

# MARINE *Life*

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## Our Goal

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

## The Crew

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**Disclaimer:** The views expressed in this publication are not necessarily the views of the editorial staff or associates of this publication. We make no promise that any of this will make sense.

**Cover photo, David Byrne, Lord Howe Island**

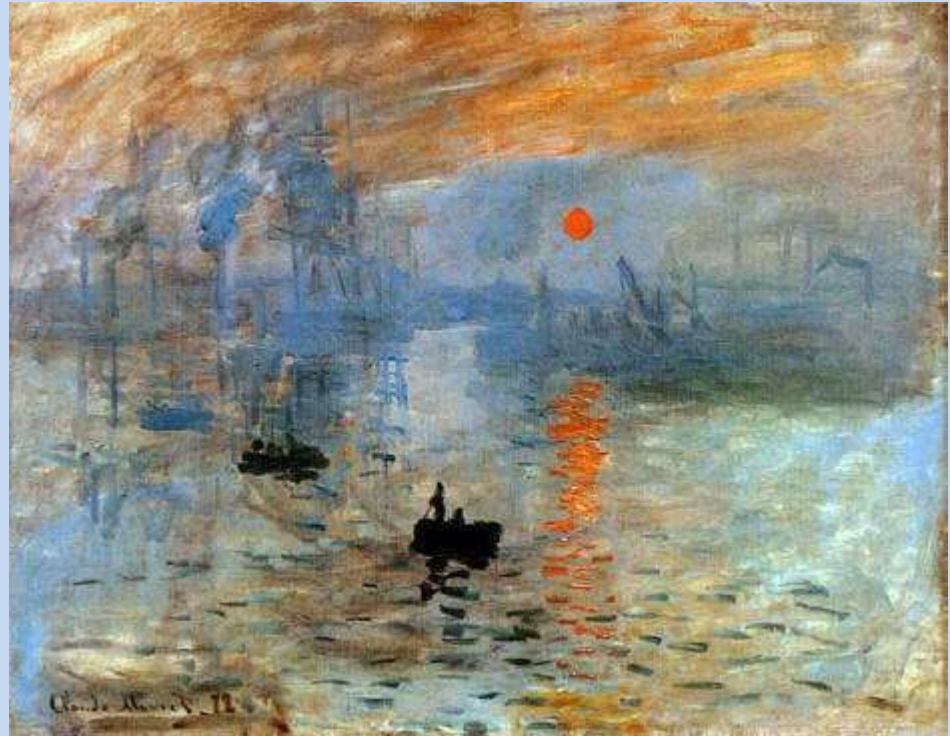


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[Indexes are a chore and this mag is thin enough to flick through, but if you use them let me know and I'll reinstate it.]

## Marine Impressions



*Impressionism Sunrise, Claude Monet*

## Marine Life Birdie Boys go Counting

### 2017 BirdLife Tasmania Winter Gull Count



***Every June Bird Life Tasmania volunteers go out and count gulls, and for several years a few Marine Lifers have assisted with a boat survey along the Western Derwent River shore from Blackman's Bay to Tinderbox. It's a fun muck around day in the boat with a purpose.***

According to Dr Eric Woehler, who should be thanked for organising it all, all three species were recorded in fewer numbers than in the 2016 WGC. Silver Gulls Silver Gull numbers decreased from 12,000 birds to 11,000 birds in 2017. The total number of Kelp Gulls recorded was 20% lower than in 2016. The total for 2017 is approximately half of the peak number recorded in 2014 of more than 7000 Kelp Gulls. The WGC recorded fewer than 500 Pacific Gulls; 40% lower than 2016. For much of the period 1980 – 2000, Pacific Gull numbers fluctuated between 200 and 400 individuals, and the recent counts appear to show an increase in the species despite inter-annual fluctuations.

Several counters commented on the low numbers of juvenile and subadult Kelp and Pacific Gulls. Juvenile and sub-adults comprised fewer than 10% of the total Kelp Gull count. Whether

these low numbers reflect a poor breeding season for the species, high post-fledging mortalities or the movement out of the count area is presently unknown.

Our contribution was made by David Byrne and Richard Mason, who braved some big seas on the return journey, following a successful count. Some of the informal observations are interesting too. On arrival back at the boat ramp a commercial fisherman told them that there were large schools of baitfish a few miles out to sea that were being mauled by large numbers of Pacific Gulls. Others saw large flocks of gulls feeding on baitfish at Lauderdale and Cremorne. The beaches at Blackmans Bay and Dru Point also had large flocks of silver gulls hanging around for no particular reason, perhaps to drink at nearby fresh water sources after a big offshore hunting foray. They have been there for weeks.



*Photo Alan Fletcher Tassie Birds– eating cockchafer beetles washed in to the river after rain in 2011*

## Why Count gulls?

**Why count these "rats of the skies"? Like many groups of birds, seabirds have been used as environmental indicator species for many years.**

*Source: Climate and competition in abundance trends in native and invasive Tasmanian gulls, Woehler et al*

Seabirds are sensitive to climate changes and ocean events such as the El Niño-Southern Oscillation (ENSO). Most surveys so far have been about one species, not several species that interact.

The southeast Tasmanian winter gull count started in 1980, counting kelp and Pacific gulls. In 1983, silver gulls were added. The counts are conducted over 3 to 5 hours on one mid-winter Sunday morning by a large team of 40 to 50 volunteers. They count the gulls seen at beaches, sportsfields, clifftops, tips and fish farms. It's the longest running gull count in Australia.

There are 2 native species of gulls in Tasmania, the silver gull *C. novaehollandiae* and the Pacific gull *L. pacificus*, and 1 recently established species, the kelp gull *L. dominicanus*. Despite (or perhaps because) gulls are seen everywhere they aren't thought of as very important by many people. Many people write them off as 'rats of the skies'.

Silver gull numbers in Australia are generally considered to have increased since European settlement, most likely thanks to human tips, but we don't know for sure. There is no other long-term population data for Pacific gulls and the species is relatively rare on a global scale, probably consisting of fewer than 11 000 individuals. Kelp gulls are believed to have established in Australia from New Zealand, with early records from the Australian mainland in the 1920s. Kelp gulls have been identified

as nest site and food competitors with silver gulls, as winter feeding ground competitors with Pacific gulls and as predators of both Pacific and silver gull chicks. We don't really know how much they predate on other gulls.

After 37 years there is enough data to start asking some big questions about (1) population trends (2) the role of the physical environment (e.g. sea surface temperature) on these populations and (3) competition between the species.

You may already have some idea based on what you see at the beach. With lots of tips around numbers must be going up all the time? Obviously big aggressive kelp gulls are driving down the numbers of other native gulls? Good thinking, but it's mostly WRONG. Keen observations are great, but data is even better.

Kelp gulls have increased in numbers until recently, while the numbers of the 2 native gulls haven't changed in line with the kelp gulls increases. So much for a big predation impact of kelp gulls on other gulls.

When scientists looked at the figures compared to climate information, they made more sense. Changes in ocean productivity are often driven by changes in the winds, which drive ocean mixing and the supply of nutrients to surface waters. Increased wind leads to increased abundance of krill, a prey item for gulls. Wind changes match up with the population changes for the 2 native species of gulls. It looks like the fluctuation in numbers of native seabirds has more to do with food supply.

One reason why it's important to keep counting is that, as the climate changes, we should start to see changes in the population of these birds. This is a warning sign for broader changes we may be causing to the ecosystem.

## Investigator Finds 'Alien' Abyssal Fish

Source CSIRO



'Deep-sea fishes' conjures up thoughts of species with enormous fang-like teeth, rows of coloured lights and peculiar structures like fishing rods tipped with glowing lures. However, these are really the twilight dwellers inhabiting waters well above the bottom, depths to little more than a mere 1000 metres or so.

Their evolution has been driven by the necessity of acquiring a meal in a food poor environment. Many living at these depths are daily migrators moving upwards at night under the cover of darkness to near surface waters where food abounds and once again back to the dimly lit depths below during the day to escape being seen.

The true abyss is many thousands of metres farther down where animals and their meals are generally far less distinctive, though similarly few and far between. Here the food is mainly the bodies of animals, tiny to whale-sized, that have died in waters above and have slowly drifted to the abyssal floor. There, life's energy is recycled by boneless scavengers that in turn provide meals for lethargic predators, conserving their energy as they go about a constant routine of acquiring what is needed in a timeless, lightless world.

The vast majority of fishes living at abyssal depths have come from ancestors that arose early in the evolution of living fish lines, we find primitive eels and eel-like relatives.

Recently the CSIRO vessel "Investigator" has been searching the deep seas of Southern Oceans for new data on these little-explored areas.

Twenty-seven scientists from seven countries left Launceston for a month of sampling that took them as far as Fraser Island in Queensland. Along the way they stopped at seven sites and lowered equipment to a depth of 4 kilometres.

They are looking at what is known as the abyssal plain, which in some parts of the ocean gets as deep as 11 kilometres. It takes the ship's sampling gear between six and eight hours to reach the sea floor, where there is mostly fine mud. The pressures would be crushing for humans and there is no light.

The grab sampler scoops up the mud and any small animals that get in the way.

The fish generally have no eyes because it is so dark they can't see. Some produce their own light through bioluminescence.

While maintaining deep-water moorings, when one of the science teams captured footage of a squid attacking another squid.



Both squid as likely belonging to the family 'Ommastrephidae', They may be different species trying to eat each other.

One of the foundation principles of the Marine National Facility, which owns and operates *Investigator*, is that all data must be open access and made freely available. Resources like the Atlas of Living Australia (ALA) is making the data accessible.

The ALA is Australia's national biodiversity database and contains more than 67 million records.



