the concrete decoys. In January 2018, three gannets settled on the island. 'No Mates' Nigel, appeared to have taken a shine to one statue in particular. Nigel remained committed to the concrete replica. In February 2018, Nigel died.

While it was sad for one bird recent projects have successfully translocated diving-petrels, fairy prions and fluttering shearwater chicks. The first seabirds to breed on Mana Island for many centuries.

The seabird translocation techniques perfected on Mana Island are also being used with rare and endangered species elsewhere in New Zealand, such as the Chatham Island taiko, Chatham petrel and Hutton's shearwater.

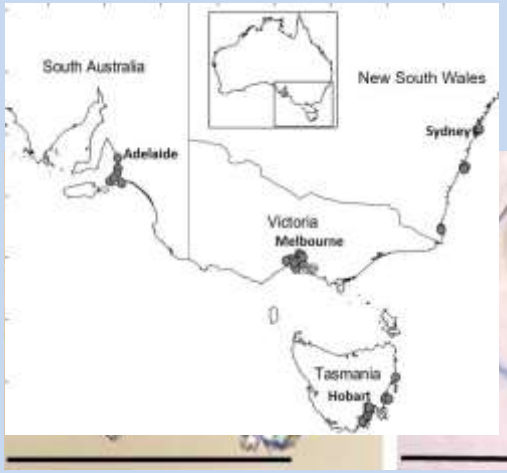
Microplastics are everywhere

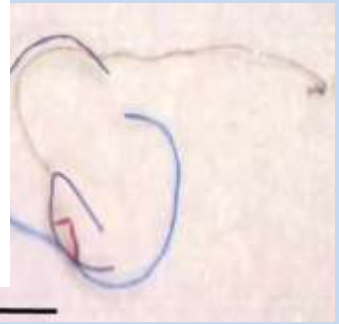
Microplastic pollution is widespread

Source: "Ubiquity of microplastics in coastal seafloor sediments" S.D. Ling, M. Sinclair, C.J. Levi, S.E. Reeves, G.J. Edgar Institute for Marine & Antarctic Studies

A new issue in ocean conservation in the 21st century has been the issue of plastic rubbish. About 250–300 million tonnes of plastic are produced per year and plastics are the most abundant type of marine litter, found everywhere from the deep ocean to the Arctic.

The largest pieces of plastic debris have long been known to affect seabirds, turtles, whales and dolphins. Recently we are also becoming aware of a threat from tiny (≤5 mm diameter) microplastic particles. These are created when larger plastic items break up, or from products made with plastics such as "micro-beads" in detergents and cosmetic. Ocean plastics are becoming smaller and more widespread. Up to 70% of this litter will eventually sink to the bottom and remain in marine sediments. Inspection of the gut contents of many marine species show that ingested microplastics are common in marine animals.





While there are a few studies on the amount of microplastics on beaches and near sewerage outfalls, there haven't been too many studies on what happens when they float off sink to the bottom. Tasmanian scientists have recently been scooping up the mud at 42 sites around South East Australia. These sites were a mix of your typically polluted city river, but also included you favourite coastal holiday town. It was expected that the really polluted cities would show the biggest results, but the big surprise was that this didn't happen.

The results were that microplastics are basically found everywhere. Only 2.84 litres of sucked up sediments contained 9552 individual microplastics (tiny bits of plastic 0.038–4.0 mm in diameter), an average of 3.4 microplastics·per millilitre of sediment. These microplastics included tiny little beads, but most (84% of total) were made up of tiny plastic filaments.

South Australian samples had the highest average abundance of total microplastics per ml of sediment, followed by NSW and then Victoria.

While Tasmania had the lowest results, it had the most polluted of the sampled sites. This was the 'pristine' coastal town of Bicheno, mostly appearing to be decaying plastic rope used in the local fishing fleet.

The way they were deposited on the bottom had more to do with the way that the waves had pushed them around the coast and

up against the shores where they broke up and sank. These coastal reef and beach areas also tend to be favoured by filter feeding invertebrates like sponges. It's likely that they are sucking up some of these microplastics in to the food chain. The most shocking result of this study is that microplastics are effectively everywhere and that can include your favourite beach holiday site that otherwise looks totally clean.

This isn't the type of rubbish we can easily remove just with a sausage sizzle and a litter drive (although that will help to at least make the beach look nice). We have to be more choosy about how we make, use and discard some of our most useful common products.

South Australia's rare pipehorses

South Australia has some unique habitats including narrow and shallow gulfs that are home to rare species. SA is particularly rich with species of pipehorse, some found in no other place.

