
MARINE Life
Autumn 2020
COVID19 Free Edition
(it comes at no extra cost)

Cover photo

Milford Sound NZ, back when you could go there, all those distant few weeks ago. Now, if you can drift ashore on an abandoned cruise liner, you would still have to self-isolate for two weeks in a 5 star hotel, and whinge about the lack of room service.

Editorial

Because Marine life HQ is in a secure location, in room lined with toilet paper soaked with hand sanitiser, we have the security needed to flippantly offer up another meagre edition.

Please do not be concerned, the digital edition was sprayed with disinfectant first and then we waved toilet paper around. Apparently that helps. Still, I'd maintain a distance of 1.5 metres from it and open the windows while reading.

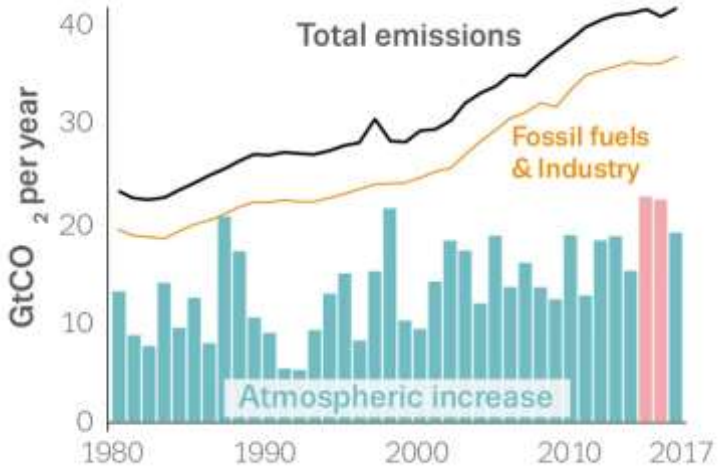
If you are reading this, the whatever hasn't disabled your sense of humour or ability to gaze in awe at the wonder of things. OK, from the inside of a window but not for much longer.

This time we couldn't spend all our energy vulgarising news feeds and scientific papers, as we had to spend quite a bit of time collecting Donald Trump's virus response statements (to hoard them as emergency toilet paper). This done, we still had enough mental clarity to offer up some relaxing, old fashioned environmental apocalypse. Ah, the old days!

On the up side apparently we are now fixated with science based policy and are willing to go as hard as we need to, to deal urgently with threats to our economy and family well-being. Climate change action is looking like a shoe-in now, surely we would follow the same logic for a more slow moving but even more devastating threat?

UNDERSTANDING CLIMATE CHANGE

Some Climate change Facts



What does CO2 do?

Carbon dioxide (CO2) in the atmosphere is essential. It's like a woollen blanket around the Earth preventing all the sun's heat from reflecting back into space and leaving the Earth freezing cold and uninhabitable. In the past this CO2 level has been in a 'sweet spot', making everything not too cold - not too hot.

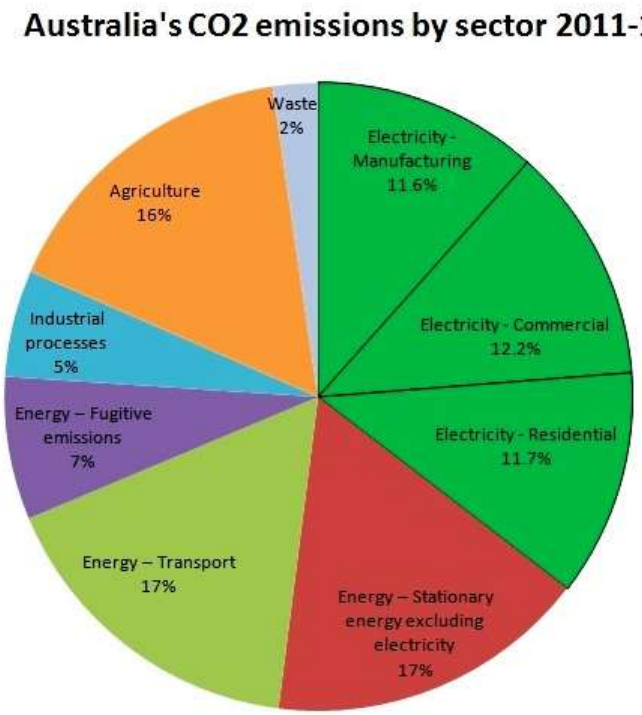
Where does the extra CO2 come from?

By burning coal and oil we are supercharging the atmosphere with extra CO2 and we are quickly going to make the earth too warm. We aren't talking nice summer weather, but changing rain patterns and failing crops, melting ice caps and rising sea levels, acidic seas and very large numbers of species extinctions. It will

cause lots of damage and, if it gets bad enough, it may threaten our survival too.

How much CO2 are we making each year?

40 billion tons (Gigatonnes) of CO2 is currently being added to the atmosphere annually. In 2010 it was 33 billion tons. The problem is not that we burn fossil fuels, it is that we have been using far too much of it in the post WWII era and the emissions have been increasing.



How much CO2 is Australia adding?

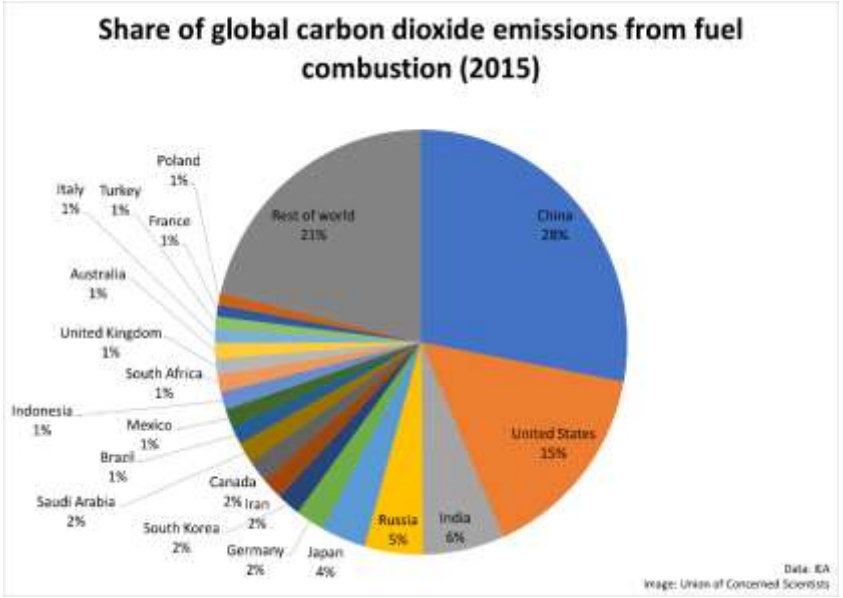
Australia isn't a really big country but it has one of the world's highest per capita emissions of CO2 0.3% of the world's population releases 1.3% of the world's greenhouse gases.

Whatever we do its small compared to China and the USA?

This is a common excuse for inaction, even in the USA. The smaller countries together emit more than China. Everyone can do something.

Can we fix it later?

CO2 can stay in the atmosphere for thousands of years, the longer we wait the greater the damage.



How much am I adding?

Australians each create 18.3 tonnes CO2 per person per year. You can check your carbon footprint against the average using on-line apps, try this one maybe,

https://www.carbonfootprint.com/calculator.aspx

Isn't it too hard?

No, we can all do something positive. Hawken's book "Drawdown" identifies significant changes we could make. The top ranking one is a simple as making changes to refrigeration technology. You can do lots of things at home too, that are good for your health and your pocket, such as cutting back on red meat and not wasting food.

Can we have a more mature conversation about these issues?

We have been hoping and wishing on something like an easy technological fix, or that if we ignore it, the problem will go away. Many voters have been frightened about the costs in money and jobs from making adjustments, without knowing what they really are, or thinking about the costs of the longer term impacts of inaction.

YOU CAN STAND UP FOR THE ENVIRONMENT AND YOUR OWN FUTURE BY SUPPORTING MATURE DISCUSSION ABOUT CLIMATE CHANGE.

ISSUES IN BIODIVERSITY

Is chess just a refuge for litterers?

A beach clean-up campaign in Northeast Arnhem Land finds an estimated 250 million pieces of marine debris present including chess pieces.

Around 4.5 tonnes of the debris removed were consumer items including:

- plastic lids, tops and pump sprays (14494 pieces)
- plastic drink bottles (6054 pieces)
- cigarette lighters (3344 pieces
- personal care and pharmaceutical packaging (4881 pieces)
- thongs (3769 pieces)
- toothbrushes, hair brushes and hair ties (775 pieces) and
- toys such as chess pieces (64 pieces)

The remaining 2.5 tonnes was made up of 72 different types of discarded fishing nets or ghost nets, some of which contained turtle bones. All are a big danger to seabirds and sea mammals.

Much of the trash found along Cape Arnhem originates from ocean currents and trade winds above Australia that pushes the debris into the Gulf of Carpentaria in a clockwise direction before washing ashore.