*Monkfish*

## No Abrohlos Marine Park

### **The West Australian Government has abandoned plans for a new Marine park.**

At a Liberal Party state conference in August, former premier Colin Barnett unveiled a plan to create a national park that would stretch across 90 per cent of the islands. Twenty-one islands which house fishers' shacks, private jetties and Department of Fisheries infrastructure would have been excluded. Camping would also have been offered for the first time, to attract more visitors to Geraldton.

The new Environment Minister Stephen Dawson has scotched the project, "While the McGowan Government is committed to the protection of world-class natural assets and the creation of national parks, our priorities for this term of government are the delivery of the commitments we brought to the election."

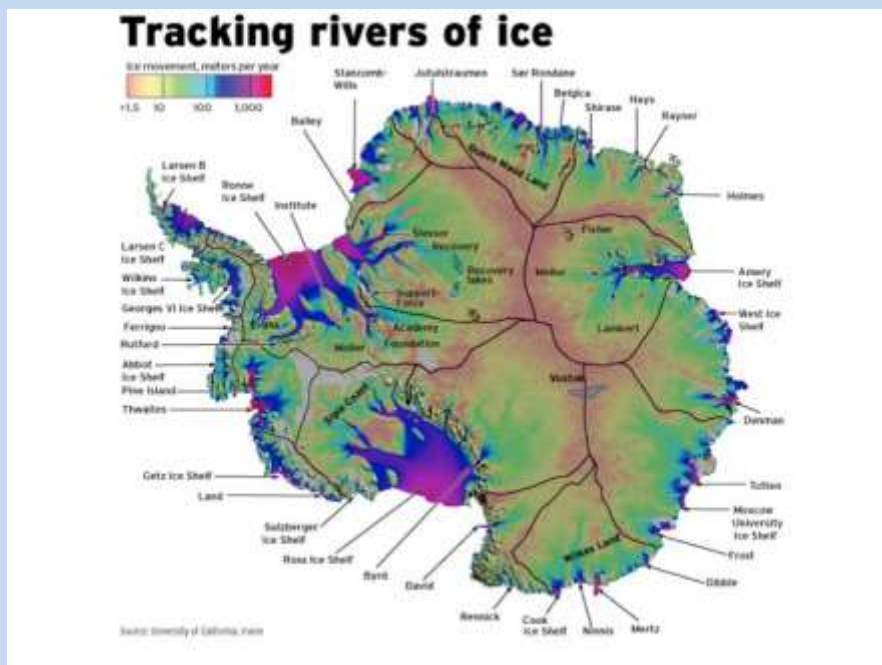
Jay Cox has operated a cruise and charter business at the islands for 14 years said, "All it's going to hurt is Geraldton and the Mid West".

"There are a lot of businesses in Geraldton that are struggling. "Tourism would go a long way to helping those businesses get more people into town". As it is now everyone just drives past Geraldton.

Here's hoping that as the new government settles in, that these issues can be brought back on to the table, as irritating as it might be when the opposition has a good idea.

## What's Happening to the Antarctic Ice Cap

**The ice shelves surrounding Antarctica have often thinned rapidly in the last decade, and much faster than scientists had thought. Recently a large section of the Larsen C ice shelf broke away.**



A new European Space Agency study looked at satellite data going back to 1994, and it showed that some Antarctic glaciers they studied had melted by almost 20 per cent. The pace of loss is accelerating, particularly in West Antarctica. However, each glacier varies quite a lot. Some glaciers thin up to three times faster than neighbouring glaciers, and vary between decades.

Possible reasons for these variations include differences in glacier catchment size, bedrock, topography and hydrology.

## Amundsen Sea

It seems likely that the glaciers flowing into the Amundsen Sea have been drastically losing ice due to rising sea temperatures recorded around Antarctica in recent decades.

“Scientists generally agree that it is warm ocean water that melts the floating part of the glacier, which then allows the glacier to flow more easily because it’s no longer held back by the floating ice shelf. As the glacier flows faster, it starts to become thinner,” said Dr Hannes Konrad.

“If there’s not enough snow and ice accumulating higher up to compensate, the glaciers lose more and more of their mass as they flow towards the sea, and that’s exactly what we are seeing here, but the detail varies considerably between the three systems, and even within each glacier.”

The Pine Island Glacier is known to contribute more to rising sea levels than any other ice stream on the planet, and the neighbouring Thwaites and smaller Pope, Smith and Kohler Glaciers are also losing ice.

## Totten Glacier

There are a few places in East Antarctica where changes in the grounded ice sheet is also visible. They’re not as dramatic as in West Antarctica.

A different Australian study has confirmed that warm water flowing through a deep channel under East Antarctica’s largest glacier is driving rapid melting.

In 2014-15, researchers aboard the Australian research vessel *Aurora Australis* gathered the first oceanographic data from the calving front of the Totten Glacier, when a long crack opened up in sea ice that is normally impenetrable to ships. Scientists knew from satellite data that the Totten has been thinning faster than

other glaciers in East Antarctica, but didn't know why. The nearby Moscow University Glacier has been pretty stable.



They discovered a large channel in front of the western side of the Totten Glacier which is around 10 kilometres wide and up to a kilometre deep. Warm ocean water is reaching the ice shelf through this channel, with temperatures high enough to drive rapid melt of the underside of the ice shelf.

On an area-averaged basis, Totten has the highest basal melt rate among Eastern Antarctic ice shelves larger than 1000 km<sup>2</sup>. If the Totten and other ice shelves around the edge of Antarctica melt, more glacial ice can flow into the ocean, raising sea levels. The Totten is the largest glacier in East Antarctica, and it contains enough ice to raise global sea levels by about 3.5 metres if it all melted (it wouldn't all melt), so it is important to know how it will behave in the future.

### Still plenty of Snow

While important glaciers and ice shelves are thinning around the edge of the continent (the most critical areas for animals) and in some areas on land, the overall picture is less clear. A 2015 NASA study showed the land ice is not dramatically lessening. This was leapt upon by climate change sceptics, but NASA also warned it might only take a few decades for Antarctica's land ice growth to reverse, according to NASA, "If the losses of the Antarctic Peninsula and parts of West Antarctica continue to increase at the same rate they've been increasing for the last two decades, the losses will catch up with the long-term gain in East Antarctica in 20 or 30 years -- I don't think there will be enough snowfall increase to offset these losses." The point is we need to understand the processes much better.

### Larsen Ice Shelf

The *Larsen A* ice shelf disintegrated in January 1995. In 2002, a 3,250-square-kilometer section of the Larsen B Ice Shelf rapidly collapsed. Since 1995, the Larsen Ice Shelf has lost more than 75 percent of its former area in a series of rapid disintegrations. While Larsen A has been historically variable, the Larsen B had been stable for at least 10,000 years. The speed of Crane Glacier increased threefold after the collapse of the Larsen B and this is likely to be due to the removal of a buttressing effect of the ice shelf.

In 2015 a study concluded that the remaining *Larsen B* ice-shelf will disintegrate by the end of the decade, based on observations of faster flow and rapid thinning of glaciers in the area.

The Larsen disintegration events were unusual by past standards. According to a paper published in *Journal of Climate* in 2006, the peninsula at Faraday station warmed by 2.94 °C from 1951 to 2004, much faster than Antarctica as a whole and faster than the global trend; this localized warming caused a strengthening of the winds circling the Antarctic.



What surprised glaciologists was the speed of the breakup, which was a mere three weeks (or less). Andrew Fleming of the British Antarctic Survey said "The Larsen B shattered like car safety glass into thousands and thousands of pieces."

On 10 November 2016 scientists photographed the growing rift running along the Larsen C ice shelf, showing it running about 110 kilometres. Calving is considered to be a certainty in 2017 (it broke away recently). This will cause the collapse of between nine and twelve percent of the ice shelf (actually 12%). The larger swath of the Larsen C ice shelf that sits behind the soon-to-calve iceberg "will be less stable than it was prior to the rift" and may rapidly disintegrate like the neighbouring ice shelf did in 2002.

Since the ice shelf is already floating, its departure from Antarctica would not affect global sea levels. But a number of glaciers discharge onto it from the lands behind the ice shelf, and therefore might flow faster if it breaks away from the continent. If all the ice that the Larsen C shelf currently holds back were to enter the sea, it is estimated that global waters would rise by 10 cm (4 in).

### Wilkins Ice Sheet

In 1993, Professor David Vaughan of the British Antarctic Survey (BAS) predicted that the northern part of the Wilkins ice shelf was likely to be lost within 30 years if climate warming on the Peninsula were to continue at the same rate.

In March 2008, the Wilkins Ice Sheet on the Antarctic Peninsula lost more than 400 square kilometers (160 square miles) to a sudden collapse. Following that event, the Wilkins continued to break up, even as the Southern Hemisphere winter brought frigid temperatures to the fragile ice shelf. Scientists at NSIDC and around the world are now monitoring the Wilkins to see if the remaining portion will break up. The Wilkins Ice Shelf is a

rectangular ice shelf about 80 nautical miles (150 km) long and 60 nautical miles (110 km) wide. This feature occupies the central part of Wilkins Sound. While temperature may have played a part in this disintegration, several recent earthquakes of magnitude 5.0 and greater along the Pacific-Antarctic Ridge may also have contributed. What was left of the Wilkins ice shelf was connected by only a narrow neck of ice, and this gave way in 2009. The Wilkins Ice Shelf is not connected to inland glaciers in the same way as the Larsen B Ice Shelf was and will have a negligible effect on sea level rise.

Sea level rises of 2 metres or more are considered likely this century, with more extreme prospects up to 9 metres. Those more extreme predictions will have cities like Shanghai and Calcutta completely disappear.