Sources Rudy Kuiter, Fishes of Aust, Aust Museum

Vercos Pipefish

This pipehorse is only found in the temperate inshore waters of South Australia, from Rosetta Head, Encounter Bay to the central Spencer Gulf, including Kangaroo Island. It may also occur near Whyalla in the northern part of Spencer Gulf. It like shallow seagrass and seaweed beds. It feeds on small crustaceans like mysid shrimps. It is about 15cm long. Like all seahorses the male looks after the young.

Brushtail pipefish

This pipefish inhabits inshore sheltered shallow seagrass beds. It is quite big, reaching 65 cms. While found throughout southern Australia it has a stronghold in SA.

Dive Safety conversation - diving with Adam Myway

You don’t want a lecture about dive safety, but we do have to talk about the rising incident rates affecting older and more experienced divers. IMHO complacency is one of the major factors in many recent dive incidents.

Our fictional diver, Adam, has been diving for a while and he's keen on the subject of diving. He talks about it every weekend, but actually gets wet a lot less than that. He has built up 4 lifetimes worth of tales of brave daring do.

He has a few faults but isn't a bad guy. He is a bit too self-centred, stubborn and isn’t always so generous with his time. He has a wife who worries about his diving, but he doesn't, as he's been doing it for years and it has become "easy".

His older kids think Dad, and his diving, are a bit daggy. If they did go diving it wouldn't be with him. They have a few experiences of his impatience on past beach holiday snorkelling trips. He's a sound family guy though.

He has endured a boring job to keep up with the mortgage payments and while he's happily uninterested in what might be coming across the horizon, he can predict that the bills will always keep coming. When the weekend comes he doesn't want any more "bulldust" in his life.

Let's interview him;

What are we here on Earth for Adam? "To have fun diving, obviously. For God's sake what's wrong with you man?" Ha Ha.

That's great, but isn't something missing? Mmmm I suppose you want me to say 'having fun diving AND coming home safe and sound'.

Who causes the safety problems in diving? New divers! Panicky, needy and slow. But I have a system that deals with that, I ignore them. Ha Ha. They probably don't like it but bugger 'em. Some guy in our group usually looks after them. Not my problem.

Weren't you a new diver too at one time? No, I was born the ultimate diver, it's genetic, I was looking for crays in the womb Ha Ha. Mmmm…or maybe I've just blanked out the whole bad experience of being shunned. Stop talking about it!

Do you still do the basic safety things you were taught in your course like buddy checks? I know how to dive without needing all that. So what if I forget my air and weight belt sometimes, even if that holds everyone else up. Have they got a bus to catch? If others have a problem like that they should learn how to sort it out for themselves.

Buddy procedures what are they? I stick with my buddy for the first 10 minutes no matter what, then it gets too hard if you are after crays or photos. You don’t need a buddy, I did a survey once and all my 3 friends agreed you are safer learning how to be self-sufficient than having a buddy. The 300 scientific papers that say otherwise are all crap.

How fit are you? Pretty fit I think, father had a heart attack at 50 but so far I feel fine, touch wood. Lucky, 'cos I can't be bothered with check ups. I do a dive every 3 months and do stamp collecting for exercise. Except when I'm busy, then I have to cut back on the stamp collecting. Ha Ha.

Do you have any special safety procedures? Sounds like work. I have a gadget built in the tropics that says I can do long dive times without doing safety stops. It's 10% better than my last one as it lets me dive 10% longer.

Do you come back to the boat with a 50 bar air reserve? And waste 10 minutes of a good dive! That air cost me $1.00. What can go wrong?

Are you happy to be boat lookout, or do other things for group safety? Errr yeah, I suppose I could. Dive lookouts are great, you can swim off for miles looking for crays and some do-gooder bloke in the boat will pick you up, unless there is a big current. I suppose I could tell the lookout where I'm going and not go so far, but he finds me eventually. It's a bit inconvenient for me to miss a dive though. I don't get much time off work and being the boat bitch is boring. Isn't that your job? You look like you enjoy boring, Ha Ha.

Is all your gear in good order? I get my reg and tank serviced regularly. First aid kit, I think that's in the car, or was it my last car? Radio is a bit dicky and the outboard splutters sometimes. I'll get to that. The dive ladder catches fingers, but that's not a problem as I've learned to watch out for it and I usually brief people to mind their fingers, usually.

Do you talk about safety stuff before and after the dive? We know what we are doing. If someone does something stupid we call him a "f-------g d--------d", problem solved. If someone criticises me (they call it "making suggestions" the idiots), I tell them to bugger off.

So safety is a second thought? How dare you! You sound like my wife. The divers who have diving accidents aren't as experienced as me. They are all idiots who stuff up. Really, dive accidents aren't that common. It can't happen to me. Buddy safety, that's their problem. Go away, I don't want to think about it.