UNDERSTANDING CLIMATE CHANGE

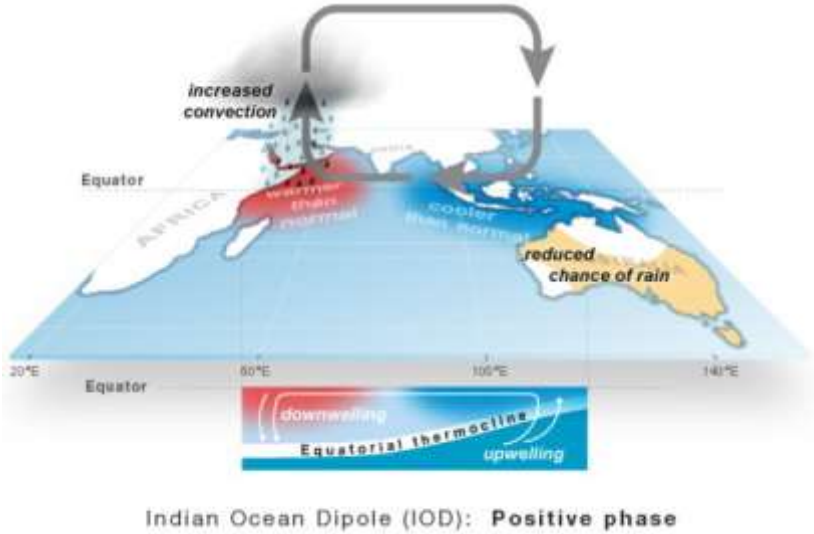
Indian Ocean Dipole linked to global warming

One of the big drivers of drought in Australia is a weather phenomenon called the Indian Ocean Dipole

Source ABC News

A recent study by Nerilie Abrams shows Indian Ocean Dipole events have most likely become stronger and more frequent since the 1960s. The researcher says changes in the Indian Ocean Dipole's behaviour is increasing the risk of more droughts for Australia. This might be caused by the Indian Ocean off Africa warming faster than the Indian Ocean off Australia. Yes, another hard-to-see impact of climate change.

"Paleoclimate data confirms that…[the] recent increase that we've seen since the 1960s is unusual", she said.

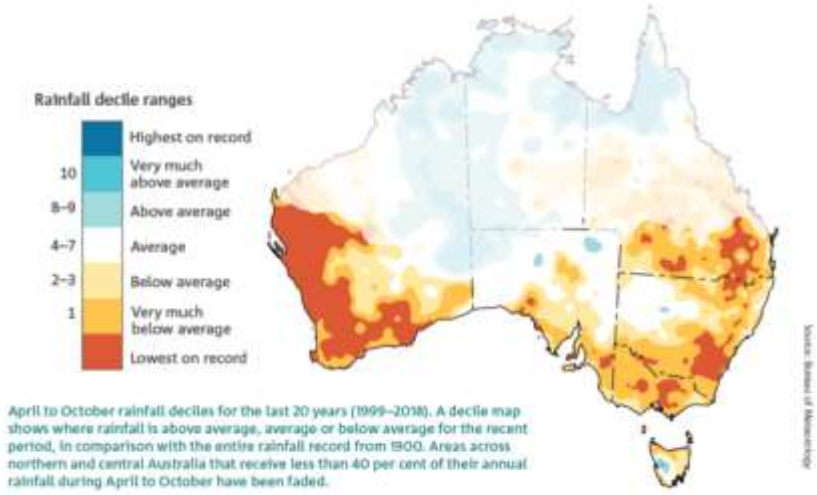


A positive IOD is caused by cooler than normal water in the Indian Ocean (BOM)

CSIRO computer models forecast Australia will experience twice as many drought-causing extreme positive IOD events if temperatures warm by 1.5 degrees Celsius.

The Bureau of Meteorology (BOM) has not yet incorporated this research into its official climate change position. They did go along with the broad scientific agreement that southern Australia is getting less winter rain, and that this is driven by climate change.

There is also a broad scientific agreement that Australia is getting hotter due to climate change.



But the Bureau of Meteorology's senior principal research scientist, Scott Power, said there was still work to be done refining the way climate models represent the IOD.

"Climate models are fantastic tools... But they're not perfect," Dr Power said. He said there was higher confidence when it came to understanding sea level rise, warming, and lower rainfall over southern Australia during winter and spring.

UNDERSTANDING CLIMATE CHANGE

Deep sea carbon reservoirs?

You might have heard of carbon capture technology, but the earth already has a number of carbon stores. The earth can be affected by disruptions in these stores.

Source: Conversation

Gas rising from the Champagne vent in the Marianas. NOAA Ocean Explorer

Scientists are aware of a disruption at the end of the last glacial era, about 20,000 years ago. Then carbon dioxide was released into the ocean from reservoirs on the seafloor when the oceans began to warm. We know that the seas are warming and releases of CO2 from these reservoirs could speed up climate change.

One of the best-known examples of a rapid warming caused by release of geologic carbon is the Paleocene-Eocene Thermal Maximum, or PETM, a major global warming event that occurred about 55 million years ago. During the PETM, the Earth warmed by 5 to 9 degrees Celsius within about 10,000 years. Climate scientists now consider the PETM to be a model for what might happen now.

The Paleocene-Eocene Thermal Maximum warmed the planet so dramatically that tropical rain forests extended northward to the Arctic.

However, hundreds of scientific studies have failed to establish what caused the rapid carbon dioxide increases that ended each ice age. Researchers agree that the ocean must be involved because it acts as a large carbon store.

Over the past two decades, ocean scientists have discovered that there are reservoirs of liquid and solid carbon dioxide accumulating at the bottom of the ocean, within the rocks and sediments on the margins of active hydrothermal vents. At these sites, volcanic magma from within the Earth meets superheated water, producing plumes of carbon dioxide-rich fluids that filter through crevices in the Earth's crust, migrating upward towards the surface.

When a plume of this fluid meets cold seawater, the carbon dioxide can solidify into a form called hydrate. The hydrate forms a cap that traps carbon dioxide within the rocks and sediments and keeps it from entering the ocean. But at temperatures above roughly 9 degrees Celsius, this hydrate will melt.

You can see types of carbon reservoirs on land. In 1986, a carbon dioxide reservoir at the bottom of Lake Nyos in Cameroon erupted, killing 1,700 local villagers and hundreds of animals.

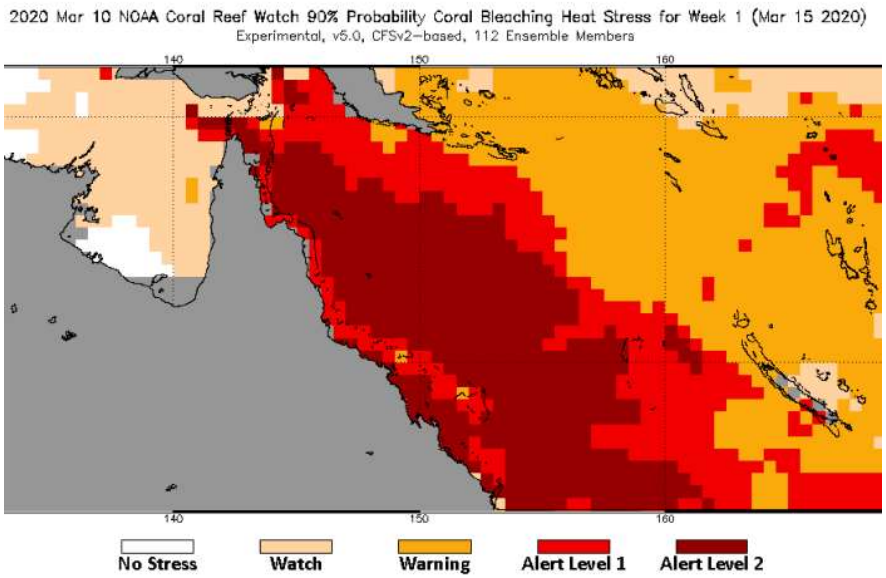
There is virtually no data that documents how much carbon dioxide is currently being held by or released from these reservoirs into the ocean.

While there is no need to panic, it demonstrates how much work still needs to be done to understand how climate change might operate in the future.

CLIMATE CHANGE - COUNTING THE COST

More Great Barrier Reef bleaching

Two record bleaching events in 2016 and 2017 have quickly been followed by a third event this February.



The bad news is that February brought the hottest month of sea temperatures on the Great Barrier Reef on record. The good news is that, the appearance of a cyclone in the Coral Sea dropped temperatures helped to limit further coral bleaching damage.

Coral bleaching is certain, but the full extent of the damage is unknown until more surveys have been completed.

David Wachenfeld, chief scientist for the Great Barrier Reef Marine Park Authority, said some parts of the reef had undergone more heat stress than in 2016 and 17. "Central and Southern coastal areas look worse." "… we know from spot checks that there are plenty of reefs in those areas that have bleaching."

"Satellite maps are showing that coastal waters are much hotter than mid-shelf and offshore waters, which would lead you to predict that the most severe bleaching this time is likely to be coastal. But we need to confirm that."

"We know there is mortality out there. But we don't yet have the big picture and the bleaching is still building despite this cooler weather."

On Monday, marine biologist Victor Huertas documented coral bleaching near Magnetic Island, less than 5 kilometres from Townsville. "A large portion of the corals were either bleached or dead or starting to fluoresce, which is what occurs when the corals start being stressed by high temperatures.

Victor Huertas

Professor Hughes said it was difficult say how much coral would die, corals were reacting differently after each marine heatwave.

"The Barrier Reef went through one hell of a natural selection event in 2016 and 17 that changed the mix of species," he said. "The proportion of the tougher ones went up. And there were proportionately less of the heat-sensitive ones." Corals are not always killed by bleaching and this will need to be assessed by divers.

"The events we're talking about are either at or beyond the extremes of any weather we've ever experienced before. And we'd better be cautious about predicting what the consequences are."

A mid-April report from GBRMPA was:

- Mostly confirming the worst bleaching is on reefs that suffered the highest heat stress this summer, which extended across large areas of the Reef.
- Detecting a wide variety of bleaching severity — ranging from no bleaching to the most severe category. Some southern areas of the Reef that had little or no bleaching in 2016 and 2017 have now experienced moderate or severe bleaching.
- Showing, importantly, key tourism reefs in the Northern and Central areas of the Reef experienced only moderate bleaching, from which most corals should recover.
- Detecting moderate and severe bleaching on coastal and mid-shelf reefs in the far north where the corals remaining after the 2016 and 2017 events are relatively heat-tolerant.