## Old Warbirds live on In Antarctica



***We often see stories of scientists using whizz bang technology, but Antarctic scientists have spent their summers flying over the East Antarctic ice sheet in a World War II vintage plane that is 70 years old.***

Any old WWII documentary will soon show a Douglas Dakota DC-3. They were used in the thousands as a supply aircraft and for dropping paratroopers. These "biscuit bombers" became famous in battles like D-Day, Arnhem, Kokoda, as well as during the Berlin Airlift in 1948. They were even used in Vietnam. An enterprising company in Canada has rescued these old relics and given them a new lease of life as polar and Antarctic research aircraft.

Basler Turbo Conversions in Oshkosh, Wisconsin has a pile of old DC-3s waiting to be lengthened and refitted with new turboprop engines.

The company looks for "low-time" (less than 40,000 hours) airframes with relatively little corrosion and a good maintenance history. Corroded parts are replaced. Fitted with skis and expensive modern equipment, they are ready to measure Antarctic ice caps.

Once refitted they become the Basler BT-67. Fly-away price starts at about \$4 million, cheap by today's standards. It is still a rugged design that is surprisingly reliable. A BT-67 boasts 45 more mph of cruise speed and almost 4,000 more pounds of useful load than the original DC-3.

The ICECAP project (Investigating the Cryospheric Evolution of the Central Antarctic Plate) brings together the brainpower of experts from around the world to investigate how and why the ice sheet and ice shelves of East Antarctica are evolving.



Run by Kenn Borek Air they fly geophysical surveys over the ice sheet and glaciers in the Casey region. Recent ideal weather conditions around Casey saw a total of 15 flights over 74.5 flying hours and covering 21 550 km.

It is hoped the results will show how masses of warm water are transported from the deeper ocean up onto the continental shelf and contribute to glacial melt.



Its not all sunny weather. On December 20, 2012 a Basler BT-67 named Lidia went down in Antarctica while flying from an American base with tourists sightseeing over the Holtanna Glacier. There were no fatalities. Lidia was built back in the 1943, and first flew in 1944. The plane sat in the snow for almost a year before a team spent two months out in the open in tents, rebuilding it in the field. They brought with them two new engines, a new cockpit, landing gear, and fuselage repair supplies.

The YouTube video is illuminating and shows what boys in the Canadian Arctic do when there is no surf, they fly planes. The pilot looked too young to hold a car license, but the young are indestructible or so they think. "I flew her in, so I'll fly her oowt". Which is exactly what he did. The props were beating the snow as he nonchalantly revved her out of the hole. He would have looked just as at home in "Lidia" over Normandy in 1944, dodging flak bursts instead of ice ridges.

## No escaping ocean plastics

Source IMAS



***Imagine you are on a desert island, all alone except for 37 million pieces of plastic.***

In the movie "Castaway" Tom Hanks build a friend and a raft out of discarded rubbish washed up on his tropical refuge, but soon you might be able to built a plastic version of the "Titanic" instead.

The beaches of one of the world's most remote islands have been found to be polluted with the highest density of plastic debris reported anywhere on the planet. Despite being uninhabited and located more than 5000 kilometres from the nearest major population centre, Henderson Island is littered with an estimated 37.7 million pieces of plastic.



Part of the UK's Pitcairn Islands territory, the island is so remote that it's only visited every five to ten years for research purposes, but its location near the centre of the South Pacific Gyre ocean current makes it a focal point for

debris carried from South America or deposited by fishing boats.

IMAS researcher Dr Jennifer Lavers, found the beaches littered by up to 671 items per square metre, "Based on our sampling at five sites we estimated that more than 17 tonnes of plastic debris has been deposited on the island, with more than 3570 new pieces of litter washing up each day on one beach alone.

"It's likely that our data actually underestimates the true amount of debris on Henderson Island as we were only able to sample pieces bigger than two millimetres down to a depth of 10 centimetres, and we were unable to sample along cliffs and rocky coastline."

Lavers said most of the more than 300 million tonnes of plastic produced worldwide each year is not recycled, and as it's buoyant and durable it has a long-term impact on the ocean.



"Plastic debris is an entanglement and ingestion hazard for many species, creates a physical barrier on beaches to animals such as sea turtles, and lowers the diversity of shoreline invertebrates.

"Research has shown that more than 200 species are known to be at risk from eating plastic, and 55 per cent of the world's seabirds, including two species found on Henderson Island, are at risk from marine debris," Dr Lavers said.

Henderson Island is one of the world's last two raised coral atolls whose ecosystems remain relatively unaffected by human contact. Ten of its 51 flowering plants, all four of its land birds and about a third of the identified insects and gastropods are still surviving and are only found on the island.



Its only 9.6 kilometres by 5.1 kilometres and is located 193 kilometres northeast of Pitcairn Island. Over its history a few castaways have been stranded there. In 1902 Henderson was annexed to the South Pacific British Overseas Territory. In 1957, Robert Tomarchin and his pet chimpanzee, lived as a castaway, apparently as a publicity stunt.

In the early 1980s an American businessman expressed interest in establishing a home and airstrip on the island. Environmentalist groups lobbied to protect the island. It was designated a World Heritage Site by the United Nations in 1988.

## Tripod Fish

Source: CSIRO NOAA-OER

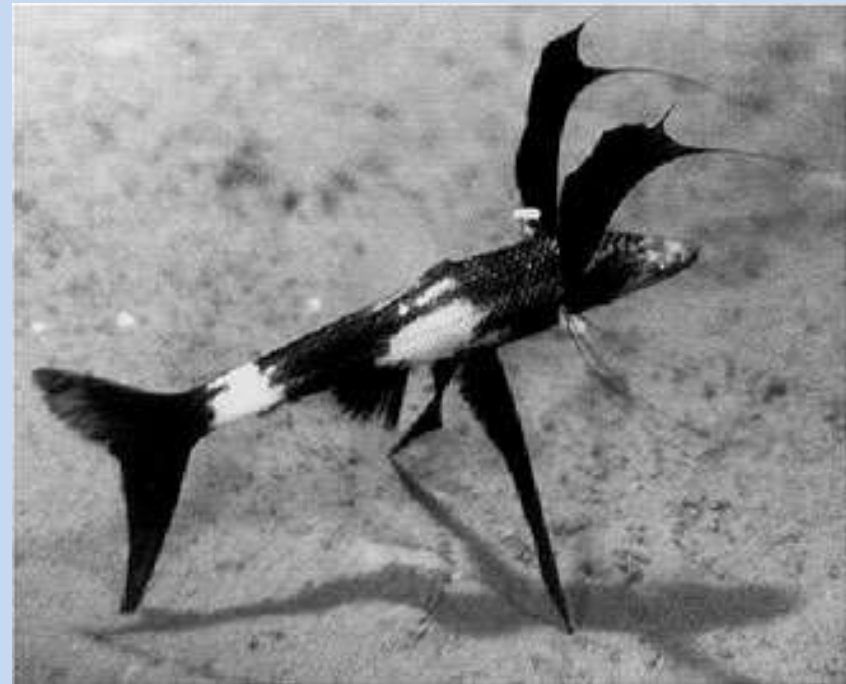
**Some abyssal species have evolved striking modifications. Among the most iconic are the descendants of shallow water lizardfish-like ancestors, the tripod fishes.**



They prop themselves above the bottom on extended rays of their pelvic fins and tail. Positioning themselves in slow moving bottom currents they direct their head toward the oncoming

water with jaws agape to filter suspended food particles with comb-like gill rakers, which function like the baleen of much shallower feeding whales.

Without the need to search for a meal, tripod fishes no longer need sight and have tiny degenerate eyes. Danger is detected by fin rays constantly sensing for the swimming vibrations of an approaching predator. The detection system compliments their well-developed lateral line sensors that are common to many fishes and are designed to do the same thing.



## Lord Howe Is Dives Part II

### ADMIRALTY ISLANDS



This area tends to be favoured as it offers some shelter in most weathers, usually has good underwater visibility and also contains some of the islands better dive sites. There are a mix of moderate depth and deeper sites from 15-30m, on the steeply sloping walls and boulders fields that fringe the shore of these volcanic islands. There are a large number of named sites near the SW side of Roach Island and Sugarloaf, with some deeper sites on North Island. Most of these dives offer good soft corals and sponges, but it is the fish life on the moderate to deep sites that is particularly good.

#### **Deacons Delight**

22m

This is considered to be an excellent dive site offering swim throughs encrusted in soft and hard corals. The fish life is also excellent with Galapagos shark, schools of fusiliers, trevally, kingfish, butterfly fish, tuskfish and Clown Triggerfish. The area can experience moderate currents at times.

#### **Octopus Gardens**

12 - 18 metres.

A large reef system with a range of diving from the shallow reef at the anchoring spot, to large sandy canyons and gutters in 16 metres. There is a lot of plate coral and fish life including, moorish idols, spotted sweetlips, butterflyfish and schools of moon wrasse.

#### **Ruperts Reef**

8-22m

Rupert's reef is in the channel between No-Name Rock and Roach Island. There is a crevice that gives access from the reef shallows to deeper water. There are green turtle, sea fans, bryozoans and lots of smaller marine life. The fish life is excellent.

#### **Noddy Island**

20m

The walls are covered in anemones, coral, sponges and weed. There is also a very nice reef in the channel just away from the island itself. It is named after the brown noddy terns that use the island as a nesting site.

## **Sugarloaf Island**

5 - 16 metres

A dive along the southern shore offers a steep rock wall. The area has some good corals and gorgonian sea fans, and a good spread of LHI fish life including moray eels. This area is dived in westerly weather when it becomes more sheltered. The area is usually exposed to the prevailing southerly weather.