Have you ever had a problem? No, of course not…except for that one time, but after the young bloke in the boat swam over to support my head, and I had O2, it wasn't really an issue. I know what you're after. Stop it.

Did you offer to be the lookout for him then after that and do some rescue training yourself in case he needed help? Look, I said thanks.

Who do you dive with usually? People like me. That way we all agree and never have to waste time thinking too hard, or wasting too much time on "details". It's really "comfortable". But, there aren't many of my buddies left now. A few have taken up golf when their backs got dicky, or they have moved to the mainland.

Lately, have you had any new people joining in? Mmmm, well there was this one guy for a while? He was fun, a real laugh. A new face made the dives a lot better. Then he just left, never said why. When was that? Anyway, aren't we talking about safe diving? What's having fun got to do with safety?

Adam is an amalgam of myself and a few experienced divers I know, hopefully he seems a bit extreme to you, but I've been given these types of answers in real life conversations. Actually I've had a version of this type of conversation several times with several people, often with more hostility and way less good humour.

Flotsam

All sorts of weird things have been washing up lately

Shipping container hazard

On January 22 this year a container was seen adrift approximately 650 kilometres off the Queensland coast. It took a few weeks for it to arrive 30 nautical miles north-east of Mooloolaba on the Sunshine Coast. A few days later the Maersk container came ashore on Moreton Island, paint peeling and with barnacles crusted on.

Containers lost at sea pose a risk to mariners.

In 2016, the international liner shipping industry transported approximately 130 million containers. Shipwreck, severe weather and rough seas cause losses and some wilder claims say 10000 are lost overboard every year. The World Shipping Council estimates that there are an average of about 1,582 containers lost at sea each year but only 568 from causes other than shipwreck.

As ships are now so huge, only a few mishaps can bump up the figures. In 2013, there was a total loss of 5,578 containers – 77% were just from the sinking of the "MOL Comfort" in the Indian Ocean.

They weigh about 20 tonnes if they are fully laden and are very dangerous to hit at sea. A 20-foot container can float for up to 57 days while a 40-foot container will float more than three times as long. They will generally float only 18 inches (45cm) above water and don't show up on radar. They can be hard to see at night.

Every few years a cruising yacht or trawler hits one catastrophically, but statistically hitting a whale or floating log is more of a risk.

The take home message is slow down and be careful. You will be doing the oceans a favour in reducing boat strike on marine mammals as well as helping yourself by not wrecking your boat and killing yourself.

Mass Whale Stranding in SW WA

In one of the largest mass strandings of its kind, almost 150 short-finned pilot whales that stranded at Hamelin Bay — about 300 kilometres south of Perth. Despite a large rescue effort most died. The natural features of Hamelin Bay may have played a role in the strandings according to wildlife rangers, "Pilot whales [are] typically an offshore species that is diving in water of several hundred meters, so they're not as familiar with shallow environments, and that can potentially get them into trouble," he said. On the same day in 2009 more than 80 pilot whales and dolphins died in a mass stranding at the same location.

Daphne duck found near Rottnest Island

A giant yellow inflatable duck missing at sea off Western Australia was found near Rottnest Island. Daphne was meant to be a mascot for the Coogee Jetty to Jetty Swim. The duck was blown into the Indian Ocean by strong winds.

Messages in a bottle

People have been putting messages in bottles forever. In 310 BC, Greek philosopher Theophrastus put sealed bottles into the sea as part of an experiment to prove the Mediterranean Sea was formed by the inflowing Atlantic Ocean. Recently, in WA a 138 year old message in a bottle was found in the dunes at Wedge Island, 180 kilometres north of Perth.

The message was dated June 12, 1886, and said it had been thrown overboard from the German sailing barque "Paula", 950km from the WA coast.

From 1864 until 1933, bottles were thrown overboard from German ships as part of an experiment by the German Naval Observatory to better understand global ocean currents. On the back, the message asked the finder to write when and where the bottle had been found and return it.

The German Naval Observatory's founder, Georg Neumayer, had an Australian connection. In 1857, with the financial support of King Maximilian II of Bavaria, he founded the Flagstaff Observatory for Geophysics, Magnetism and Nautics in Melbourne, which he directed until 1864. He also went on numerous expeditions into the interior.

In 1864 he returned to Germany and suggested the creation of a German *maritime watch*. Teaming up with Wilhelm von Freeden, the *North German Seewarte was* founded a few years later. They set upon the idea of using messages in a bottle to plot the world's ocean currents.