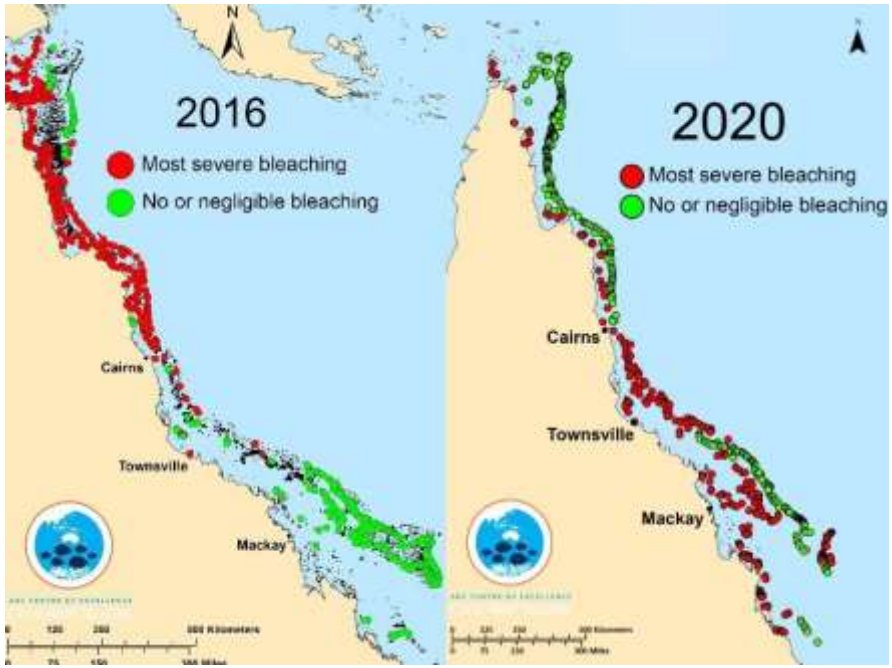
According to JCU/ARC media releases,the footprint of each bleaching event closely matches the location of hotter and cooler conditions in different years.

"The north was the worst affected region in 2016, followed by the central region in 2017. In 2020, the cumulative footprint of bleaching has expanded further to include the south."

"As summers grow hotter and hotter, we no longer need an El Niño event to trigger mass bleaching at the scale of the Great Barrier Reef", "Of the five events we have seen so far, only 1998 and 2016 occurred during El Niño conditions." The gap between bleaching events is also shrinking, hindering a full recovery.

After five bleaching events, the number of reefs that have so far escaped severe bleaching continues to dwindle. Those reefs are located offshore, in the far north, and in remote parts of the south.

Bleaching isn't necessarily fatal, but many corals die when bleaching is severe. The ARC will go back underwater later this year to assess the losses of corals from this most recent event.[research is currently hampered by Coronavirus]



CLIMATE CHANGE - COUNTING THE COST

Surf's Up! Wipeout!

Climate change may change the way ocean waves impact 50% of the world's coastlines. Australia is going to lose about 40 per cent of its beaches over the next 80 years.

Source: The Conversation, ABC News

The rise in sea levels is not the only way climate change will affect the coasts. Research analysed 33 years of wind and wave records from satellite measurements, and found average wind speeds have risen by 1.5 metres per second, and wave heights are up by 30cm – an 8% and 5% increase, respectively, over this relatively short historical record. These changes were most pronounced in the Southern Ocean.

Waves are generated by surface winds. Our changing climate will change rain and wind patterns around the globe. Sea level rise can also change how waves travel from deep to shallow water.

If the climate warms by more than 2℃ beyond pre-industrial levels, southern Australia is likely to see longer, more southerly waves that could alter the stability of the coastline.

Models agreed we're likely to see significant changes in wave conditions along 50% of the world's coasts. These changes varied by region. Less than 5% of the global coastline is at risk of seeing increasing wave heights. These include the southern coasts of Australia, and segments of the Pacific coast of South and Central America. Some areas will see the height of waves remain the same, but their length or frequency change. This can result in more force exerted on the coast (or coastal infrastructure), perhaps seeing waves run further up a beach and increasing wave-driven flooding. 40% of the world's coastlines are likely to see changes in wave height, period and direction happening simultaneously.

No big waves aren't just about a fun days surfing. Flooding from rising sea levels could cost US$14 trillion worldwide annually by 2100 if we miss the target of 2℃ warming.

This latest research is based on satellite images mapping shoreline change between 1984 and 2015, combined with IPCC sea-level rise forecasts for the year 2100.

By "lose", the researchers mean those beaches will recede by more than 100 metres. If we factor in erosion of less than 100 metres, the figures will be much higher.

The Intergovernmental Panel on Climate Change (IPCC) predicts oceans to rise, on average, by around 70 centimetres if we rapidly get our emissions down, and around 1 metre if we don't.

The researchers concluded that of all the countries in the world, Australia is forecast to lose the most sandy coastline.

That also impacts on towns and infrastructure that are often built right up to the dunes.

The Australian Government's environment department website notes that even with a best-case scenario by 2100, we'll see a

drastic increase in coastal inundation. "The current 1-in-100 year event could occur several times a year."

"Managed retreat" is the first of two strategies for dealing with rising sea levels. Leaving it to the last minute will be more expensive, less ordered, and people could end up much worse off compared to a tactical retreat, according to those researchers.

The second strategy for dealing with sea-level rise is what is called "holding the line", where seawalls and other infrastructure are built in an attempt to hold back the water.

But there are big ongoing costs with holding the line, and seawalls aren't feasible across large areas of low coastline.

"I think there'll be a time in the not too distant future where some areas of the coast become, perhaps not uninhabitable. but uninsurable."

This issue has recently been in the news after a cyclone sparked five-metre swells and king tides in NSW. This kind of periodic erosion damage can happen even without the added energy from climate change.

The damage seen at beaches like Collaroy-Narrabeen on Sydney's northern beaches so far is mostly to do with poor planning, not sea-level rise, according to coastal geographer Tom Oliver from the University of New South Wales.

He said the CoastSnap beach monitoring station at North Narrabeen recorded a 21-metre recession in the coastline following the weather chaos.

COUNTING THE COST - CLIMATE CHANGE

Disruptions to turtle breeding

Turtle eggs transported away from Sydney as turtles struggle to be male.

Source Northern Coast Council

A green turtle has laid her eggs on a Sydney beach where it is to be too cold for the eggs to hatch. 144 green turtle eggs have been relocated 500 kilometres north to Coffs Harbour in the hope they will hatch.

The eggs are expected to hatch in two months time with hopes they will increase the male green sea turtle population

As temperature determines the sex of the turtles was also hoped that most of the eggs would hatch as males as most hatching in Queensland have been females. "With rising temperatures what we're seeing is most of our northern nesting beaches are producing mostly females off their beach," Ms West said.

"Most of those northern nesting beaches are producing predominantly females and we're really focusing on these southern hatchlings to help us replenish males back into our sea turtle populations."

GM corals

Source: AIMS

Hundreds of juvenile corals bred at the Australian Institute of Marine Science (AIMS) have survived being transplanted on the Great Barrier Reef.

The Assisted Gene Flow trial on the central Great Barrier Reef aims to show young coral offspring produced from corals from warm northern reefs, can survive in cooler environments.

The seven-month-old corals have one parent from the warmer northern reaches of the Reef and the other from the cooler central Reef. The corals were cross-fertilised in climate-controlled tanks at the National Sea Simulator in Townsville. The National Sea Simulator is the world's most advanced research aquarium. These crosses were then settled onto terracotta tiles and moved to a site on the Great Barrier Reef, in March 2019.

Dr Kate Quigley says research has shown the offspring then inherit heat tolerance from their northern parents, and may pass on these heat tolerant genes. This could make reefs more resistant to future marine heat waves. "

When corals get too hot they are damaged and bleach, and this can lead to extensive mortality as we have recently seen on the Great Barrier Reef. Dr Bay said. "If corals are to persist into the future, they have to cope with these increasing temperatures, and because of the rate of warming, they will have to become more tolerant fast. We are focussed on developing new solutions for managing our coral reefs in a warming future."

ACTING ON AND ADAPTING TO A DEGRADING ENVIRONMENT

Living seawall replaces lost foreshores

Volvo has teamed up with the Sydney Institute of Marine Science and Reef Design Lab to create a Living Seawall in Sydney Harbour.

The first seawall at Milsons Point was installed with 50 tiles on 30th October 2019. Another 108 have followed at Sawmillers Reserve.

Tiles made from 3D-printed moulds using concrete and recycled plastic that mimic the root structure of native mangrove trees, provide habitat for marine life. These are installed along an existing seawalls. These tiles are designed to attract filter-feeding organisms that will absorb and filter out pollutants, such as particulate matter and heavy metals, helping to keep the water clean. Researchers will monitor the Living Seawall for the next 20 years to see if it improves biodiversity and water quality.

Barnacles, smaller seaweeds, oysters, marine snails and limpets are expected to attach to the tiles within a year. Over time, this colonisation is likely to grow and new species will colonise the tiles and beyond so that eventually they will be hardly visible.

The tiles are expected to remain in place until at least 2038, with their effectiveness in improving marine life to be monitored by SIMS.

ACTING ON AND ADAPTING TO A DEGRADING ENVIRONMENT

The push for "blue carbon" farming

Mangroves, saltmarshes and seagrass beds are sinks for 'blue carbon' – the carbon stored in coastal sediments and plants.

Marine soils accumulate far more carbon than soils on land. the soils of mangroves, saltmarshes and seagrasses exist in a low oxygen, wet, salty environment. Decomposition is much slower than on the land, and the carbon is locked into the sediment at far greater rates.

"We've cored into seagrass meadows and they can be thousands of years old," CSIRO marine ecologist Mat Vanderklift said.

Blue-carbon farming has interested the Queensland Government as they have created a Land Restoration Fund – $500 million specifically to expand carbon farming.