## **Tenth of June Bombora**

7 - 18 metres



This dive is usually centred on a small pinnacle of reef that comes close to the surface. On the northern side there is a deeper boulder field near the island, draped in sea fans and patrolled by a dazzling array of schools of pelagic fish, white-spot chromis, trevally, drummer and fusiliers. It is known for having

unusual fish and invertebrate species including spanish dancers, as well as rarer blue angelfish, green jobfish, and Japanese boarfish. The dive can be completed by working back up the pinnacle where there are a few coral and sponge patches with interesting invertebrates, including various feather stars, ascidians, egg cowries.

## **North Rock (North Rock Close and North Rock Deep)**

Depth 18 - 35 metres

This island tends to be more exposed to swell and current and is infrequently dived, but is considered one of Lord Howe Island's best dive areas. The swell has carved tunnels and crevices through the fringing reef, then it drops over a wall into deeper water. Along the wall the current encourages the pelagic fish and invertebrate life. There is prolific soft coral growth and large black coral trees in deeper areas. Schools of southern fusiliers, violet sweep, spangled emperors, amberjack, yellow striped goatfish, trevally, tri-coloured basselets, kingfish and Galapagos sharks may be encountered.

## **Flat Rock**

12 - 24M

This small rock close to North Rock is often wave-swept. Experienced divers can visit the site and see large schools of pelagic fish swimming by in the current. The fish species include kingfish, big-eyed trevally, unicornfish, surgeonfish, knifefish and rainbow runners. Along the reef wall there are anemonefish, rare nudibranchs and christmas tree black corals.

## North East Shore



## Ned's Beach

2-10m

This beach is a major tourist drawcard and for good reasons. It offers snorkelling, safe swimming, fish encounters, nesting seabirds and lazy sunbathing, all close to facilities and a short stroll from the town. Years of feeding the local fish with pellets (which can be bought from a dispensing machine) has seen the sandy shallows routinely patrolled by mullet, dart, drummer and trevally. The fish will come close to swimmers, a hoot for the kids and adults alike. In late spring, the dunes are clustered with seabird nests, they make a racket but are apparently quite happy nesting in close proximity to humans.

The inshore beach area is protected by a shallow coral reef that provides good snorkelling very close to the shore. Snorkelling gear can be hired from a nearby amenities shed, where there is

an honesty box for payment. A good range of LHI inshore reef fish, and quite a few pelagic fish can be seen. There are even a few small giant clams as well as the popular anemonefish. The surge can get uncomfortable in a big sea, but it is generally very safe. If in doubt, ask a local.

On moderate days a 2 metre deep sandy gutter offers a passageway through the shallow reef, out past the breaking surf, and on to the offshore reef. It is a longish surface swim for anyone who has limited finning fitness. Just beyond the breakers there is a hole in the reef marked by a large bommie. The reef is heavily scoured in to some crazy shapes, and there are crevices and overhangs with reasonably good smaller marine life including the odd turtle. Tourists will need to be guided as navigation back to the beach can be tricky.

## Middle Beach

10-16M

This bay can be hard to reach in southerly weather, but on a good day it offers a very large area of reef. The offshore end of the reef is skirted by brilliant white sand, and the limestone has been carved into a honeycomb of interesting passages and crevices. The reef top is quite scoured, but the crevices have patches of interesting coral growth, quite a few feather stars and seastars and other invertebrates. Schools of small damsels, morwong, wrasse and doubleheaders.

The beach can also be snorkelled from land, but you need to be wary of currents. The best part of a snorkel trip is the walk there, and make sure you also fit in a walk to the nearby point. Clear Place Point trail offers mutton bird rookeries, big banyan trees, seabird roosts, Kentia palms and big vistas up and down the coast including of Ball's Pyramid.





## **SOUTHERN END**

### **South Head**

50m

There are a number of sites on the southern tip of the island but they are all deep dropoffs that are rarely dived. The sites offer big schools of pelagic fish including sharks. The area is for experienced divers and requires very calm weather.

### **Little Slope**

54m

Large boulders and caves mark this deep wall and it offers huge schools of pelagics in very clear visibility. Rarely dived and for experienced parties only.

### **Balls Pyramid**

25m

This is the world's tallest sea stack, located 26km (and a one hour ride) south of the island. The above water scenery is half of the attraction. Because of the distance the dives are double the usual price and are for experienced divers only. Dives are all drift dives due to the current.

The heavy swells mean that the exposed and shallower parts of the rock are swept of life, but the deeper crevices have caves and cracks with coral encrusted walls. There are three varieties of black coral tree in the area, with one 2 metres high. There are massive schools of violet sweep, amberjack, kingfish, silver drummer, rainbow runners, trevally and occasionally marlin, dolphins and even whale sharks may be seen during the voyage. Smaller reef inhabitants include one-spot chromis, clown triggerfish, turtles and stingrays. Small Galapagos sharks are also common. It's also possible to see the rare Ballina angelfish

has been encountered here although it is usually only found in depths over 100 metres in other areas. Named sites include The Dungeon and Ballina Bommie, but the area has a lot of scope for further exploration.

### **Observatory Rock/Wheatsheaf Rock/ SE Rock**

These sites lie close to Balls Pyramid and offer deep drop-offs patrolled by pelagics. They are rarely dived. There are two main dive sites that are more commonly visited Treasure Trove (Wheatsheaf Islet) and the Aquarium (Observatory Rock).

### **MIDDLETON AND ELIZABETH REEFS**

Middleton Reef lies 450km east of Ballina and 190km north of Lord Howe Island. This lagoon is reached by yachts and private launches. It is hard to hire vessels for tourist visits, as the charter boats based in Lord Howe are not usually rated for trips of that distance. Middleton is a kidney shaped atoll with a lagoon entrance on the NE side. It sits basically in the middle of nowhere and is a hazard to shipping. There are 16 wrecks on the reef. The only ones with identifiable remains are the ones that drove onto the top of the reef where they can usually be inspected at low water. The reef still regularly claims yachts and fishing trawlers. The largest wreck is the massive 13,500 ton freighter "Runic" that was a huge landmark for a long time, but is now collapsing onto the reef top.

Around the reef, the seafloor plunges to 400m very quickly, except on the north side where there is a narrow shelf of pristine corals. This site is very rarely visited and the anchorage is poor in a heavy sea. The reefs have dropoffs patrolled by lots of sharks, not all of them small. The coral in the lagoon is storm damaged but there are lots of big fish, kingfish, sweetlips, Japanese boarfish, double-headed wrasse, black cod, drummer and trevally.

Elizabeth Reef lies 28 nautical miles south of Middleton and has claimed 10 ships. It is very similar to Middleton except there is even less shelter.



## Pink Beaches and Forams



**Many shelled animals are so small they aren't often collected on beaches. There is a very ancient family of shelled animals called the Foraminifera that usually have to be seen at least with a magnifying glass. They come in an amazing array of forms.**

Forams" are members of a phylum called protists, although everyone argues about their classification. The majority live on or within the seafloor sediment (i.e., are "benthic") while a smaller variety (40 species only) are floaters in the water column at various depths.

Over 50,000 species are recognized, both living (10,000) and fossil (40,000). They are usually less than 1 mm, but one is 20 cm wide.

A number of forams have absorbed unicellular algae a bit like corals, to help them make food from sunlight.



Most have calcareous shells like beach shells. In other forams, these "tests" may be made of organic material, small pieces of sediment cemented together, and even sand.

These are old animals, shells are known as fossils as far back as the very early Cambrian period (540 million years), and they have been so numerous through time that many marine sediments are composed mostly of foram shells. A cubic centimetre of sediment may hold hundreds of living individuals, and many more dead shells. The limestone that makes up the pyramids of Egypt is composed almost entirely of Foraminifera. The pink sands of Bermuda beaches get much of their colour from the shells of a species of foram.



Dying planktonic Foraminifera continuously rain down on the sea floor in vast numbers, their mineralized tests preserved as fossils. Beginning in the 1960s, they have been used to date core

samples from oil drilling, so we know quite a lot about the different species that have lived at different times.

Foraminifera are found in the deepest parts of the ocean such as the Mariana Trench. In the deep ocean the bottom is often made up almost entirely of the shells of planktonic species. At these depths, the shell is soluble in water due to the extreme pressure. The Foraminifera found in the Challenger Deep have no carbonate shell, but instead have a shell of transparent organic material believed to be a type of clay.

Very little is known about how most species of foraminifera live. The few species that have been studied show a wide range of behaviours, diet, and life cycles. Individuals of some species live only a few weeks, while other species live many years. Some species burrow actively through sediment, while others attach themselves to the surface of rocks.

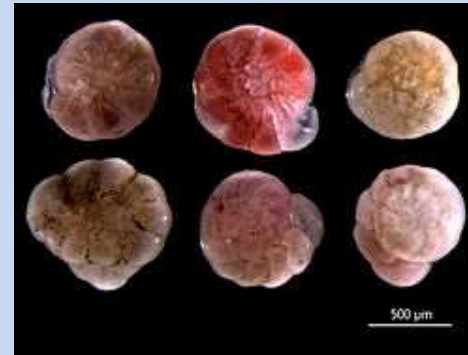
Foraminifera are an important part of the marine food chain, and their predators include marine snails, worms, crustacea, sand dollars and small fish. Anything sifting through sand is probably looking for forams.

Fossil Foraminifera are formed from elements found in the ancient seas where they lived. Thus, they can be used to reconstruct past climate by examining the stable isotope ratios and trace element content of the shells. Global temperature and ice volume can be revealed by the isotopes of oxygen, and the history of the carbon cycle and oceanic productivity by examining the stable isotope ratios of carbon.



Geographic patterns seen in the fossil records of

planktonic forams are also used to reconstruct ancient ocean currents. Because certain types of Foraminifera are found only in certain environments, they can be used to figure out the kind of environment under which ancient marine sediments were deposited.