Experts estimate that the probability of a bottle message being found undamaged is about ten percent, but about 660 bottle messages have been found and returned.

The Observatory still exists as the Federal Maritime and Hydrographic Agency of Germany (*Bundesamt für Seeschifffahrt und Hydrographie*, BSH) and is still responsible for maritime safety, hydrographic survey, maritime pollution monitoring, and approvals of offshore installations.

Messages in bottles have been replaced by other methods, like free-drifting scientific instruments. About 3,300 ocean floats are drifting in the oceans as part of the global ocean observing programme "Argo" . The BSH still deploys about 50 Argo floats a year.

Sailing robots to collect data

The CSIRO has three new sail drones to collect scientific information from the surface of the ocean.

The wind and solar-powered robots need no fuel. The sailing bots were equipped with sensors and record ocean chemistry, temperature, salinity and marine life.

Saildrone Founder Richard Jenkins said, "We don't have a control centre, we have an iPhone, we have a web app that controls the drone and tells it where to go." Two of the sail drones have gone to the Gippsland Basin, while the other one will go to the Southern Ocean. The three sail drones could be at sea for up to 12 months before returning to Hobart.

Macquarie Harbour still damaged

Source: IMAS, DPIPWE, EPA, ABC

The environmental condition of Macquarie Harbour still a problem despite recent action to reduce fish production.

Macquarie Harbour, is a huge and partly enclosed waterway on the west coast of Tasmania. The harbour circulates it waters slowly and in a complicated way due to a narrow entrance to the ocean and the interaction of freshwater inflows.

The Tasmanian Wilderness World Heritage Area (TWWHA) encompasses approximately the southern third of the harbour, with fish farms taking up much of the middle harbour.

Finfish aquaculture in Macquarie Harbour began in the 1980s. Annual production was under 2000 tonnes until 2005, when production began to steadily increase. In May 2012, the Minister approved an increase in the marine farming from 9000 tonnes to 21,500 tonnes.

In late 2013, the EPA water quality monitoring program identified a long-term trend of declining dissolved oxygen (DO) in the deeper waters of Macquarie Harbour. Fish farm production continued to grow and peaked at 20,000 tonnes in January 2015.

In Spring/Summer 2016 high temperatures in the harbour, combined with overstocking of fish farms and ongoing declines in dissolved oxygen levels, led to a severe deterioration of conditions in Macquarie Harbour.

The water was starved of oxygen, seafloor species diversity declined (it is relatively quite low normally), and large mats of bacteria formed under the pens and were now spreading up the harbour and into the World Heritage Area. Fish farming is now potentially threatening the rare species occupying the shallows of the middle and upper harbour, such as the Maugean Skate

After the blaze of publicity in late 2016, production fell to 16,000 tonnes. The biomass cap was further reduced to 14,000 tonnes, then recently to 12,000 tonnes.

The head of the state's Environment Protection Authority (EPA) finally unequivocally admitted that the science behind the decision to massively expand fish farming in Macquarie Harbour was wrong. The Institute of Marine and Antarctic Studies recently released a study showing oxygen levels in the harbour are still very low. Recent harvesting has reduced stock to currently about 7,000 tonnes, 2000 tonnes less (at least temporarily) than before the expansion.

All three of Tasmania's salmon companies farm in Macquarie Harbour and all have had pens affected by pilchard orthomyxovirus, or POMV, this summer. In November, the virus killed about 50,000 juvenile salmon from Petuna and Tassal's leases in the harbour. In December, Petuna culled 100,000 fish to stop the spread of the virus.

Legal action has also been underway involving the three big salmon companies. Huon is after damages arising from the 2012 decision of the then-federal environment minister to allow salmon farming expansion. According to Tassal, the action is motivated by a dispute over profits and not the harbour's environmental health. According to Tassal, until recently Huon had complained about the allotment of stock in the harbour, and not environmental concerns. Tassal said Ms Bender's end game was for the decision to be overturned, and the stock levels to be re-visited in Huon’s favour. Huon strongly rejected these claims.

Whatever the result of the court action it looks like low stock and oxygen levels in Macquarie Harbour are here to stay for the foreseeable future.

Lack of cool is the issue for Tasmania's summers

Allen et al

A reconstruction of the last 1000 years shows that Tasmania's summers lack cool years rather than being exceptionally hotter.

Since 1910 Australian temperatures have increased on average by ~ 0.9°C, and much of this increase has been sustained since 1970. Temperatures will continue to rise and hot days will become more frequent and hotter. What is less clear is whether warm conditions have occurred in previous centuries. Without exception, reconstructions show a strong and sustained temperature increase since at least the mid-20th Century.

