

# 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, Thornfish - *Bovichtus angustifrons* Blairgowrie, Port Phillip Bay, Victoria by Andrew Newton**



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## National News

### Climate Research & Issues Summary

#### ***Ocean Acidification***

A report to the UN Convention on Biological Diversity meeting in South Korea has warned that the acidity of the oceans has risen by more than a quarter over the last 200 years, mirroring the proportion of carbon dioxide it absorbs from the air.

Rising acidity will have damaging consequences for shellfish, corals and other calcium-making organisms which play a vital part in the food web. Acidification may already be affecting shellfish farms in the northwestern United States. "Recovery from a major decrease in ocean pH takes many thousands of years," the report said.

The scientists pointed to a mysterious mass extinction from natural causes called the Paleo-Eocene Thermal Maximum, which occurred around 56 million years ago. The fossil record suggests it took around 100,000 years for calcifying organisms to recover from the acidification shock.

#### ***Sea Level Rise***

Professor Kurt Lambeck from the ANU (Australian National University) has put together a very comprehensive modelling record of ocean volume changes for the last 35,000 years. He found sea level did not show any fluctuations during the last 6,000 years, but sea level rises over the past 150 years are unprecedented. The average is about two millimetres per year for a hundred years (20cms). Professor Lambeck wonders whether sea levels will continue to rise by around four to five metres as they did during the last interglacial period 100,000 years ago. The main contributing factor is the thermal expansion of the ocean during the last 100 years or so.

#### ***(In) Action on Carbon***

For a while there was nothing to report here with the carbon tax going and not being replaced with the hoped for emissions trading scheme (ETS). Instead Australia will create direct incentives for reducing CO2

emissions. The Coalition went further and ruled out any future ETS, something even the Palmer United Party wasn't willing to suggest.

The ETS would have taken a more market based approach by creating carbon credits. These can be sold to polluters and traded between businesses. It provides incentives for Australia's largest polluters to reduce their greenhouse gas emissions.

It is a paradox that the scheme which most experts think will work the best, has attracted the harshest criticism. Australian industry was concerned about cost impacts of an ETS. However, environmentalists also had a bit to say, including wanting more ambitious targets. Ironically, we may now look back on the arguably flaccid 2009 Rudd ETS as something of a golden opportunity.

However, all is not lost it seems. At the recent G20 summit the Australian Government was caught completely flat-footed when the US and China started to move towards a climate deal. Obama and Xi Jinping talked up saving the world. It was bit of a contrast with Abbott threatened a bar brawl and Putin played boy games with his rusty old ships. Previously, local right wing policy makers had labelled Australian climate policy efforts as pointless unless the 'big international polluters' agreed too. When they did, the Treasurer warned against getting 'distracted' from an important economic debate with the climate change issue...can someone shirt-front that guy! Sorry, I forgot, Australia only talks the talk.



*I apologise for this photo, I am experiencing a lot of embarrassment lately*

## Studying Whale Poo and Snot

### **Sometimes the ikky stuff makes for the best science**



Whale poo could be the key to promoting plant growth in the Southern Ocean, as it is a rich source of iron, essential for plankton. The only problem is, there is not enough of it.

Researcher Lavenia Ratnarajah has found that whale poo contains over 10 million times the iron concentration of sea water and significantly adds to the ocean's iron content. Other sources of iron in the oceans included continental coastlines, underwater volcanoes, glaciers and melting sea ice, but it was not enough. "Turns out [whale] poo is really important. It's really nutritious and it can potentially act as a fertiliser, so we can get more plant [plankton] growth with whale poop," she said. The migration period for whales also played its part by naturally spreading iron through the great distances covered by the mammals. "They [plankton] also produce over half of the world's oxygen, so every second breath you take comes from the ocean," she said.



Some other scientists are in to snot instead. Griffith University researcher Dr Jan-Olaf Meynecke has been using drones to hover above migrating humpback whales off south-east Queensland to collect their snot from the blowhole. The whales took a breath every three to four minutes, so timing was critical. "We wait for their second

breath and so they come up for a second time and that's when I usually try to get the whale blow," he said. He collected 11 samples during the pilot study and will spend the next month in a laboratory examining whale DNA.