Foraminifera can also be used in archaeology in sourcing some stone raw material types. The types and concentrations of fossilised Foraminifera within a sample of stone can be used to match that sample to a source known to contain the same "fossil signature".

They are also used as indicators of coral reef health. Because calcium carbonate is susceptible to dissolution in acidic conditions, Foraminifera may be particularly affected by changing climate and ocean acidification.



## State of Antarctica Report



Andrew Peacock

***The Antarctic environment is generally in good condition however it is showing clear signs of impact from climate change according to The State of the Environment 2016 Report, released by the Department of Environment and Energy.***

The most important factors contributing to physical change are warming of the oceans and the lower atmosphere, both of which are associated with increasing greenhouse gasses, and cooling of the stratosphere, mainly from ozone depletion.

The Report's key findings:

- Antarctica continues to warm, with changes in atmospheric circulation brought about by the Antarctic ozone hole reducing the overall amount of warming, particularly in summer.

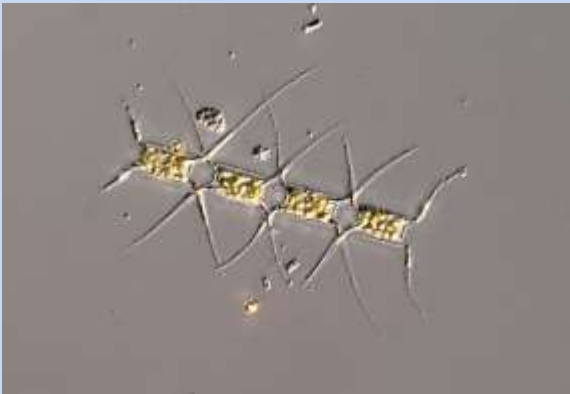
- While the Antarctic ice sheet is losing mass overall, this is primarily occurring in West Antarctica and the Antarctic Peninsula. The East Antarctic ice sheet remains close to neutral, or with a small gain in mass.
- While there has been a small increase in the extent overall of sea ice, and length of the ice season, there are strong regional differences which remain under investigation.
- The Southern Ocean continues to warm, with species from warmer waters increasing their range southwards.
- Ocean acidification, increasing wind strength and changes in ocean circulation in the Southern Ocean may affect the base of Antarctic food webs.
- Antarctic ecosystems are changing, especially where snowfall is replaced by rain.
- Population trends of animals vary across Antarctica with populations decreasing in some regions and possibly increasing in others.
- Sub-Antarctic islands continue to change, with a continued retreat of the glaciers at Heard Island. Areas affected by human activities in Antarctica continue to increase.



## Big changes for Southern Ocean Plankton

photos: IMAS Alyce Hancock

**Stronger winds, increased warming, ocean acidification and declining sea ice have been identified as major threats to some of the keystone members of the Southern Ocean community – phytoplankton.**



Each chain is roughly 1/5th of a millimetre

There will also be changes in nutrient availability, reduced sea ice extent, thickness and duration, and increased melting of glaciers and icebergs.

Phytoplankton are single celled marine plants at the base of the Antarctic food web, which sustain the immense diversity of life in Antarctica including krill, seals, penguins and whales.

Phytoplankton also play a critical role in mediating global climate by removing carbon dioxide from the air.

Changes in the growth, survival, productivity, composition and seasonal abundance of phytoplankton are expected in the future. Many of the expected environmental changes will tend to favour the small, flagellate phytoplankton over the larger diatoms

Diatoms are mainly eaten by krill, which are then consumed by the larger Antarctic species such as penguins, seals and whales. Small phytoplankton are generally eaten by gelatinous grazers such as salps and smaller zooplankton like copepods.

But a review of the latest scientific research, by IMAS PhD student Stacy Deppeler in collaboration with the Australian Antarctic Division and ACE CRC, has revealed that a clear trend of how Southern Ocean phytoplankton are affected is not expected to become apparent until mid-century, by which time the changes may be too far progressed to mitigate or reverse.

“It’s unlikely that we’ll be able to identify clear trends until around 2050, by which time some big changes in phytoplankton communities will probably already have occurred and it will be too late to consider mitigating them.

“But understanding exactly what’s happening is difficult due to the complexity of the stressors affecting phytoplankton, the size and regional diversity of the Southern Ocean, and the logistical challenges of conducting research there.

“While the changes in phytoplankton might happen quite quickly they’ll take a very long time to reverse.

“Although it’s currently unknown whether the rate of environmental change will outpace the ability of Southern Ocean phytoplankton to adapt, it is inevitable that changes in the Southern Ocean will influence the food chain there, the ocean biogeochemistry, and feedback on climate,” Ms Deppeler said.



## 30 Year GBR Coral Survey

***With AIMS' reef surveys extending over more than 30 years, the AIMS Long-Term Monitoring Program provides a long-term record of change in coral reef communities in the Great Barrier Reef.***



In 2012, an AIMS Report said that average coral cover on the GBR had fallen by half over the preceding 27 years. This data has now been updated as events have quickly overtaken this assessment. The scale of the coral cover decline in the Northern GBR since 2013 is unprecedented, first due to 2 severe cyclones and then the severe coral bleaching event which began 2016.

Averaged for the whole GBR, coral cover has declined by about a quarter from 2015/2016 to 2016/2017. Average reef-wide coral cover is down to 18%. It is important to note that these

updated results do not take into account the impact of Tropical Cyclone Debbie or the further intense coral bleaching in 2017.

### **The Northern region**

As of early 2017, coral cover in the Northern GBR was less than half of what it was in 2013, due to mortality caused by two severe cyclones, an ongoing crown-of-thorns starfish outbreak and severe coral bleaching in 2016. This level of decline is unprecedented in the 30+ year time series.

Bleached corals and dead coral skeletons overgrown by turf algae dominate the reefscape following the coral bleaching event of 2016 that devastated many reefs of the northern GBR.

### **The Central region**

Coral cover on reefs in the Central GBR has been generally lower than in the other two regions. Cover decreased to the lowest level on record in 2012, following Tropical Cyclone Yasi



in 2011, and was on a trajectory of recovery up until 2016. Surveys in early 2017 showed that coral cover started to decline, in response to the 2016 coral bleaching and increasing crown-of-thorns activity.

### **The Southern region**

The only good news was that coral cover on reefs in the Southern GBR fell to very low levels (less than 10% cover) following storms and Tropical Cyclone Hamish in 2009. Following this, the region experienced several years of little to no disturbance, allowing the reefs dominated by fast growing tabulate *Acropora* species to recover. Impacts of the 2016 coral bleaching were negligible in this region and, as at early 2017, the mean coral cover had increased to more than 30%.

### **2017 impact update**

In March 2017, bleached corals were most intense on reefs between Cairns and Townsville, but was evident on reefs from north of Princess Charlotte Bay to as far south as the Whitsunday Islands. Cloud cover and mixing of the water column by winds associated with Tropical Cyclone Debbie in late March 2017 may have eased bleaching conditions in the southern GBR, but wave action caused by the powerful and slow moving cyclone will have caused extensive coral loss on reefs in at least the Whitsunday sector. The impacts of these latest disturbance events on coral cover will be captured in future AIMS Long-Term Monitoring Program condition updates.

### **Assessing the long-term health of the Great Barrier Reef**

The sharp decline of coral cover in response to the severe disturbances affecting the GBR over the past two years is concerning. A recent study investigating the impacts of tropical cyclones on GBR reefs concluded that recovery can be strong on some reefs, as observed on reefs in the Central and

Southern GBR. However, the predicted increases in the intensity of tropical cyclones due to climate change could greatly accelerate coral reef degradation and will make it increasingly difficult for reefs to bounce back from disturbances.

The future recovery of the much reduced coral cover in the Northern GBR cannot be predicted at present, because it is the first time a decline of this magnitude has been recorded in that region. Past AIMS survey results have shown that reefs subjected to major heat stress events can exhibit slow rates of coral recovery, even if bleaching is not severe. Another factor of concern is the prevalence of coral disease on already stressed and impacted reefs. After the 2002 heat stress event, reefs with the greatest reductions in recovery rates had high levels of coral disease. Coral disease is a symptom of chronic ecosystem-level stress, and high levels of coral disease were confirmed at some reefs in February 2017.



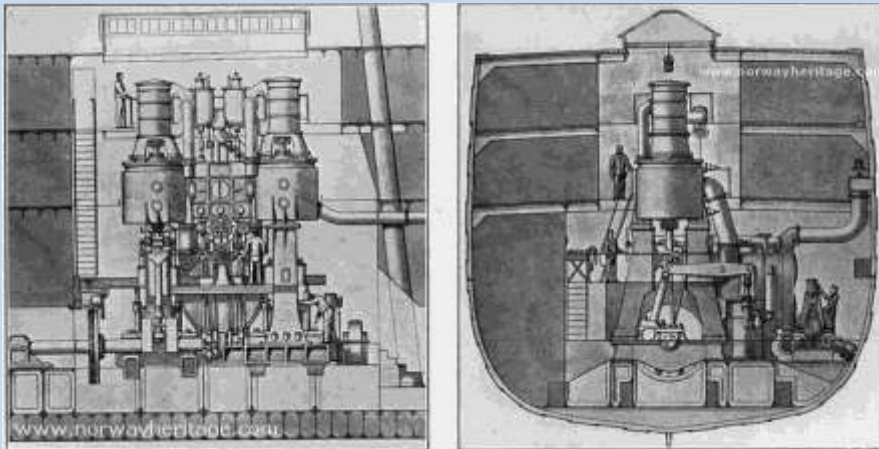


## Wrecks and their old Steam Engines

### Simple Inverted Engine

"Simple" Inverted Engines were the first modern steam engine. They had two cylinders (engines) of the same size mounted vertically (inverted from old arrangements). They took up little room and were of the jet condensing type using sea water. The first efficient propeller steam engine, they could run at high revolutions without gearing or vibration problems. The *Simple Engine* is known as an engine of the 1860's, but was soon replaced by the development of the *Compound Engine*. These were initially of similar size but generated more power with greater economy.