A recent study has attempted to reconstruct a record of the summer temperatures for the Southern Hemisphere. They use information from 1000 year old tree ring records including Huon Pines in Tasmania.

The reconstructions show that for numerous individual years, especially in the 15th - 17th Centuries, we had temperatures that were comparable with those of the late 20th Century. The 1950-1999 period, however, stands out as the warmest 50-year period on average for the past 979 years, with a sustained shift away from relatively low mean temperatures, the length of which is unique.

Although the warmest summers of the post-1950 period are not unprecedented in the past millennium, the near complete absence of relatively cool summers is unique to last 50 years of the 20th Century. What we have in Tasmania at least, is not just unusually hot summers, but more noticeably summers that just aren't ever cool.

Another interesting finding was how well using living and fossilised Huon Pine tree rings matched up with other temperature reconstructions.

The study used Tasmania's 10,500-year-old stand of Huon Pine at Mt Read near Rosebery - the world's oldest clonal tree.

Discovered in 1995, the ancient Huon Pine has grown over more than a hectare, reproducing genetically identical male clones of itself. While the oldest individual tree or stem on the site now may be 1000 to 2000 years old, the organism has been living there for 10,500 years.

Tasmanian seaweed pest helpful against cancer

Source Mercury, seatechbioproducts.com

Test on animals at the University of Texas have found extracts from two pest seaweed species reduce tumour growth in select cancers.

Undaria pinnatifida is a pest in Tasmanian after it was first identified off the state's East Coast in 1988. It was introduced by ballast water from Asian bulk carriers using the nearby pulp mill at Triabunna.

An extract from this pest has been found to have medicinal properties. Ingestion of the fucoidan extracts decreased the growth of a human ovarian cancer tumour by up to 33 per cent and a human cervical cancer tumour up to 70 per cent.

Researchers found fucoidan improved the effectiveness of the drug for breast cancer. It decreased breast cancer tumour growth by up to an additional 26 per cent (when taken alongside tamoxifen).

The extract called fucoidan has the potential to be used as a complementary cancer therapy rather than a magic cure.

Marinova chief scientist Helen Fitton said the research was groundbreaking.

"These results show the potential for fucoidan to help restore functional immunity in cancer patients," Dr Fitton said

"To have identified a safe, natural compound that has such a significant effect on immunity in an oncology setting is really quite remarkable."

It is also edible and has some health benefits. Wakame (Undaria pinnatifida) has a high total dietary fiber content and the fat content is quite low. The seaweed is relatively rich in vitamin B. Raw form contains appreciable amounts of trace elements such as manganese, copper, cobalt, iron, nickel and zinc.

It is a native to Japan, the Republic of Korea and China. It grows on rocks and reefs in the sub littoral zone, down to about 7m. It has been spread, probably via ship ballast water, to France, New Zealand and Australia.

This isn't the first attempt to find commercial uses for this pest species, which has invaded disturbed kelp beds on the East Coast of Tasmania, displacing native species.

It possibly won't lead to the pest being controlled or eradicated, but its at least some compensation for that ecological damage.

Shellfish reef habitat

I've tended to see sharp foreshore beds of feral Pacific oysters as a pest habitat. Apparently oyster beds are more natural than they seem, a component of our ecosystem that we have destroyed and no longer remember.

Source: Australian shellfish ecosystems: Past distribution, current status and future direction, Gillies et al

Oysters and mussels create habitat for a range of other species. They can form reef structures of living and dead shells. Shellfish ecosystems provide food, habitat, water filtration, fish nurseries and shoreline protection.

Once covering vast areas of coastal waters, shellfish ecosystems have been decimated globally. Over 85% have been lost or severely degraded through fishing, water pollution and disease.

Generally, shellfish ecosystems occur in bays, estuaries and nearshore coastal waters in both tropical and temperate regions across every state within Australia. Only *O. angasi* and *Pinna bicolor* can form reefs or beds down to a depth of tens of metres in oceanic waters.

Nine oyster and five mussel species are likely to form defined reef or bed ecosystems including *Crassostrea gigas* (Pacific oyster) an oyster introduced from Japan in 1947 for the purposes of aquaculture. In south east Tasmania they have taken over the spots vacated by native oysters, although they also took over the last of the native oyster beds and have caused the already depleted beds near total loss.

Shellfish have historically been an important food source for Indigenous Australians, with shell middens dating back at least 6,000 years. James Cook provided the first European account of extensive oyster reefs in Botany Bay in 1777. Several other early explorers also documented extensive reefs in locations such as Port Phillip Bay, Streaky Bay, and Oyster Harbour, Western Australia.