The fund is set to announce the results of its first round of pilot project funding early this year. One scenario for blue-carbon development is removal of bunds – or earthen walls – that block tides from entering estuarine saltmarshes. Since European settlement, thousands of bunds have been built by pastoralists up and down the Queensland coast to keep out salt and create ponded freshwater pastures in which cattle can graze. A 2017 CSIRO report identified the introduction of tidal flow back into mangroves and tidal marshes as a significant blue-carbon farming opportunity. restoring estuarine wetland, has fisheries benefits as well,"

Another blue carbon-farming scenario involves working with cattle farmers to fence off shorelines. This prevents the cattle disturbing coastal soils and causing erosion. "Sea-level rise could also provide an opportunity for landowners along coastlines to work with the rising water, rather than be hampered by it. "We could be planning to encourage sealevel rise to go into those areas and find new economic opportunities for landholders to be offset and compensated for the loss of land they have as a result of sea-level rise," Peter Macreadie explains. "They're actually farming mangrove forests, for example, instead of cattle."

Australia does not yet have an agreed method for blue-carbon accounting. This is something that must be established by the Australian Government's Emissions Reduction Fund before blue-carbon trading can start. The Emissions Reduction Fund are worried about doublecounting of carbon dioxide. Mat Vanderklift says. "We know they're there, but can we quantify them?"

An even bigger challenge is accounting for the avoided emissions associated with turning methane-producing freshwater, ponded pastures back into saltmarshes and mangroves. "That could double the value of our projects, because in some cases the carbon sequestration part might actually be quite small."

Another question is how to map Australia's blue-carbon resources, says Mat Vanderklift. "Seagrasses live underwater and they're not usually visible, so mapping them is a bit harder than mapping a mangrove" he says. if blue carbon is to command a higher price as a 'boutique' product on the carbon market, there's also a need to account for additional environmental and social benefits like measuring what are the fishery benefits of a mangrove or a seagrass,"

Carbonfarming operations on public land might operate under a similar model to aquaculture leases. Proponents have already applied for funding for a blue-carbon project on the Mossman floodplain and Burdekin delta in Queensland. "If companies start to invest in mangroves and seagrass beds, which are the nurseries for the fish we harvest, then we get a double win out of it," Bryan Skepper says. "We're not only offsetting our carbon; we're creating habitat or rehabilitating habitat that enables the fish stocks to breed, which if you're really successful with it, enables the sustainable catch rates to increase." f

VALUING WONDER – CONNECTION WITH THE OCEAN IS A VERY HUMAN THING

Townsville's new Underwater Art

An ambitious new arts project, the Museum of Underwater Art (MOUA) may one day see diving tourists flocking back to Townsville.

When I went to Townsville in the 1980s it was the centre of diving in the Great Barrier Reef, then they built the airport in Cairns and Townsville's reefs were too far away for day trippers. It was nothing to do with the quality of the reefs which were world class. Townsville might now be looking for the 'MONA arts effect' that has revitalised tourism in Tasmania.

Stage one of the project is now complete, with the installation of a dive site off the north Queensland coast. about 20 sculptures is submerged to a depth of about 18 metres.

"It's at a beautiful, sheltered site at John Brewer Reef that will be accessible to snorkellers and scuba divers, and it's near one of the best reefs, in my view, on the whole Great Barrier Reef."

The "coral greenhouse" features more than 20 marine sculptures made from stainless steel and marine-grade cement at John Brewer Reef.

It's submerged at around 18 metres deep, it rises up to nine-and-a-half metres high and it weighs over 160 tonnes. They expect corals, sponges, and fish population will move in pretty soon. The site would be open to tourists in April 2020. There will be moorings in place and educational material.

The project's includes the "ocean siren", a sculpture installed at the Townsville Strand.

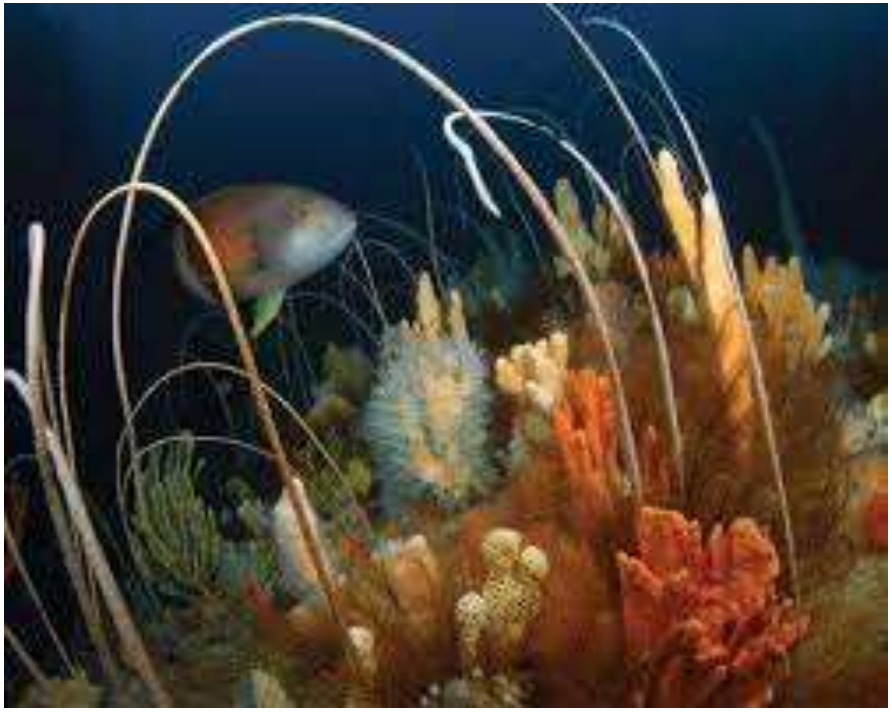
Stage two of the project will include the installation of sculptures off Palm Island, north-east of Townsville. "It is a piece that showcases the link between Indigenous culture and the reef."

The MOUA board said discussions about a proposed sculpture at Magnetic Island off Townsville were still underway.

WILDLIFE ENCOUNTERS

Sea Whips - (order Alcyonacea)

An instalment of a series on strange and beautiful marine animals - Octocorallia Soft Coral



They are weird bushy looking colonial animals that seem to belong in an odd spot between hard reef coral and something soft and squishy like a sponge. In fact some are soft, and some are noticeably hard. Some look like corals and lots don't. Not being too economically important we don't really study them too hard. They are a bit of a fascinating mystery.

John Smith

A sea whip is really just a shape rather than a species. It's a type of gorgonia sea fan that doesn't grow into a fan shape but a long, whip-like growth. The "whip" consists of a colony of tiny polyps that grow upon one another along a continuous single stem. Spicules, or needlelike structures, of lime embedded in the polyp body provide a firm flexible support.

The species Primnoella australasiae is found in SE Australia and New Zealand. Primnoid corals are among the most diverse and species-rich group in the octocorals. Species in the family Primnoidae present a beautiful array of whip-like, spiralling, fan shaped, or tree-like forms, and possess a solid central skeleton with a golden or metallic sheen.

Due to their size and form the primnoid corals are important habitat formers, providing refuge and shelter for fishes and other invertebrate species. The family is likes the deep sea, occurring down to 6400 metres. Primnoella australasiae is a rarer shallow water species that occurs as shallow as 13 metres.

In Tasmania Primnoella australasiae doesn't like the abrasion of seaweeds so is rarely seen shallower than 30 metres. Often a basket star or some other animal is attached to it.

ACTING ON AND ADAPTING TO A DEGRADING ENVIRONMENT

Warrnambool residents claim victory over Wannon Water

Residents are claiming victory over a water authority they state was causing beach pollution

Issues around pollution escaping from Wannon Water's sewage treatment plant came to light in November 2017, when millions of plastic beads — nurdles — began washing up on south-west Victorian beaches. Beachcombers have been also been finding large amounts of balls of fat and grease on the beach, which is near an outlet from Wannon Water's sewage treatment plant. Wannon Water denied pumping fatballs and plastic into the sea.

For two-and-a-half years, a community group has been demanding action over the amount of pollution washing up at an area known as Shelly Beach. The EPA agreed and hit them with new licence restrictions.

The EPA's south-west regional manager, Carolyn Francis, said "While Wannon Water has taken practical steps to improve the plant's environmental performance, the changes EPA has made to the licence have tightened the requirements and set clearer limits to what is permissible," Ms Francis said.

Wannon Water responded that it would make no difference, "The reality is that Wannon Water has already got the investments in place to meet these licence parameters," Mr Jeffers said.

"We've installed final effluent screens back in 2017 and are making further amendments to have them as fully automatic screens [by] mid-2020."

He said Wannon Water was spending $1.1 million to improve the screens, on top of a $40 million upgrade to increase capacity.

Mr Jeffers acknowledged past problems with plastic spills, but said they would not happen again.

WILDLIFE ENCOUNTERS

Southern right whale dolphins wash up

PHOTO: Caitlin Em

Southern right whale dolphins have never washed up in Victoria before, but two of the dolphins have been found dead at a Port Fairy beach within weeks of each other.

Two separate southern right whale dolphins have been found dead at Port Fairy's East Beach in the state's south-west in the past couple of weeks, but only one was able to be retrieved by authorities for further examination.

The species inhabits deep offshore waters and are rarely seen by people. Little is known about the mysterious species of dolphin that inhabits waters across the Southern Hemisphere.

The first dolphin that was found was picked up and is being examined by a team including scientists and traditional owners from the Eastern Maar Aboriginal Corporation. The second very unusual dolphin washed back out to sea after being discovered and photographed by a member of the public.

Deakin University marine ecologist, Paul Tixier, said there were only about 30 records of southern right whale dolphins in Australian waters going back to the early 1900s. Dr Tixier said it was likely the two stranded dolphins were from a group that came unusually close to the south-west coast of Victoria, but the reason remained a mystery.

"We don't know much about these species, really, because they live in habitats that are so rough and so remote from us that it makes everything complicated," Dr Trixier said.

He said he was intrigued to find out if the examination of the carcass that was picked up would shed light on the animal's cause of death.