He is trying to establish whether the increase in whale population is placing pressure on the species. "It's the same as humans, you know you could be walking down the street and have a really bad virus - you look healthy but you're definitely not," he said.

## Whale Misadventures

Photos; ABC News, Sunshine Coast Council, ORCCA

A juvenile humpback whale caught in a shark net off Queensland's Rainbow Beach has been cut free by rescue teams. The mother whale was hanging around very closely and they were reunited. Humpback whales are currently migrating south back to feeding grounds in Antarctica after spending time in the warm waters between Fraser Island and Hervey Bay. "But we've got roughly 20,000 whales migrating back home... and it would be naive of us not to expect that we would entangle at least one during the southern migration," a spokesperson said. Errr...this was actually the eighth whale to be caught in a shark net in Queensland this year.



Then a rare beaked whale five-and-a-half metre beaked whale was then found dead at Redhead Beach south of Newcastle. This secretive species is almost never seen at sea and only rarely washes up. They are deep sea animals and they very rarely come close to shore.

Then oddly another one washed up a week later at Wurtulla on the Sunshine Coast. It was believed to have died of natural causes.



A rare pygmy right whale also washed up at Sealers Cove on the South Gippsland coast of Victoria. This is the first time that an adult pygmy right whale has stranded in Victoria.

The flesh was stripped away and the bones will be then buried in a pit in some sand dunes, where nature will do its part to remove any remaining flesh. Museum Victoria will then come back to collect the bones at a later date [pack your nosepegs].

## WA News

### Kimberley Coast Mapped

Photos: Dr Monika Bryce

**Scientists led by the Western Australian Museum have finished a six-year project to map the sea floor off the Kimberley coast.**



The most extensive marine biodiversity survey of the region ever undertaken has been completed, taking in 181 sites and 475,000 square kilometres of ocean. The team surveyed from north of Cape Leveque, out to the continental shelf, including the Rowley Shoals. The team saw lots of new species.

The scientists descended underwater for an hour at the same time each day to gather data. "... by replicating the same methodology on transit,... you can compare like with like."

The results are due to be released next year but Mr Bryce said the science would continue to be studied for years to come. Results from this series of expeditions will eventually be used to guide development and protection of the area.



## Sulfur and Seagrass

**Western Australian and Danish researchers have found that sulphides from polluted sediment is affecting seagrass.**

It is already known that seagrasses need good light conditions to thrive but a new study has also highlighted the importance of clean estuaries.



Management of the Swan-Canning estuary in recent decades has focused on inorganic pollution, like nutrients washed in from chemical fertilisers. Organic matter such as manure could be just as problematic. When this breaks down it is producing sulfide in the sediment—and sulfide is toxic to plants.

Six sites in the Swan-Canning estuary were chosen for testing. Scientists sampled a small piece of seagrass plant tissue in a mass spectrometer to see if sulfur has been absorbed into the plant from the seabed.

The results showed that the amounts of nutrient entering the estuary has reduced, either through better catchment management or reduced rainfall. That is great news, but the estuary sediments have become increasingly organic-rich. This is breaking down into stinky sludge and generating sulfides. This is likely to have been part of the reason for the large reductions in seagrass habitat since the 1980s.

All this means less birds and fish in the estuary, and a reduced quality of life for the citizens of Perth.

## Seagrass Survival Secrets

**Seagrass meadows are under threat, but they have strategies that might help them to hang on.**

Source, courtesy Science WA



*Posidonia australis* seagrass Kathryn McMahon

Vast underwater meadows support thousands of animals and act as a nursery for many of the species we like to fish. They also lock up carbon and help our struggling atmosphere.

But seagrass is delicate and is under threat from coastal development, pollution and climate change.

Recent research work has focussed on how seagrass spreads and whether it can readily recolonise damaged areas. Scientists found that seagrass is a well-evolved survivor, having five different strategies for moving around and recolonising areas after big seagrass diebacks.