*Simple Engines* were developed using the steam hammer, a manufacturing device used to forge steel and iron, and were sometimes called *Steam Hammer Engines*. They are a rare engine type on Australian wreck sites. To date, examples have been found with the ss *Lady Darling* and ss *Woniara* wreck sites in NSW. In Victoria, they are found on the *Barwon* and *City of Launceston*.



## The S.S. "Barwon"



The 175ft long, 401 ton iron screw steamship S.S. "Barwon" was built in 1863 by R. Little & Co, Greenock Glasgow. She had 90 horsepower direct action inverted engines.

She arrived from Greenock in December 1863, "The trial trip of the steamer Barwon look place yesterday, and a very pleasant excursion was enjoyed by a party of about fifty; ladies and gentlemen, who wore invited by the proprietors to be present. This fine little steamer is intended for the trade between Melbourne and New Zealand, for which she is well adapted. She is a screw boat of 400 tons, two direct action inverted cylinders of 90 horse power, built by Messrs Steele, of Greenock, the celebrated builders of the Cunard steamers, and engined by Caird. She is the first introduction to the colony of a class of vessels which has proved, eminently successful in the home trade, namely, small power, fine lines and large capacity".

In November that year she ran between Melbourne, Sydney, Newcastle and the Hokitika goldfields in New Zealand. In April 1866, 1000 ounces of gold from the Grey River goldfields in NZ

on consignment to a bank in NSW was left unguarded in an empty cabin. It was stolen. Later the steward and stewardess were arrested and gave up the location of the stash, which was hidden in a pile of ash at Darling Harbour.

In a further embarrassment to her owners, she was stranded at Queenscliff on the 24th June 1866. The helm unexplainably heeled over and she ran straight onto the shore. The engines seemed to be working normally, and the papers hinted at the crew being drunk at the time. She had to be abandoned.

S G Henty, of western Victoria bought her and spent a good sum on salvage efforts. Marred by accidents and disappointments, his persistence was rewarded when she refloated in December, little damaged. In March 1868 she was sold to the Bulli Coal Mining Co., Sydney for use as a collier.

On April 3rd 1871 she struck Wadmore's Rock off Cape Bridgewater during foggy weather. The passengers took to the boats while the crew attempted to run the vessel ashore. The ship foundered 200 metres off the beach, in about 2-3M, about 30 metres up from the rocks on the NW corner of Bridgewater Bay near the Horseshoe Reef jetty.

By June, "nearly all the necessary preparations for raising the Barwon are now completed. Every opening on the main deck, the hatchways, the engine-room, the quarter-deck, the manholes— have all been battened over with tallow canvas fastened on wooden frames securely nailed down. Over the main hatch a strong framework trestle has been made to it securely, and this framework has been carried above the water, and is to serve as the support of a small steam-engine and centrifugal pump, which is held to be sufficiently powerful to pump the Barwon dry, that is, provided all the vents by which water could enter the vessel can be closed. The work is being carried out under the superintendence and direction of Mr John M'Kay, Portland, who has strong hopes that he will be able to float the vessel. All efforts up till this time have failed to discover the original leak that sunk the Barwon; but till this is found and stopped we

presume the final attempt to raise the vessel will not be made." This attempt failed.

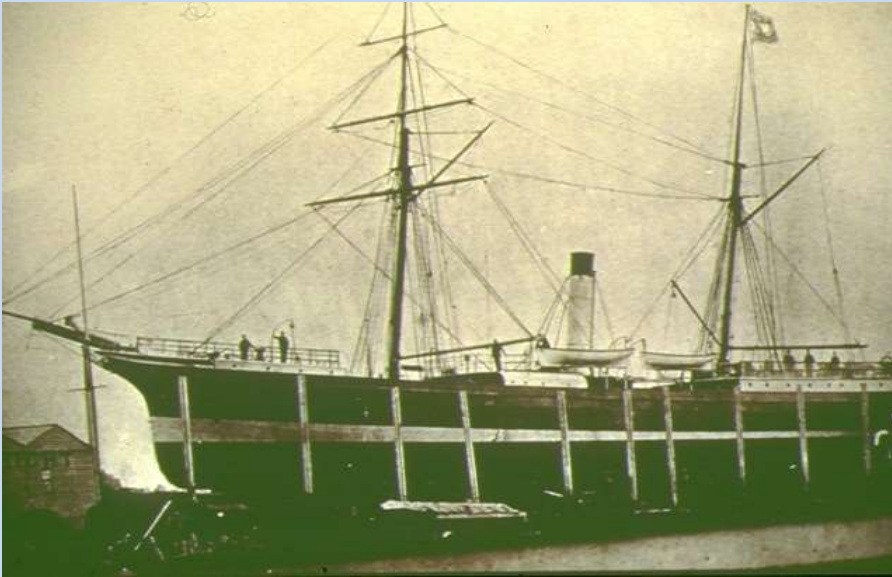
In November 1872, they had given up refloating her as she was progressively more filled with sand. Divers started to dismantle her where she lay "...three expert divers have, been at work on the wreck of the Barwon, steamer, in Bridgewater Bay, and a considerable quantity of iron donkey boiler, steam winch, screw propeller, anchors, chains etc have been recovered. We learn that the proprietors intend to make the attempt to float the main boiler, and if the weather continues good, it is more than probable the attempt will be successful".



It is likely that the smaller items in the Barwon have been removed, but her fine hull below the waterline, and I suspect her unique engines, are still buried on site.

The remains of the vessel could apparently be seen from the cliffs overlooking the bay as a dark patch. The only visible dark patch appears at these quoted coordinates, 38°22'36.51"S 141°24'31.15"E, although she seems to have mostly disappeared under the sand. Happy hunting.

## City of Launceston



The City of Launceston is one the most intact iron steamship wrecks of its age in Australian waters. The City of Launceston still has evidence of its cabin fittings, passengers luggage and cargo.

The City of Launceston was built at Greenock, on the Clyde, by Blackwood and Gordon. Her dimensions were-277 registered tons, length 177 feet. She came out to Melbourne under sail. The engines are inverted direct action, having cylinders of 94 in. diameter and 27 in. stroke, and though nominally 80 horse power could work up to 800.

"Her machinery is very compact, and at the same time very powerful. When under full steam they make 76 revolutions per minute. They are fitted with improved expansion sides, which can be adjusted at full speed so as to cut off the steam at any portion of the stroke from 7-8ths to 1-6th. By this arrangement steam and consequently fuel are economised when the ship is

under sail. The engines are also fitted with Silver's Patent Governor, a most ingenious invention for preventing the injurious racing of the engines in a heavy sea. The crank shaft is a single forging, and the Company have taken the precaution to import a duplicate of this, as well of other important parts of the machinery".

The "City of Launceston" made a trial trip to George Town and back with 600 passengers, who had been invited to witness her performance. "The banks were closed in honor of the occasion, and business in town was partially suspended". "Adorned from stem to stern with gaily colored flags, and her decks alive with pleasure-seekers, the noble looking vessel presented a pretty picture as in the morning sunshine she glided swiftly along the smooth waters of the Tamar". "Wines and refreshments were laid out in the saloon, and were free to every one. The brass band of the Volunteer Artillery was on board, and served to enliven the whole proceedings with their merry music. A space was soon cleared, and dancing was kept up with infinite spirit".

The *City of Launceston*'s usual route saw the ship travel for two years across the Straits. But on the night of 19 November 1865, it was clear and calm on the waters of Port Phillip as the *City* left Melbourne heading to Tasmania at the same time as the 500 ton *SS Penola* was coming into Melbourne. The *SS Penola* rammed into the side of the *City of Launceston*, with such force that the *Penola*'s bow was wedged into the side. The *City* was on the bottom of Port Phillip in less than an hour. All passengers and crew had no time to collect any belongings before they were forced to struggle aboard the *Penola* who limped back into port with its bow missing.

The *City* lay undisturbed until 1980 when it was relocated by members of the Maritime Archaeology Association of Victoria. The *City* currently lies within a protected zone, limiting access in an effort to preserve the wreck for as long as possible.



These days, the *City of Launceston* sits upright sunk into the silty bottom, a magnet for fish. The bow of the *Penola* can still be clearly seen, the large triangular piece of metal sticking out at a 45 degree angle. The wreck is covered in weed. A spiral staircase lies next to the remains of the smokestack. Bottle racks and loose bottles are scattered about. Despite being in an exclusion zone marked on nautical maps and charts the Launceston is draped in fishing line and snagged lures. Her hull and deck is damaged in places, presumably from carelessly placed anchors

While the protected zone is in place you can't dive the wreck without a permit but you can apply to Heritage Victoria for one.



Size comparison with the current Bass Strait ferry, *Lloyd Clearihan, Jane Mitchell*



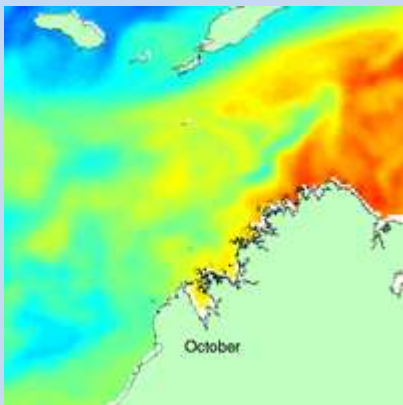
A 3D model of the ship's toilet, built for comfort not speed,- the ship I mean-

## Kimberley coral reefs vulnerable

***Tropical reefs in the southeast Indian Ocean previously seemed very resilient to periodic heat waves, but not any more. Scientists have confirmed that under global warming, stronger swings of climate variability, on top of the warming, will affect the Kimberley coast.***

Kimberley corals thrive on a much hotter part of the coast growing at rates similar to corals from less extreme reef environments. They are less affected by the sometimes hot Leeuwin Current. Kimberley coral calcification rates have been remarkably stable over the last 100 years. Until recently they have largely escaped bleaching events.