Southern right whale dolphins feed on a variety of fish species and squid and are often seen associating with dusky and hourglass dolphins, andpilot whales. A key feature is a lack of a dorsal fin, just like a southern right whale. Large numbers are sometimes taken by gillnetting and longline fishing in oceans off the southern coast of Australia. It is believed the dolphin species live in groups of up to 1,000 individuals.

MANAGING DEVELOPMENT

Life and Death At Thevenard Jetty

Source AIMS

Any fisherman can tell you that structures such as jetties are an attractive shelter for hungry fish. They lie in shelter during the day then hunt during the evening.

At Thevenard Island on Western Australia's NW coast, predatory fish, such as mangrove jack gather under the jetty. A problem is that the jetty is sited next to a rare flatback turtle breeding beach, does this cause any problem?

Small, sound-emitting tags were attached to 61 recently hatched flatback turtles to monitor their movements in the ocean. Signals from the tags were detected by a grid of underwater receivers, allowing scientists to track them as they swam out to sea.

Turtles breed in high numbers because just about everything likes to eat their hatchlings. Only about one in a thousand survive to maturity. Nearly three quarters of the hatchlings entering the sea for the first time were taken by fish while still close to shore.

Ms Wilson said turtle hatchlings normally swim quickly in a straight line away from the beach, out to the relative safety of the open ocean. "However, the baby turtles we tracked behaved differently by swimming parallel to the beach and many of them resided under the jetty during the day". This made no sense until they realised they were tracking mangrove jack who had eaten the hatchlings and their transmitters.

The turtles ran into a hotspot of predatory fish using the jetty as shelter during the day. At night they left the jetty to feed on hatchlings along the nearshore zone.

It turns out that an artificial shelter for the fish near turtle nesting beaches can greatly increase the threat to hatchlings. Back to the drawing board for those jetty siting plans

A school of mangrove jack sheltering under the jetty at Thevenard Island.

Great Australian Bight oil drilling

A legal challenge against plans to drill for oil in the Great Australian Bight might have scared off an oil company.

Equinor planned to drill an exploration well 372 kilometres south of the Nullarbor coastline, off South Australia. They got conditional environmental approval for a mobile offshore drilling unit to drill for about 60 days between November and April in either 2020–21 or 2021–22.

The Wilderness Society took the national regulator to the Federal Court. The society alleged Equinor did not consult "important and relevant parties", as required by regulations.

However, the Norwegian backers have pulled out even before the first court date, with activists claiming a big victory. The energy industry and government ministers talked up lost jobs and revenues, those nasty hippies!

However, I had heard well before any of this has started that the informal scientific view was that they weren't likely to find a spoonful of oil, let alone enough to cause massive oil slicks along the South Coast.Apparently Equinor may also have had trouble with European banks not wanting to fund controversial fossil fuel projects.

I prefer the oil company's view as the most accurate likely reason,

"Following a holistic review of its exploration portfolio, Equinor has concluded that the project's potential is not commercially competitive compared with other exploration opportunities in the company".

Salmon Aquaculture in Tasmania

Humans impact upon the environment all the time. There is no human economic activity in the modern era that has no impact on the environment. It happens every time we set up a factory, catch a fish, or flush the toilet.

There are ways that we can manage that impact and minimise the permanent harm that might be caused to our ecosystem. After all, we are part of the environment ourselves and rely on the resources of the environment for our ongoing economic and physical health.

The marine environment of Tasmania is special, and although you may not see it on a screensaver or postcard, it contains some of the richest oceans in the world with many rare and special animals and features.

Salmon farming is a relatively new industry to Tasmania and has grown rapidly, partly on its image as a "clean and green" way to produce food. From small farms in the back of a bay, salmon farming has grown in to a large industrial scale agribusiness. It is providing a significant percentage of the fish we consume in Australia.

Marine farming has been important in providing economic stimulus and jobs, especially in depressed rural areas. If we make mistakes with fish farming, it will affect not just the environment, but also sales income and jobs growth.

A slow drying up of public support for salmon farm expansion is a serious risk to this industry. Fish farming was relatively uncontroversial until a very large expansion project was encouraged in Macquarie Harbour. This was based on inadequate research and set an overly-ambitious stocking target in a sensitive area. A need to announce "good news" stories led to the approval of unsubstantiated stocking rates. These rates were largely based on single research reports that proved to be inadequate.

The public failure of this project has caused a lot of adverse publicity. It fed into a concerted campaign to stop the Okehampton development, despite this area being relatively dissimilar scientifically to Macquarie Harbour.

It is of concern that expansion in Storm Bay is based on media releases again stating huge stocking figures that are not obviously supported by detailed scientific assessments. Does this risk a repeat of the Macquarie Harbour overstocking scenario?, but in an area close to very large urban populations. Even smaller failings are likely to have large public confidence impacts. Another significant round of adverse publicity about a failure to protect the environment, or unreasonable conflicts with users and residents, may cause serious brand damage to the industry.

It is likely that the rapid pace of fish farm expansion is outpacing our research effort, forcing us to rely on scientific modelling with higher degrees of uncertainty. The impression that salmon farming is 'rushing ahead of the science' feeds into the angst felt by many local residents about the amenity and environmental impacts of fish farming in their local area. The fact that salmon farming is partly and progressively moving further offshore does not appear to be totally allaying these concerns.

The industry is growing in scope too. It is expanding into new parts of the State that draw more local communities into close contact with its benefits and disadvantages. Rural communities need economic stimulus. If that is perceived to be damaging the rural "serenity" that is also valued by some of its residents, an emotive and divisive debate is likely to follow. This can have a significant adverse impact on a small community. Marine farming also has the potential to be another broadscale divisive debate in society, as was forestry and Hydro development in the late twentieth century. These issues will require careful management.

On the positive side, the industry is capable of being operated in a manner that is sustainable in the long term. The argument is more about at what level of intensity is appropriate, and whether economic returns should be maximised ahead of potentially competing environmental and amenity concerns.

There are good reasons for hoping that a general consensus on salmon farming expansion is possible. The industry is relatively science and innovation friendly. It has environmental management professionals on staff, keeping abreast of improving standards and capable of appreciating the risks of particular decisions. The industry will spend on innovations, such as new styles of predator netting and offshore farming technology that often have environmental and production advantages. They should be encouraged to continue with this positive science-friendly aspect of their commercial culture.

The State is also blessed with many marine science institutes that are capable, with adequate planning and resourcing, to provide recommendations for improvements in the industry. They can also provide higher quality assurances to the public, given sufficient funding and time.

Despite some opponents of marine farming having particularly fixed and emotive views about the industry, the knowledge resources of the broader community should not be overlooked. Many community groups like Bird Life Tasmania have large storehouses of specific knowledge in their area of interest. Local groups also have unique knowledge of their area. They all believe they know how marine farming has impacted on their fishing or other interests. This concern is potentially able to be directed into positive outcomes, e.g., to form research plans for an area, or to shape the manner in which planning processes or information resources are open for public scrutiny and debate.

A more fearless, independent and well-resourced marine planning process would also enhance long-term public confidence in the industry. A slower paced and more inclusive process may also tend to defuse the more emotive aspects of the public debate.

Salmon prices are high presently while there are production problems in Europe, and the rush is on to gain market share in this growing industry. This should not result in permanent changes that are environmentally damaging, or result in unreasonable blights on public amenity.

HOW IS MARINE FARMING DONE?

Atlantic salmon is the species most often chosen for fish farming in Tasmania. It adapts readily to the environment of sea cages, is hardy, easy to handle, is well-known to consumers, and gets a premium price.

Norway, Chile, Scotland, Canada and increasingly, Tasmania, are major producers. Tasmanian companies are also expanding operations to the mainland States. It is an intricate process. Corporations operate it on an industrial scale with increasing levels of sophistication and automation.

In 2007, nearly 1.5 million tonnes of Atlantic salmon were harvested worldwide but, in 2017, over 2 million tonnes of farmed Atlantic salmon were harvested [Wikipedia]. In Australia, growth has been even faster and it is now larger by volume than the wild fishery.

Hatcheries

At inland hatcheries, salmon are hatched from eggs and raised on land in freshwater tanks. Conventional hatchery systems feed freshwater streams into the hatchery. The eggs are hatched in trays and the salmon smolts (juvenile salmon) move to raceways.

The waste products from salmon fry and the feed are usually discharged into the river. Alaskan hatcheries use 100 tonnes of water to produce a kilogram of smolts [Wikipedia]. Chemicals may be used to control disease in smolt.

In Europe, the fresh water used is likely to be recycled within the hatchery but this does not appear to be the case in Tasmania. Recycling allows the farm to heat the water to reduce hatching times when demand is high.

Fry are generally reared in large freshwater tanks for 12 to 20 months.

There have been complaints from the public about nutrients discharged into stream. It has caused detectible increases in nutrients in the upper Derwent Valley, although still not as much as the long-standing problem with agricultural runoff. It still isn't a desirable additional burden.

Fish pens

When salmon are 12 to 18 months old, the smolt are transferred to floating sea cages or net pens There they are fed pelleted feed for another 12 to 24 months.

Generally, cages are made of mesh framed with steel or plastic with volumes varying between 1,000 and 10,000 m3. A large net can hold up to 90,000 fish. There are often two nets. The outer nets, which are held by floats, used to keep predators out. Stocking densities range from 8 to 18 kg/m3 for Atlantic salmon. Tasmanian nets now tend to be covered by mesh to limit interactions with seals and birds.

As Tasmanian fish farms are now operating in more exposed sites, much recent effort has been spent on strengthening pen designs, which have been called "storm pens" by local firms.

Nets will be tended by staff operating from a variety of craft from small utility boats to largely automated feed barges. More recently, purpose-built wet-well boats have been added for fish transport and also to fresh-water "bathe" the fish for the purposes of disease control. Fish farm crews include divers who routinely inspect the nets.

Nets can be damaged by storms and predators, or damaged during handling. Farmed salmon tend to survive poorly in the wild. Despite being in Tasmania on and off for over 100 years, there is no evidence of an established feral salmon population. Recaptured salmon have empty stomachs and appear to be unable to recognise and capture wild prey.