Native oyster species were commercially harvested by dredge and hand methods from first European settlement in Sydney in 1788. These fisheries spread as local resources became depleted and demand increased.

Today, only a single *O. angasi* (native oyster) reef system is known to exist that is comparable in size to reef systems historically harvested, of the at least 118 previously harvested locations. Less than 1% of *O. angasi* reef systems and 8% of *S. glomerata* reef systems still remain.

Several authors have attributed the primary cause of decline for *O. angasi* and *S. glomerata* reefs to overexploitation largely through dredge harvesting during the mid to late 19th century. Dredging directly removed adult shellfish, and thereby reducing the spawning stock, and also removed, broke up, or buried shell material inhibiting spat settlement.

Oyster populations were severely reduced in New South Wales estuaries during the 1850s-1870s through a process referred to

as skinning, where live oysters were raked up to supply lime kilns in Sydney and Newcastle.

Increased sediment loads into coastal waters resulting from land clearing could also have contributed to reef burial. Many estuaries along the east coast of Australia have been affected by acidification caused by the disturbance of acid-sulphate soils brought about by land use changes.

Invasive animals and new diseases may have also contributed to shellfish ecosystem decline. One oyster dredging company undertook a large restocking exercise in Western Port Bay, Victoria in 1861. Subsequently, all stocked reefs and surrounding natural reefs died mysteriously in 1862, possibly through the introduction of a new disease (e.g. the parasite *Bonamia* sp.).

Some scientist attributed the collapse of subtidal oyster reefs in eastern Australia to mud worms, possibly introduced from New Zealand with live oyster imports in the 1880s.

English biologist William Saville-Kent tried replenishing oyster populations in estuaries using primitive aquaculture methods, but without much success.

The commercial harvest of wild shellfish ecosystems has since ceased in all Australian states except Tasmania where a small hand harvest industry still exists.

We therefore recommend the expansion of research into the current distribution, ecology and function of Australia's shellfish ecosystems in order to inform appropriate levels of conservation.

Restoration projects are planned in all states (except the Northern Territory) and several have already been implemented with the assistance of private, government and non-government funding. A national network of practitioners, The Shellfish Reef Restoration Network, has been established to help support protection and restoration efforts.

Three key actions are needed:

1. Raise the profile of shellfish ecosystems by increasing education and communication on their function and value
2. Support protection of remaining shellfish ecosystems and eliminate current and future threats by determining eligibility for protection under Commonwealth and State Government threatened ecological community, flora and fauna and fisheries policies and legislation
3. Invest in the development of early restoration projects to build momentum, expertise and capacity in Australia's marine restoration community

Shellfish ecosystems were once common features in Australia's estuarine and nearshore marine waters and could be again.

NT Coral bleaching

This January coral bleaching has been noted in waters near the Cobourg Peninsula.

Source Jane Bardon

Rangers at the Garig Gunak Barlu National Park on the remote peninsula, about 60km north-east of Darwin, filmed large patches of bleached coral from the air in January, in the same area where they filmed healthy coral in January three years ago.

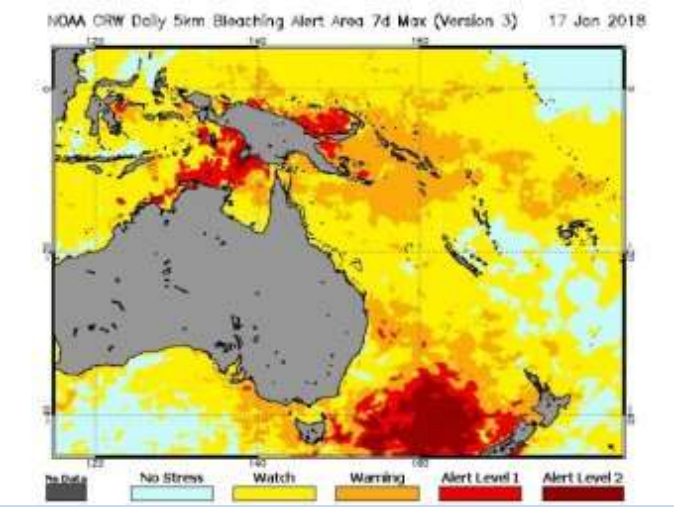
Their finding followed a warning from the National Oceanic and Atmospheric Administration in the USA, that NT waters were on a red alert for water temperature rises of 4 degrees Celsius.

Photo Aust Geographic

Conservationist Adele Pedder said it would be tragic if some of the Territory's remote reefs died before many of them had been explored and studied.

Reefs in the NT's tropical waters were likely to be stressed by continuing sea surface temperature rises as global carbon emissions increase, said Selina Ward, a coral researcher from the University of Queensland's School of Biology.