The CSIRO looked at historical data and numerical modelling and found that over the past six decades, ocean temperatures off the Kimberley coast have been rising at a moderate rate of about 0.05 to 0.1°C per decade, lower in comparison to waters off the southwest coast of Australia, but not low enough.



Along with a large number of the world's coral reefs, Kimberley reef were recently influenced by one of the most severe El Niño events on record that lasted from early-2014 to mid-2016. Dubbed the Godzilla-El Niño, it caused severe coral bleaching worldwide.

The 2016 mass coral bleaching event was the first time that regional-scale bleaching has been documented on inshore Kimberley reefs, leading researchers to confirm that Kimberley corals are vulnerable to marine heatwaves and climate change despite their ability to withstand temperature extremes in the short term.

Most coral reefs in the southern Kimberley had 30-60% bleaching during the first natural bleaching event in summer 2016 but the full extent of coral mortality and recovery is yet to be determined.



*Bleached coral Cygnet Bay, Kimberley, in April 2016. (Morane Le Nohaïc)*

Most of the severely bleached corals observed near Cygnet Bay in the Kimberley have now died, with the Australian Institute for Marine Science reporting similar findings from Scott Reef.

“Kimberley corals have a remarkable ability to thrive under extreme conditions that many other corals would not survive,” Dr Schoepf said. “However, it is important to understand that even these naturally stress-tolerant corals are still threatened by the increasing frequency of extreme marine heatwaves events associated with climate change.”



The researchers found that although Kimberley corals are not immune to bleaching, extreme daily temperature swings enhance the heat stress resistance of intertidal corals. They also found that intertidal corals recovered much better from the natural bleaching event in 2016 than subtidal corals.

“We are now working to understand the physiological and genetic mechanisms underlying the exceptional heat tolerance of Kimberley corals in a collaboration with Curtin and Stanford Universities,” Dr Schoepf said.

“We believe that tidal mixing is likely to play a key role in regional heat balance and biochemical processes. Surface salinity and ocean stratification off the Kimberley coast are also strongly influenced by climate variability.

## Anchor points to convict-shipwreck find

15 April 2017

***The location of a convict ship that sank in the Torres Strait off northern Queensland two centuries ago may have been discovered.***



A heavily encrusted anchor found by scuba diver Hubert Hofer has led him to believe he has found the 512-ton *Governor Ready*, which struck a coral reef on 18 May, 1829. Now Hofer has told the Cairns

Post that he is “99% sure” that the anchor, which he found 7m deep on a reef in Cumberland Passage, is from the *Governor Ready*.

The Canadian-built merchant vessel was returning from her second convict-transportation voyage, carrying 200 men from Ireland to Sydney, and was bound for Batavia (now Jakarta). Captain John Young and his crew survived the sinking and reached Timor after two weeks at sea.

Hofer told the newspaper that, despite the years of exhaustive research, it was only when he happened to be near the location of the anchor reading a journal written by ship’s surgeon Thomas Wilson that “it all of a sudden became clear”.

## Exceptional north-west shoals

Source AIMS

**Scientists have found exceptionally diverse and abundant coral-reef fish communities at submerged oceanic shoals near Ashmore Reef some 400 kilometres off north-western Australia.**

The north-west oceanic shoals are natural banks that rise from the seabed from depths of 200 m up to within 15–50 m of the surface. They were found to support the highest fish diversity reported globally for the 20–80 metre mesophotic depth.



Deeper reefs beyond the reach of SCUBA-based surveys are poorly studied. The survey used remote monitoring technologies including multibeam acoustics, photography, towed video, remotely operated vehicles and baited remote underwater systems. AIMS found 341 species of fish. The fish communities were 1.4 times as diverse and almost twice as

abundant as those on similar deeper coral reefs on the Great Barrier Reef.

The relatively clear waters in the study region allow fauna such as hard corals and macroalgae to grow in depths of up to 60–70 m. The fishes may also benefit from a local upwelling and currents.

Deeper reefs may act as important refuges, to replenish more exposed shallow-water reefs after impacts such as coral bleaching, storms and cyclones, fishing pressure and warming events.

Currently, 30% of north-east Australia's mesophotic reefs are within no-take management zones of the Great Barrier Reef. In contrast, just 1.3% of Australia's north-west oceanic shoals are in designated no-take areas.

Australia's north-west is one of the country's most economically significant marine regions, producing most of Australia's domestic and exported oil and gas. It also has high-value ecological habitats supporting a range of protected species such as dugong, turtle and whale sharks. The need for baseline ecological data for this region was highlighted by the 2009 uncontrolled release from the Montara wellhead platform, which triggered monitoring of key ecological communities to ensure the protection and sustainable management of natural and economic values into the future.



## Sedimented corals 'sneezing' out mucous



**Field observations and laboratory tests have shown a strong relationship between the increased prevalence of mucus – or coral snot – produced by boulder corals when exposed to high sediment levels.**

*This small coral fragment in the SeaSim, has produced a mucus sheet to trap and remove fine sediment and reveal clean colony underneath.*

The response appears to have a very important self-cleaning function. "It's one way the boulder corals can prevent being smothered and killed by the sediment," explained Dr Ross Jones, AIMS Senior Research Scientist, "The coral produces the mucous sheet, trapping the sediment. The coral then sloughs, or rejects this sediment-laden, gooey sheet, exposing the clean, sediment-free colony underneath." It's likened to a human sneeze.

Over 400 boulder corals were monitored at varying distances from dredging activity for over 18 months. The team observed that corals close to the activity (and therefore exposed to more



sediment) were far more likely to produce mucous sheets than corals further away from the dredging. Many corals close to the dredging also produced multiple sheets during the study period, but none showed any mortality.

Lab experiments confirmed the field

observations – that corals exposed to higher sediment loads produced more mucous sheets.

This research was published recently in the paper "*Mucous sheet production in Porites: an effective bioindicator of sediment related pressures*" in Ecological Indicators.





## St Judes

### **Recognising our common temperate fish**

We found a new dive site near the northern end of the Tinderbox MPA in Tasmania that probably everyone knows about, but it's all new to us. It was a great site, except that it seems to be a place of mishaps. Expensive items of diving equipment get strewn around the site. After finding a rusty diver's knife I decided it was not just us. As it was Easter we decided it to call the site something biblical, maybe St Christopher's after the patron saint of missing things, but after several hours of fruitless searching for one item, we decided to call it St Judes, after the patron saint of hopeless causes.

Running lines around to search for the item (it will remain nameless to spare the former owner's feelings) we did get the chance to see what else was ferreting around under the thick mantle of weed. It was an opportunity to share with you what a temperate weedy reef looks like and what sort of fish and animals you can find there. Timely, as many of us can't identify any fish species unless it's cooked in batter.

St Judes was a pretty much stereotypical weedy reef, with half of all the fish seen being either 1. Blue-throated wrasse or 2. Purple wrasse. A colourful 'third' species was the rarer male blue-throated wrasse that looks so different it can hardly be credited as the same fish. He is only temporarily male, as he was born female. If the lead male is killed, one of the females changes sex to replace him.

3. Senator wrasse – I believe this wrasse gets its names from the showy colours of the males, a joke on egotistical Canberra politicians.

4. Leatherjackets- the juveniles are not always noticed, but they love thick weed and swarm around the fronds in large numbers. They are easily identified thanks to the retractable single spine

on the head. He adults are also lingering near the bottom and come in many sizes and species.

5. Shaw's Cowfish – Again the males are the brightly coloured ones, but the brown and white females are much more common.

6. Smooth stingray – the largest stingray in the southern hemisphere is an unmistakable sight. While not threatening to humans, it gets your heart pumping when they burst out of the gloom.

7. Trachinops – clouds of these little fish cluster around every small crevice and they are very common in SE Australia. They are a favourite menu item for larger predators like squid.

8. Swell shark, when caught it will swell up with water to appear larger and more 'buff', otherwise it just dozes in the weed.

9. Goatfish, It has small barbels around its mouth that look like a goatee beard. They use these to find food in the sand. They are often common on the reef edge and turn a red colour at night.

### Seen but not pictured

Globefish – also known as porcupine fish, they blow themselves up in to a ball when threatened. A bit of overkill as they are also poisonous to eat.

Pretty polly (castlenau's wrasse) These small wrasse come in dark or green blotchy colours but are instantly recognised by their strange swimming style, where they appear to 'moonwalk' swimming up and down in an upright stance.

Little red rock cod – a master of disguise, they are often seen briefly and they escape as soon as the weed is parted, or lie down in a crack in the rocks trying not to be noticed.

*Find out more? – Buy Graham Edgar's Australian Marine Life, or any Rudy Kuitert fish book.*



1.



2.



3.



4.



5.



6.



7.



8.



9.

## Macquarie Harbour still struggling

Source: IMAS, DPIPWE, EPA, ABC

***The environmental condition of Macquarie Harbour hasn't much improved since the fish farming controversies of late 2016 and despite recent action to partly reduce production.***

Macquarie Harbour, is a huge and partly enclosed waterway on the west coast of Tasmania. 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.

The harbour has a shallow, restricted entrance to the ocean and a long deep central basin with depths of 30-50m. There are big freshwater inflows into the Harbour from the Gordon River at the southern end and the King River at the northern end.