Ocean plants and animals quickly grow on (foul) the nets and grow so vigorously they would quickly sink nets and block water flows. Marine farms have historically used anti-fouling copper-based paints on nets to control algae growth. Copper contamination guidelines are set by the Australian Pesticides and Veterinary Medicines Authority. Globally, aquaculture developing nets made of copper alloys rather than applying anti-fouling paint after manufacture.

In sites without adequate currents, heavy metals can accumulate on the benthos (seafloor) near the salmon farms, particularly copper and zinc. Contaminants are commonly found in the flesh of farmed and wild salmon, particularly in Europe.[Wikipedia]

Feeds made from fish that contain trace elements of contaminants from the polluted waterways where they grew, can accumulate in salmon. This process has caused periodic health scares in Europe.

Heavy metal PCB fears in the northern hemisphere led to one study concluding in 2005 that "...consumers should not eat farmed fish from Scotland, Norway and eastern Canada more than three times a year; farmed fish from Maine, western Canada and Washington state no more than three to six times a year; and farmed fish from Chile no more than about six times a year".

The health impacts are unclear, with some scientists arguing the contamination risks in European fish did not outweigh the health benefits of the Omega 3 in the fish.

Maintaining a reputation for high quality healthy product is likely to be important for the reputation of the Tasmanian industry.

Feeding

Feeding is a focus of ongoing research because of its cost to producers and environmental impact. Farmed salmon in Tasmania are fed pellets comprising small bony oceanic fish and fish oil. 2–4 kg of wild-caught fish are needed to produce 1 kg of salmon [Wikipedia].

Macquarie Harbour feeding barge, Photo Mike Jacques

The use of forage fish for fish meal production has been almost a constant for the last 30 years and is at the maximum sustainable yield. The principal uses of fish meal have shifted from chicken, pig, and pet food to aquaculture diets.

Fish do not actually produce omega-3 fatty acids, but instead accumulate them from either forage fish like herring and sardines that have accumulated omega-3 fatty acids from microalgae. To satisfy this requirement, more than 50% of world fish oil production is fed to farmed salmon.[Wikipedia]

Alternatives such as vegetable protein have been trialled. The difficulty has been that salmonids do not properly metabolize many plant-based carbohydrates. Waste products such as chicken feathers and wheat byproducts have been successfully added to feed pellets. Chile has had an advantage in being located next to a massive resource of small pelagic fish, which is not the case in Tasmania.

New enzymatic processes may lower the carbohydrate content of grains, making it suitable for salmon. Co-locating farms for worms, algae and other natural food sources have also been trialled. These alternatives will require a pre-harvest finishing diet to lift the desirable omega-3 content of fish.

Wild salmon get their red flesh colour from eating krill and shrimp. Before harvest, the fish are fed astaxanthin and canthaxanthin, a manufactured copy of the pigment that wild salmon eat in nature. This is done so that their normally light grey flesh colour matches that of wild salmon.

Diseases and pest treatment

The intensive nature of fish farming periodically encourages the spread of diseases among fish stocks, especially when the environmental conditions are adverse, such as when sea temperatures are high. Antibiotics are used for short periods. Fish treated with antibiotics are not harvested for a period to allow chemical residues to leave the fish's systems.

Another possible solution is genetic modification to create disease resistant strains and also to synthesise feeds. Salmon have been genetically modified in laboratories so they can grow faster. A company, Aqua Bounty Farms, has developed a modified Atlantic salmon which grows nearly twice as fast (yielding a fully grown fish at 16–18 months rather than 30), and is more disease resistant, and cold tolerant. It also requires 10% less food. This will raise similar issues to those that arose from the use of GM crops.

It is alleged that parasites are increasing resistance to chemicals and antibiotics, with chemical use increasing dramatically in

European fish farms. A native sea louse has caused production problems in Europe, causing a spike in global prices.

It is likely that even in Tasmania, strong biosecurity measures and ongoing research will be needed in to non-chemical treatments for diseases and pests.

A pressing issue in Tasmania is pilchard orthomyxovirus (POMV), which can be transmitted to farmed fish from wild pilchard. Pilchard orthomyxovirus was found in 1998 in South Australia as an incidental finding after an investigation in to an unrelated fish kill. Outbreaks in salmon are associated with pilchards schooling around cages. POMV was first detected and reported in salmon in 2006 on the Tamar River, also as an incidental finding, Prior to 2012 POMV was not known to cause an actual disease, until fish kills occurred in south east of Tasmania. An outbreak led to cull of 100,000 juvenile salmon in Macquarie Harbour in December 2017. That event coincided with higher than usual temperatures and low dissolved oxygen (DO) levels in the harbour.

The virus is spread by contact with infected fish or their secretions, or contact with equipment or people who have handled infected fish. The virus can survive in seawater, so a major risk factor for any uninfected farm is its proximity to an already infected farm. Huon alleged that Tassal heightened the risk of spread at Macquarie Harbour by farming salmon of different age classes in the same pens, juveniles are more vulnerable to disease.

The government requires mandatory reporting for events that exceed levels of 0.25 per cent mortality for three or more days. Leaked photos suggest regular fish kills (probably in smaller numbers) have been occurring at Dover. Huon reported POMV in their Storm Bay stock in late 2018.

"As we know, Biosecurity Tasmania, through the Centre of Aquatic Animal Health and Vaccines, is developing a [POMV] vaccine [and] currently working with a manufacturer on commercialisation of production and regulatory approvals." The ALP wants the government to develop a biosecurity plan.

Harvesting

Harvesting is meant to kill the fish in a way that minimises stress and physical damage. Apart from humane treatment concerns, stress hormones negatively affect flesh quality. Modern harvesting methods are shifting towards using wet-well ships to transport live salmon to processing plant. Methods include, anesthetising in water saturated in carbon dioxide and then mechanical stunning. *[leaving you with that mental picture - more next time]*

MANAGING DEVELOPMENT

Macquarie Harbour getting back to normal

The latest IMAS survey of environmental conditions in Macquarie Harbour, shows sediment health continues to improve.

"The abundance and numbers of benthic species seen at the majority of both lease and externals sites have returned to, or are closely approaching, levels observed prior to the major decline seen in Spring 2016 and early 2017," Dr Ross said.

"We also continue to see improved conditions in our video assessments of the seabed, and the presence of Beggiatoa bacteria remains low."

Dr Ross said that while the trend of improving harbour health over recent years is encouraging, oxygen levels are still lower than observed historically. "Through Spring 2019 bottom water oxygen levels declined due to higher river flows and limited oxygen oceanic recharge.

In late 2016 IMAS reported a major deterioration in sediment conditions around salmon farms in the harbour. It occurred thanks to a hot summer, and overstocking of local salmon farms. Oxygen was severely depleted causing fish kill and increased concerns about the survival of the rare Maugean skate. "Preliminary research suggests that the skate has limited ability to tolerate low oxygen concentrations, although the threshold levels are yet to be determined.

Dr Jeff Ross, is mapping environmental conditions, including oxygen levels, throughout the harbour. This information is available in real time, via satellite communications.

Dr Ross said the information is critical to an understanding of changes in the harbour ecology and the effectiveness of remediation strategies and aquaculture pen fallowing.

"Oxygen levels are a major determinant of the response of the environment at the bottom of the harbour (the benthic zone) to fish farm waste, so it's important that we're able to combine real-time dissolved oxygen data with benthic observations," Dr Ross said.

The next IMAS report will be available in mid-2020.

ACTING ON AND ADAPTING TO A DEGRADING ENVIRONMENT

Slimy algae at Port Arthur

Source ABC, Parliament of Tas

Last summer algae blanketed the shore near Long Bay and Stingaree Bay, near Port Arthur.

Residents were told not to swim or fish in the affected area. Representatives from salmon producer Tassal, which has fish pens in the bay, and the Environment Protection Authority said they would conduct environmental monitoring.

Christine Coughanowr, who is also an environmental scientist and fish farming activist, has noticed a severe increase in algae a year ago. Dr Coughanowr believes the algae, primarily a filamentous kind known as catgut weed, is a result of the nearby fish farm. "The nutrients from those fish pens is a very large amount of nutrients … it's probably in the order of 150 tonnes of dissolved nitrogen, which is essentially like a liquid fertiliser," Dr Coughanowr said.

"That would be equivalent to the sewage nutrient load that's coming out of Macquarie Point in Hobart and the Blackman's Bay plant, and this kind of algae love those nutrients."Dr Coughanowr is worried the algae is damaging important seagrass and fringing reef habitat.

There is no nitrogen cap or biomass cap to limit the tonnes of salmon permitted on the lease, which is instead regulated by monitoring the impact on the seafloor.

"What we'd really like to see is really an investigation done into how many fish can live in the bay and at the same time we have a healthy ecosystem."

In 2017, salmon giant Tassal reintroduced fish pens to its Long Bay lease after 10 year break. Local resident Glenn Martin said to a recent Parliamentary enquiry, "after the first fish farm was removed many years ago, I had noticed that the kelp had slowly been regenerating. However, with another fish farm installed, this kelp has dropped off again and seems to be 'choked'…"

Tassal said its water-quality monitoring, including biological monitoring, showed full compliance, and pointed out the health of the system could be influenced by factors beyond its control.

Tasman Mayor Kelly Spaulding said recent low rainfall and an increase in the area's population could also be impacting the waterway. "It's hard to blame it on a specific industry, I think it's a good thing that we're monitoring it and people are aware of it," he said. "All residents should be aware, or anyone visiting the area, that if you notice an algal bloom or something that just doesn't look right, don't enter the water, don't eat the shellfish, and just avoid," Cr Spaulding said. "We've got plenty of other bays and beaches that these aren't occurring at."