"We keep having, or almost having, the warmest years on record, so at the moment that's the trajectory that we're on, that we're likely to get more and more bleaching events if we don't reduce our emissions quite drastically," she said. Frequent bleaching events give the reefs less chance to recover, she said.



Marine heat wave alerts issued by NOAA

Dr Ward warned that entire ecosystems dependant on the reefs were threatened by coral mortality.

The NT government said, "We have put funding into researching the mangrove die back in 2016, so we are absolutely committed to making sure the monitoring programs are in place and that we're having a look into the claims of coral bleaching in the Cobourg marine park."

"We are doing everything that we can to provide certainty around major projects, and their impacts on our environment into the future, and we know that climate change is becoming increasingly concerning."

Urchin Barrens in Port Phillip Bay

Starving sea urchins are destroying huge swathes of the bay, a symptom of drought and declining kelp beds.

Photo: Nearmap.com.au

Sea urchins are native to the bay, and normally live in stable numbers. They feed off drifting seaweed. But in about 2007, around Ricketts Point, and at Point Cook and Williamstown, locals noticed there were a lot more urchins and a lot less kelp.

Dr Carnell of Deakin University studied aerial photos, "In some of the images in the 1970s and '80s, you can start to see urchin barrens on parts of the reef, particularly deeper, where people would not have noticed," "But then through the 2000s you see the urchins coming from the deep and just clearing everything. You go from lots of kelp to basically nothing."

The creatures normally mass about two to three per square metre, Dr Carnell found patches of the bay with up to 20 urchins chomping away at kelp.

Dr Carnell believes it may have been driven by reduced rainfall during southern Australia's Millennium drought.

Rainfall washes nutrients into the sea, encouraging kelp growth. Without it, the kelp dies off, leaving the urchins hungry. "They just plough down the kelp," says Dr Carnell. "In 60 years, there has never been this much urchin barren in the bay."

They have taken to urchin smashing 17,000 urchins in a single day. Parks Victoria plans to fund multiple trips out to Point Cook and Williamstown (Jawbone Marine Sanctuary and Point Cooke Marine Sanctuary) over the next two years to see if regular culling can control the problem.

Parks Victoria ranger Emily Verey, said "The damage is quite extensive – it's completely changed the habitat around there." The urchins were everywhere, turning the seafloor into an underwater desert.

I have some concerns about culling a native species that is reacting 'normally' to an environmental cycle. This is the "native" or purple urchin that is normally present in high numbers in this sort of habitat. We cyclically get lots of these types of urchin barrens in Tasmania.

Dr Rebecca Morris, from the National Centre for Coasts and Climate, said "Unfortunately, it takes 10 urchins to eat all the kelp in a square metre, but you only need two or three to stop that area of kelp from coming back," Dr Morris said.

"We have seen a shift in the balance of the reefs in the bay, and some areas seem unable to recover on their own, so they'll need a little help from us. "That's why a culling program is needed. To make a difference in restoring some of this critical habitat, we need urchin numbers to be kept really low for at least two years."

Narooma's marching urchin horde

Meanwhile 'up' the coast in southern NSW, the Narooma News is reporting a different kind of urchin barren.

Conservationists and abalone divers are trying to raise awareness of the black urchin plagues they say could wipe out life on reefs from Sydney to the Victorian border.

The black urchin *Centrostephanous Rogersii* is also called the NSW urchin and is a native to this area. It often causes barrens, and in 1999 it was measured that 50%- 65% of NSW reefs are ordinarily urchin barren. (I say "ordinarily" but we really don't have good baseline information prior to 1999, so we don't know if they that is just something that has arisen since records were kept or whether that is 'normal').

However, this urchin responds well to warming waters and its larvae is riding the Eastern Australian Current and establishing itself further south into temperate regions in massive numbers. It has already obliterated large areas of reef in eastern Tasmania. It is also getting worse in the usually cooler and seaweed dominated southern NSW reefs, with extensive sea urchin barrens dominating reefs at Montague Island, off Narooma, and south to reefs off Bermagui, Tathra, Merimbula and Eden.

Local divers have said that sea urchins are the greatest threat to Far South Coast coastal biodiversity and are creating vast wastelands on offshore reefs, largely devoid of life.

Divers from the Abalone Association of NSW recently culled urchins off the Three Brothers island at Bermagui, thanks to a program funded by the Fisheries Research and Development Corporation.

Similar programs are proving successful further south at Mallacoota and also Victoria and Tasmania *[really!]*, "where purple sea urchins marching south have attacked large kelp forests" *[no they are black urchins not the local purple urchins and the results are that culling won't fix the problem, but it can reduce pressure on small areas of reef such as parks and fishing 'hotspots']*.