The harbour circulates its waters slowly and in a complicated way due to the interaction of freshwater inflow; the shallow oceanic opening at "Hell's Gates"; tide; wind; atmospheric pressure; and temperature layers in the harbour and currents. The water from the King River is affected by a legacy of acid drainage pollution from past mining, which has resulted in poor water quality in the north of the harbour. To monitor these environmental impacts, the EPA has been sampling water quality since 1993.

Finfish aquaculture in Macquarie Harbour began in the 1980s. The high freshwater levels made it an ideal place, as fish can be raised with less disease risk (and using less antibiotics and other chemicals). The downside was the risk from relatively low levels of dissolved oxygen in the harbour, and the proximity of the World Heritage Area in the upper harbour. Annual production under 2000 tonnes until 2005, when production began to steadily increase. In 2009, a drop in dissolved oxygen in the harbour started to occur but this does vary a lot naturally and no alarm went off.

In May 2012, the Minister approved an increase in the marine farming lease area from 564 ha to 926 ha which provided for a potential increase in salmon production to 21,500 tonnes. At the time production was around 9000 tonnes. All the salmon companies pushed for this increase. There were a few doubters, some locals worried the harbour would not cope and Environment Tasmania and the Greens attempted to publicly lobby against it.



As part of the expansion of marine farming in the harbour, water quality monitoring was increased to monthly samples. 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. Other key indicators of stress were the increases in dorvilleid (sludge) worms and Beggiatoa (mat-forming bacteria), a sign of growing nutrient levels. This report was completed in August 2014 but not released to the public.

At the same time producers weren't alarmed. Instead they were complaining that the government was too close to TASSAL and allowing them 3 times the stocking density of other farms. Fish farm production continued to grow and peaked at 20,000 tonnes in January 2015.

In March 2015, the suppressed report and internal emails leaked to the Greens and the media. After having a previously unified desire to expand, and a sometimes spotty record themselves in relation to licence condition compliance in previous years, Huon Aquaculture in particular, attacked the main industry player, TASSAL.

In April 2015, the Government commissioned the Cawthron Institute, to assess the data and suggest improvements to monitoring. A more obvious but bigger question to ask at this point was, what is a sustainable fish farm stocking level? The Senate also started an enquiry in to the finfish industry.

In May 2015, a big storm pushed sea water in to the harbour, forcing oxygen poor harbour water to the surface. Petuna lost 85000 fish. The Government was pressing ahead with plans for expansion and jobs regardless. The State Government called any protests, scaremongering. By August 2015, the industry was effectively given the all-clear to proceed with its plan to double in size overall by 2030. There was growing opposition even among some industry insiders.

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. In March 2016, Huon Aquaculture shelved its harbour expansion plans. Huon Aquaculture was now arguing for reduced production levels especially near the WHA (coincidentally where mostly TASSAL leases are located). In October 2016, Huon blew the whistle by talking to the TV program "Four Corners" about the condition of the harbour, and largely blamed Tassal.

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.

Dorvilleids worms were now being found in high abundances up to 7.5 km from the nearest salmonid farm. Bacteria mats increased from zero of ten sites (January 2015) to seven of ten sites (January 2017). This could have been partly natural, but seems to be coming mainly from fish farms. Most of the 'muck' is focussed around the fish farm pens. 71 % of observations of *Beggiatoa* bacteria mats were within 50m of the cage and 90% of observations within 100m.

While much of Macquarie Harbour is pretty deep, dark, muddy and relatively lifeless, fish farming is now potentially threatening the rare species occupying the shallows of the middle and upper harbour, such as the Maugean Skate

The Maugean Skate is now found only in Macquarie Harbour. It is extremely rare and is one of the few skates in the world that can live in brackish water. We have only recently conducted detailed studies in to their life cycle and vulnerabilities. Skates spend the 85% of their time at 6–12 m depth, but they will travel to the deeper (and now deoxygenated) parts of the harbour. Maugean skates may go to waters deeper than 20m to lay eggs. They can also be found in larger densities around the Liberty Pt area, close to fish farm pens. Maugean Skates have a restricted diet dominated by crabs, shrimp and mysids that may be vulnerable to the impacts of fish farms. Maugean skates don't often eat fish, but they might rob farms for discarded feeding pellets if a farm is nearby, but there is no firm evidence of this. IMAS is now planning more research to learn more about the future viability of the Maugean skate population.

After the blaze of publicity in late 2016, there was a rush to manage the political fallout. Production fell to 16,000 tonnes in late 2016, under a biomass cap set for the Harbour. The biomass cap was further reduced by the EPA to 14,000 tonnes, then

recently 12,000 tonnes. The Tassal "Franklin" lease was completely fallowed in April 2017.

Subsequent industry monitoring in March and April 2017 has indicated that the Beggiatoa mats have contracted substantially and are now well outside of the TWWHA boundary.

A more recent IMAS report in to environmental conditions at the Macquarie Harbour fish farms has recently been released. Dissolved oxygen conditions in the middle and bottom waters remained extremely low in late 2016, before a replenishment of oxygen was seen in the deep bottom waters in early December 2016. Little has changed in the 20 and 30m depth range, which is the bulk of the water volume in the harbour. The abundance and diversity of seabed fauna is still poor. There is relatively little adverse change to the shallower regions in the mid-harbour or to the north or south of the harbour. The results still reflect a harbour community subject to organic enrichment. Although not emphatically stated, fish farms are the likely culprit for the majority of these impacts.

Lured by one unduly positive study and the promise of more jobs and investment, we have taken a risk on a dramatic increase in production volumes in the harbour. It would appear that the risk-taking hasn't paid off. The persistent low oxygen levels in the harbour are a risk to farmed fish stocks and shallow water ecosystems. It seems pretty clear now that 20,000 tonnes p.a. of farmed fish production was too much for the harbour. Perhaps the pre-expansion figure of 9000 tonnes is looking more likely as an average sustainable figure for the long-term?

We have an "adaptive management" system in Tasmania, where the rate at which we farm is supposed to be linked to the fluctuations in the environment. That way we get maximum yield in a sustainable way. Talking out of my rear end (and everyone does), unfortunately this is linked to a necessarily slow scientific review process, and an even slower and way more partial political process. Industry gets in politician's ears and the reality struggles to reflect the theory.

With the benefit of hindsight, we needed a larger margin for error and a more gradual implementation in this sensitive place. It sounds like the Government was too desperate to pump up the economy and their own stocks with big announcements.

Like all local environmental issues, the debate is often more compelling than the facts in issue. While a few picked that this would happen (not me), we now hear quite a lot of after the fact soothsaying. Many are also trying to link all of the lessons to more conventional ecosystems and to partly-unrelated future projects. A common thread is the usual energy around the 'evil' and untrustworthy capitalists.

These 'greedy devils' haven't done much to aid their cause with clumsy cover ups of information that was always going to get out. Then there is the 'after the horse has bolted' attempts at message management, which are transparent and unconvincing. You got it wrong, 'fess up and 'fess up often.

I also don't buy the 'good corporate citizenship' image, which appears to have recently flourished in some non-TASSAL quarters, to me that's based more on blame-shifting and commercial rivalry. Everyone had a role in the debacle.

The only lasting result has been severe brand damage to the Tasmanian salmon industry. I suspect that the harbour will slowly repair itself.

Fish farming could work in Macquarie Harbour and it's a good place for it, but only if we have the maturity to calmly and promptly determine how much is enough. Maybe the protesters are right and that means we can't be trusted to farm it at all, but I don't think we are there yet and our processes can be improved.

## Bird Life Tasmania News

### CSIRO RV 'Investigator' seabird research

Dr Eric Woehler undertook another research voyage on the CSIRO's RV Investigator in late March on a voyage to the south-west of Tasmania well into the Southern Ocean. The research involves documenting the distribution and abundance of seabirds at sea in relation to oceanographic processes. Highlights of the trip included a large pod of approximately 150 or more Long-finned Pilot Whales, Gould's and Westland Petrels and a colour-banded Gibson's Albatross. The bird was originally banded as a breeding male in 1991 on Adams Island in the Auckland Islands, suggesting the bird is at least 36 years old, but the New Zealand researchers suggested the bird was older based on their experiences with the bird in the colony.

### EAAF shorebirds paper

An international collaboration of researchers and observers from Australia, the UK, USA and New Zealand have just published a paper documenting the decrease in shorebirds using the East Asian–Australasian Flyway (EAAF). The study focused on the role of the Yellow Sea foreshore as a refuelling area for migrating individuals, and showed that the greater the reliance on the Yellow Sea by a species, the greater has been the decrease in the Flyway population. BirdLife Tasmania's Convenor, Dr Eric Woehler, was a co-author in the study. The article attracted international attention and is available at: <https://www.nature.com/articles/ncomms14895>.

## Diver Alert Network

### ***10 things doctors want from Scuba Divers this Xmas***

1. Correct Weighting  
Divers are being found dead, overweighted on the bottom, or underweighting and missing safety stops.
2. Better Buoyancy Control
3. More Attention to Gas Planning  
The most common trigger for a diving accident for divers under 50 is running out of air.
4. Better Ascent Rate Control  
DCI is often associated with fast ascents.
5. Increased Use of Checklists  
checklist and dive buddy checks lessen stupid errors.
6. Fewer Equalizing Injuries  
Middle ear barotrauma is the most common injury.
7. Improved Cardiovascular Health in Divers  
Cardiac arrest is the main cause of diving fatalities. Over 50% of the divers who died in the United States were obese.
8. Diving More Often  
Diving is a set of skills and abilities that must be fresh.
9. Greater Attention to Diving Within Limits
10. Fewer Equipment Issues / Improved Maintenance