In December the EPA published a report after doing their independent monitoring. Unless I'm missing something, the findings were bald statements of technical facts without any real discussion, "Total Ammonia Nitrogen (TAN) was noted to be elevated for the surface water of site … [*at the mouth of the bay near the fish farm*] when compared to historic water quality data ...". No comment was made about the standard of company testing. IMHO this emphasises the need for a funded politically independent program of vetting.

https://epa.tas.gov.au/Documents/Port%20Arthur%20Water%20Quality%20Observations%20December%202019.pdf

MANAGING DEVELOPMENT

How is the Derwent River doing?

As is usual, reports about the quality of the Derwent River are a bit of a mixture of modestly good news and some slightly sad stories.

I was asked by someone the other day what was happening with the Derwent and the eating of fish?

Fishing in top hat and tails from a relatively slime free foreshore at Bridgewater in the 1870s

On the upside Taswater has been active and sewerage nasties have been declining from sewerage treatment outfalls. The sewerage story is a mixed one though with persistently high levels of beach pollution in places like Nutgrove and Blackman's Bay South. The latter hit the news recently and some effort was put in to identifying the source, which turned out to be illegal plumbing connections to the stormwater system. Council picked up the tab for this, instead of the shonky plumbers who thought it was a handy shortcut. The good news is that we seem to have been seeing cleaner beaches overall as a result of this effort.

The Nyrstar paper mill at Boyer has also been busy lifting its game and nutrient outputs have been falling. The seagrass meadows around Bridgewater have been on the mend, and seem to be bursting with Black swans and ducks.

The river is still full of heavy metals as a legacy of unrestrained industrial pollution in earlier decades. Detectable levels in the water are falling as the contaminants are covered in increasing quantities of fresh mud. Nrystar still reprocesses its contaminated groundwater. There are still no plans to drop health advisories about fish consumption from the river.

What is left of the saltmarshes in the upper estuary are still in good condition and are an important remnant of the rivers natural ecosystem.

While we are slowly fixing up the damage from old industries and old practices, new sources of pollution have emerged.

The upper Derwent has long been dominated by grazing, but Tasmania is shifting towards more intensive agriculture. Fruit, hops and dairy are making a comeback. Agriculture is the principal source of total nitrogen and total phosphorus loads to the river in winter. A new industry is salmon hatcheries. I understands they are now the principal source of nutrients in summer (and mainly at the outfall). In the upper Derwent catchment (ending at Bryn Estyn) aquaculture is the largest point source, but agriculture overall is still the largest contributor to total nitrogen and total phosphorus loads.

Another negative is funding. It seems that the Derwent Estuary program is making do with less cash, as it appears to have both a small and fluctuating budget. Its budget in 2019 was a modest $365k split between grants and member contributions, that's down from $741k the year before and $450k the year before that. The new funding agreement is on-line but not the schedule that shows what will be paid. The DEP gets a lot of in-kind support but it does seem to be cash-strapped in recent years. Any plans for a private party to tip in?

ISSUES IN BIODIVERSITY

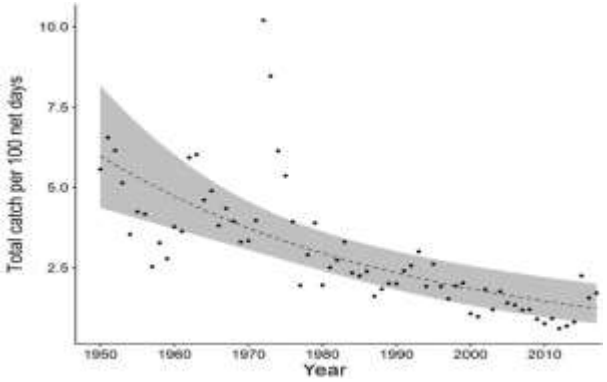
Shark nets don’t keep you safe

Source: The Conversation

New research says there is no reliable evidence that shark nets protect swimmers.

A study, in People and Nature, presents evidence that lethal shark hazard management damages marine life and does not keep people safe.

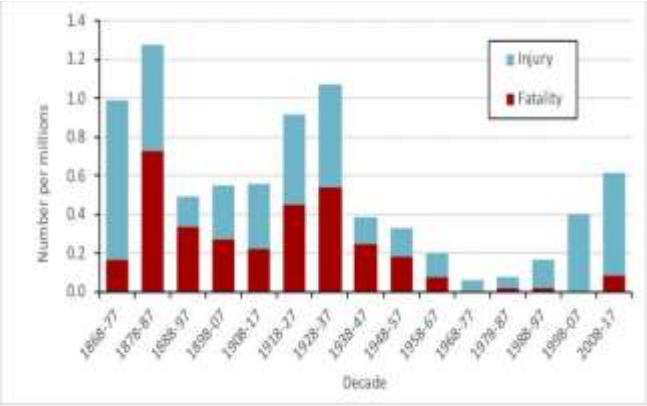
In NSW, 51 beaches between Newcastle and Wollongong are netted. The nets don’t provide an enclosure for swimmers. They are 150 metres long and suspended 500 metres offshore. In the process of catching targeted sharks they also catch other animals including turtles, rays, dolphins, and harmless sharks and fish. It’s the world’s longest-running lethal shark management program and has been going since 1937. The three key target species are white shark, tiger shark and bull shark. Shark catches in the NSW netting program have fallen since the 1950s.-



Total shark catch per 100 net days 1950-2019.

Shark bite incidence is also declining over the long term. The last two decades have seen more shark bites than the previous two. This is not surprising given Australia’s beach use has again grown rapidly in recent decades.

But shark bite incidence relative to population is substantially lower from the mid-20th century than during the decades before.



Shark bite incidents in NSW per million people per decade

In NSW, lifeguard beach patrol grew over the same time period as the shark meshing program. More people swam and surfed in the

ocean from the early 20th century as public bathing became legal. The surf lifesaving and professional lifeguard movements grew rapidly in response.

Today, 50 of the 51 beaches netted through the shark meshing program are also patrolled by lifeguards or lifesavers. Yet improved safety is generally attributed to the mesh program. The role of beach patrol is largely overlooked.

So, claims that shark bite has declined at netted beaches might instead be interpreted as decline at patrolled beaches. In other words, reduced shark interactions may be the result of beach patrol.

More good news is that since the mid-20th century the proportion of shark bites leading to fatality has plummeted. This is most likely the result of enormous improvements in beach patrol, emergency and medical response.

The study says there is no reliable evidence that lethal shark management strategies are effective.

The NSW Department of Primary Industries, manager of the shark meshing program, is investing strongly in new non-lethal strategies, including shark tagging, drone and helicopter patrol, personal deterrents, social and biophysical research and community engagement. This study provides further evidence to support this move.

Investing in lifeguard patrol and emergency response makes good sense. The measures have none of the negative impacts of lethal strategies, and are likely responsible for the improved safety we enjoy today at the beach.

WILDLIFE ENCOUNTERS

Tiger sharks are lazy

Source: AIMS

Specialists tags which combined cameras were attached to 27 tiger sharks in the Ningaloo Reef off the coast of Western Australia. What do they do? Not much.

Collecting 60 hours of footage, the tags showed target species including turtles, large fish and other sharks performing escape manoeuvres when a tiger shark showed interest. The response from the tiger sharks was surprisingly lazy. "Our tagged sharks just continued on their courses without attempting to predate on the alert individual even if they were right in front of them," said Dr Andrzejaczek. "We found the sharks were more likely to use stealth to sneak up on their prey."

Dr Adrian Gleiss of Murdoch University's Harry Butler Institute compared tiger sharks to lions. "They don't waste energy stalking prey that are already aware of them and can easily escape," Dr Gleiss said. "These sharks minimise energy output and chances of success by sneaking up on unsuspecting turtles and large fish." The tags revealed the tiger sharks frequently hunted in the shallow sandflat habitats of Ningaloo Reef.

ISSUES IN BIODIVERSITY

Whitsunday shark culling measures

Shark killing in the Whitsundays is back on despite a court ruling, thanks to Federal intervention.

The Humane Society successfully challenged the Queensland Government's practice of culling sharks caught in drum lines. It found the evidence that killing sharks did nothing to reduce the risk of unprovoked attacks. The Federal Court ruling that meant Queensland Fisheries staff could not automatically kill the sharks they caught. Five months on, the Federal Government changed the State Government's permit to get around the ruling.

Now captured sharks must be assessed by fisheries staff and released at the site of capture, if they are judged as healthy enough. Tiger, bull and white sharks will need to be tagged and moved elsewhere. Neither minister said how many sharks they anticipated would be euthanised.

Marine biologist Lawrence Chlebeck said "We're going to keep close tabs on it … we expect Queensland fisheries to release statistics on how many sharks are caught, and what their condition was upon release. "If any euthanising does occur, we hope to be able to have access to that information as well, so we can closely monitor it."

The announcement included a further $1 million towards shark management in the Whitsundays.

There have been fatal shark attacks in Cid harbour that have severely impacted on tourism. Whitsunday Tourism CEO Natassia Wheeler said, "Forward bookings are showing an impact and the enquiries are not coming through like they were." She was "thrilled" with the announcement to resume selective culling, and said that it would have a positive impact on tourism.

Still, local MPs have protested about what they see as inadequate measures.

North Queensland Surf Life Saving regional manager, Rob Davidson, said the announcement was an overall win for swimmer safety. "It is a control measure. Let's be honest sharks live in the ocean and that is what we can expect," he said. "But having a control measure at our high-use beaches or our bathing beaches — it's a good way of mitigating risk to people who are in the water.

However, research shows that large sharks tagged in the Whitsundays and Cairns have travelled thousands of kilometres throughout the Great Barrier Reef and beyond. According to Roof and Brown in the Conversation, baited drumlines and nets have been found to actively attract, not deter, large sharks.

There are 173 drumlines in the GBR Marine Park and another 23 in adjacent State waters. Last year they killed 557 sharks. About 180 were tiger sharks, about 100 Bull Sharks and 3 Makos. Most of the smaller sharks are already dead when retrieved.