Abalone Association of NSW member and Narooma commercial abalone diver, Steve Bunney said action must be taken now. "More research on the problem needs to be done but the present situation is probably the result of ecological processes that have been going on for many years that can be traced back to historical overfishing of the natural predators of the urchins. This has allowed their numbers to explode."

MONTAGUE BARREN: Photo by Jennifer Thompson

He said the only solution was killing urchins on a large scale and then propagating and replanting "cray weed" or kelp and also translocating gastropods such as abalone and turban shells to breath new life into barren reefs.

Mr Barker and the Nature Coast Marine Group provided detailed information for the government's Threat and Risk Assessment last year, as part of the Marine Estate review.

They also want more marine parks to protect urchin predator numbers, but ironically that is causing an issue in other areas. As a native species they are protected from commercial removal in these areas.

Rachel Theodore runs a small business at Tomakin, diving and processing sea urchins for the domestic market. "Our biggest struggle is we are on probably the best piece of coast there is — right here at our boat ramp we can't dive. On rough weather days we have to ship [sea urchins] up from Victoria just so we can keep supply up." I do see the logic though of not overfishing an animal that is native to the area, hence the need for research.

Mr Barker said, "Despite the fact that DPI Fisheries scientists and other experts are well aware of the problem, the government's recently-released draft Marine Estate strategy contains nothing specific aimed at turning this situation around, or even to undertake research into the problem."

"A decline in productivity and diversity is obviously bad for the environment. But there is an economic dimension as well: urchin barrens are bad for the abalone industry and even for the urchin fishery.

"It can't be good for fish populations, since no plants and their associated animal life means no food for the smaller creatures and fish on which bigger fish feed. And that is before we consider the multiple challenges posed by climate change. Something needs to be done."

Keep fighting the good fight. More research and more public pressure to deal with climate change are great ideas.

Dan's Super Photo

Thanks to Dan Monceaux for offering shots of his recent trip to the Tamar, all done on snorkel with a compact, I'm amazed he even spotted this elusive fish.

Longnose Weedfish Heteroclinus tristis

He IUCN says *Heteroclinus tristis* is found across southern Australia, and is most abundant on reefs in Tasmania and Victoria. Although the species may not be uncommon there are few published records, possibly due to the cryptic habitats and effective camouflage of this species in macroalgae-rich reef habitats

Fishing for Urchins

Often cited as a cure for urchin plagues, urchin fishing is financially risky and can even damage the environment if done badly.

Pt Phillip Marine life index, Sea urchin fisheries of NSW and eastern Victoria, Blount & Worthington

One of the issues is that the largest masses of urchin pests often have poor roe quality and aren't always worth fishing. The costs of collection and processing are high and markets are small. Often less dense and rarer species of urchin are more viable to fish and they are easily overfished.

The red sea urchin, Heliocidaris tuberculata, is found along most of the NSW coast, especially between Jervis Bay and Montague Island. Large catches of the red sea urchin were taken during 2000-02, depleting the population by 53% between Jervis Bay and Batemans Bay and 18% between Batemans Bay and Montague Is. Surveys estimated a total biomass of only about 1000 t of red sea urchins, and the stock is only capable of supporting a fishery of 60 t per year.

The black sea urchin, Centrostephanus rodgersii, can be a real pest and has about 20 000 t biomass in fringe areas and 32 000 t in barrens just in NSW. High quality roe exists mainly in the fringe areas where their numbers are relatively normal, rather than in barrens. In barrens, the urchins have competition and are not as well fed. The roe colour is not what restaurants want, meaning that they can be far less profitable to handle.

There are vast numbers of black urchins in some areas of Tasmania, but again not generally of good quality in the massive barrens without manipulating their numbers.

In Port Phillip Bay, the white sea urchin appeared to be present to be dense but with roe of a poor quality. Surveys estimated a total biomass of white sea urchins of about 9000 t.

Experiments in reducing the density of white urchins in barrens improved the yield and colour of their roe when 66% of sea urchins in barrens were removed. This only made them marketable but still not as good as urchins fished from healthy reef. They quickly spawned lots of little urchins suggesting you have to keep up the culling constantly to have a lasting effect. Transplanting urchins on to healthy reef for 'fattening up' also works but involves costly double handling.

In short, urchin fishing isn't yet really firmly established because margins are low and handling costs high. The product is not winning reliable markets, partly due to variable quality, but a lot more work is being done lately to produce better results.

It is a lot easier to fish healthy reef than tackle massive barrens.

Stopping the problem from occurring in the first place is the real solution.