People threaten sharks on the Great Barrier Reef

James Cook University

Much of the Great Barrier Reef is legally protected in "no-take" marine reserves but shark populations on the Great Barrier Reef aren't recovering thanks to poaching.

The entire Great Barrier Reef was open to fishing until 1980, when no-take reserves were established. More reserves were created over the next two and a half decades, resulting in reserves that vary in age from 14-39 years. A small number of no-entry reserves, which are completely off limits to humans, were also implemented to gauge the potential effects of activities such as boating and diving.

Using underwater survey data from 11 no-take reserves and 13 no-entry reserves, scientists reconstructed reef shark populations through the past four decades of protection. Surprisingly, they found shark populations were substantially higher – with two-thirds more biomass – in no-entry reserves than in no-take reserves, indicating that the reserves currently do not support natural shark populations.

After 40 years of protection, the average amount of reef sharks in no-take reserves (areas where fishing is forbidden but people can boat or swim) was only one-third that in strictly enforced human exclusion areas. It isn't the boating or diving impacts, the difference is likely down to poaching. Recent research found up to 18% of recreational fishers admit to fishing illegally and the majority of people who see it say nothing.

No-take marine reserves are an effective way to combat overfishing. With few exceptions, well-enforced no-take marine reserves result in rapid increases in target fish populations, leading to flow-on benefits for fishermen.

In many cases, no-take marine reserves are considered to have intact ecology and show us (including scientists) what undisturbed ecosystems should look like. However, no-take marine reserves may be inadequately reflecting ecological baselines in areas open to poaching.

Enforcement of no-entry reserves is much easier than no-take reserves as evidence of fishing is not required for prosecution. On the other hand, vessels are allowed to be present in no-take reserves.

While the creation of more and larger no-entry reserves may solve the problem, this approach is likely to be unpopular. An alternative approach, would be to tackle poaching.

Managing a troubled fishery

Primary Source: FISHERY ASSESSMENT REPORT TASMANIAN ROCK LOBSTER FISHERY 2017/18

I'm a diver who is no longer obsessed with looking for crays. Lucky, as the allowable daily catch has dropped from 10 to 2 in my lifetime, and even then they take some effort to find. That's happening because fishing in Australia is going through some fundamental (but managed) changes.

When I started cray diving, cray (southern rock lobster) dens with a dozen crays of mixed sizes were commonly seen. Now I don't see very many, and they are all one size, usually undersized with very few small juveniles. Instead, urchin barrens are forming along the East Coast, making large areas virtual deserts. The exceptions are marine parks where huge crays are at their 'virgin' unfished stock levels and are roaming everywhere in broad daylight. All this is explainable if the fishing areas I've seen are overfished, suffering from poor recent recruitment and climate effects. It seems that this is what has been happening, but there are people out there trying to cope with the changes. They need your help.

<u>Crayfishing controls</u>

Fishing for crays is controlled by a limit on the total tonnage of fish that can be caught, as well as bag and possession limits. The total allowable catch (TAC) has been constant at 1050.7 tonnes for the last four years. This is a catch of around 1.1 million crays. These caps were introduced in the 1990s to combat overfishing and it improved things until 2006. Then there was a dramatic decline in recruitment from the early 2000s. As the older crays were fished out there were no replacement new recruits, and it led to substantial decreases in catch rates from 2006 onwards.

This caused the TAC to be cut by about a third in response. There was a lot of kicking and screaming about that, but the changes were essential. Various cuts from then until 2015 have achieved a rate that will see stocks slowly rebuild if everything else stays the same. For the last six years the amount of work commercial fishermen do to catch a cray (catch per unit effort (CPUE)) has improved with noticeable changes in the last two years.

<u>East Coast problems</u>

What happens to sheltered places close to processors, boat ramps, cities and holiday shacks? They get belted harder than other places. Recreational Rock lobster fishing is mainly about the East and especially the SE coast. 36% of all recreational cray fishing occurs in the Hobart, Tasman and Bruny region (Area 1).

In 2011/12 east coast cray stocks hit an all-time low, because of years of below average recruitment and heavy fishing pressure. DPIPWE put together the East Coast Stock Rebuilding Strategy (ECSRS), for the area between Eddystone Point and Tasman Head. This limited the average annual total catch (recreational and commercial) off the east coast of Tasmania to 200 tonnes. In 2016, it was determined that the catch limit be split 79% to commercial and 21% to recreational, which is the historic catch split in the zone.

Commercials got catch caps just for their East Coast journeys and when the catch approaches the cap, the commercial fishery in the East closes until the following March.

Recreational fishermen saw their catch limits plummet. Even then, the modelled recovery tonnage didn't work, so measures were taken to see the catch drop to 195 tonnes in 2017/18, which seems to have done the job and stocks should now slowly recover. Again, there were lots of threats and screaming at quaking politicians, but the changes were essential.

While the commercial sector is intensively managed with scientific modelling and logbooks, "management of the recreational component of the fishery has proven difficult". The allocated recreational catch share has been exceeded in all but one season since the rebuilding strategy was started.

Commercial crayfishing is shrinking but profitable

As commercials are recently having to spend less on fuel to get crays, they are willing to pay more to lease pot licences. The more prosperous fishermen in bigger boats are pushing out the smaller players. Ironically, recent stock improvement is actually causing unemployment, but it's a process that has been going on for a long time. The crays are now caught by 194 licensed vessels, down from 300 vessels for the 1998/99 season when quotas were first introduced. However, these guys are likely to make even more money thanks to a growing export demand (Covid19 ignored for a moment). Ironically, restricted catches might just push up the price.

The Science

This IMAS assessment relied on modelling, using past fisheries data to build a picture of what the future might look like in certain scenarios. This modelling is affected by the assumptions used, some of which I find a bit too optimistic,

"Projections of the stock made for the purposes of this report had a series of settings with the most important being:

(i) future recruitment assumed to be broadly reflect that observed from 2000-2014 [no changes for issues like climate change];
(ii) no change in catch was modelled except through changes in the TACC (i.e. recreational and illegal catch was constant);
(iii) no loss of productivity through expansion of no-take MPAs [that is disagreeable to me but likely];
(iv) no loss of productivity through expansion of urchin barrens [to me this is very unlikely];
(v) no loss of productivity through increase in natural mortality [In 2013, south-east Tasmania experienced a climate shock when they were forced to close in response to a toxic algal bloom]; and
(vi) all other management rules were held constant.

Fortunately, some statistical 'slack' has been built in, for "…protection against declines in productivity that could occur through processes such as expansion of urchin barrens, increase in natural mortality or decline in recruitment".

Recruitment (new baby crays arriving and surviving) occurs in infrequent large pulses with long gaps of nothing much in between. Recruitment has been low and patchy for a long while, more than usual.

If the recruitment process is fundamentally changing (for example due to changing oceanic currents) historic data isn't a great guide for modelling. Using short term recent data is also flawed if there has just been a 'run of bad luck'. More recent data was used for

the modelling. That suggests researchers (quite rightly) aren't writing off our problems with recent low recruitment as just a 'run of bad luck'. Thanks to a warming world, I'd suggest that is possibly the 'new normal'.

What are we after from fishing?

Basically, commercial fishermen want what all businessmen want, to make money without too much competition from others for the resource. Tasmanian recreational fishermen want to catch lots of crays and we aren't keen on sharing either, including to the environment. However, that can't even be partly delivered with everyone doing their own thing, or by setting fishing limits based on daydreams.

The biomass target reference point (TRP) is the state of the cray stock we would like to see, "for maximising economic rent and recreational amenity" (note nothing for the environment there). We want to restore stocks to 25% of the unfished biomass. That basically means 25% of what you might see in a closed marine reserve. For IMAS this "TRP is an extremely low value for a target relative to those used in most fisheries". Have you noticed that we are struggling to get to even this unambitious target?

It seems that we might be happy with not having too many crays around long-term, if it means not having to accept more short-term restrictions on our fishing.

Marine researchers are still hopeful, "Once reached it is expected that a new and higher TRP that continues the rebuilding pathway will be established". It would also be nice to have a few more crays around for the environment, to eat up some of those feral urchins, or dare I say it, a tiny bit more land for more marine reserves.

Unlike the optimistic tone of the IMAS stock assessment, a recent IMAS study by Associate Professor Jeremy Lyle (on recreational fishing) was a bit more blunt. He stated that recent adjustments won't do enough to constrain the combined recreational and commercial catch and rebuild stocks. As stocks rebuild higher catches are likely to attract more fishers, making the problem worse. "To rebuild the east coast stock, we need to accept that further management intervention is unavoidable," Assoc Prof Lyle said.

Add to that the environmental factors that seem to be 'softly spoken' in the IMAS stock assessment. The long term prognosis for many types of fishing are not great in a warming world. Climate change not only increases water temperatures but also boosts acidity, reduces nutrients, and changes water currents. Oxygen levels also decline in warm water. All this is likely to have an effect over time.

Dr Alistair Hobday's research at the CSIRO isn't quite so upbeat on the future prognosis for our fisheries, "We've been predicting climate impacts to fisheries and aquaculture for several decades, but there has been a lack of urgency to respond." "The next decade will be critical for the seafood industry". "Over the next ten years we expect to see continued and rapid changes to the marine environment including marine heatwaves and increased disease of aquaculture stock. This will likely lead to further changes in abundance and distribution, quota allocations, and increased domestic and international market demands."[my emphasis]

Surveys of recreational cray fishers indicated strong opposition to any further reduction in daily bag limit (currently two lobster), or season length. There was more support for a maximum seasonal catch and an increase in minimum size limits. "The limit that would be acceptable to most (20 lobsters) was much greater than the average individual catch required to meet the east coast recreational catch share target". In other words, we had fine ideas, but no-one was serious about giving up anything.

Beware, further changes to your fishing are inevitable. Do the right thing, bear up with any new restrictions. They are designed to keep your fishing working well under trying and changing circumstances. Adapt, before you lose not just the 'right to fish' but the fish themselves.