The plant's flowers and seeds can hitch a ride on the current, or the seeds can be dropped in the faeces of turtles and other animals. This could protect the species against the effects of climate change and allow it to migrate to recover from disturbance. "If areas get degraded, then there is the potential for new populations to come in and recover that area, because they have that ability to move," Dr McMahon says.

Despite the ability to breed like the proverbial rabbit, seagrass struggles to recover. It can travel across the globe, covering hundreds of kilometres in just a few weeks, but once it takes root on the sea floor the process slows down. Plants growing on the ocean floor can take hundreds or thousands of years to spread over any large distance.

If you have ever tried to establish a lawn in your dry back yard, well think of something about 100 times harder. Once a seagrass lawn gets going its ages before a lawn becomes large and established. Luckily, some species like the Australian *Posidonia* family live for more than 100,000 years.

It sounds to me like it's not so hard to totally kill off seagrass. Then it can't support all those fish, birds, dugongs and turtles. Once lost, don't expect it back in your lifetime. Ideally, look after what you have, and avoid the costly and slow recovery programs you might need later to support your local fishery or bird haven.



Buoyant fruits of *P australis*. Image: Michelle Waycott

## Black swans and seagrass, striking a delicate balance

Source, courtesy Science WA



**W.A.'s iconic bird once thrived around Perth, but development in the Swan River basin has meant that black swans are more often seen on flags and signs than in the wild.**



Image: Alexander Fortin

Swans provided vital food supplies for the early settlers, and were so abundant that they gave their name to the Swan River colony. This didn't last, and hunting meant that they quickly declined in numbers. Black swans were saved by hunting bans, becoming the object of Australia's first wildlife conservation measures. Old photos and early diaries show that by 1910 black swans had bounced back and were abundant on the Swan River, Perth Water and upriver around East Perth.



Since then intrusions to shorelines and habitats by dogs and jetties have cut swan numbers, but the biggest driver of their decline is seagrass abundance. Seagrass meadows have taken a dive as more of the river is urbanised. Seagrass is susceptible to algal blooms caused by nutrients and suburban water runoff containing contaminants like phosphates and detergents. This is clouding the water and polluting the sediments.

Researcher Gary Choney recently investigated the grazing pressure black swans exert on seagrass in the lower Swan River, between the Narrows Bridge and East Fremantle.

He estimates there are now just 185 birds in the lower estuary in autumn, when they are most abundant, dwindling to just 53 in spring. "When bird numbers peak in summer and autumn it is also when seagrass production is at its peak..." Although flocks of swans chomp through the grass, it still thrives in the ideal conditions. When the seagrass declines, swans move to other food sources in other areas (if there are any) or starve.

Claisebrook Catchment Group plans to provide conditions that will attract them back to the Swan River. The group engaged Dr Mike Bamford to investigate how this section of the Swan River could be more swan-friendly.

Swans need access to quite large stretches of water for take-off and landing and they need a food supply. In this part of the river the seagrass is long gone, so swans need to feed on land and be provided with fresh water. Steep banks don't suit them and they need refuges from harassment by dogs and vermin. Likely habitats include Heirisson Island, Barrack Street, the Narrows Bridge and Claisebrook.

The Claisebrook Catchment Group has sought support, contacting various stakeholders behind proposed Riverside and waterfront developments, such as the City of Perth and East Perth Redevelopment Authority.

It is expected to take some years before significant results would be noticeable.

## Qld News

### Waterways report card



**A not for profit group, "Healthy Waterways" has released a report on Queensland's south east estuaries.**

Moreton Bay rated a B-, an improvement from its previous C grading

Deception Bay likewise received a B-, its best rating ever, with better water quality prompting the

recovery of seagrass meadows.

Bramble Bay rated a D-, but this was still an improvement on last year's F rating.

The Oxley, Redlands and mid-Brisbane catchments each scored an F in the latest report.

In this reporting period, many of the catchments received the lowest rainfall since the monitoring program began. Low rainfall and a lack of riverbank vegetation negatively impacted native fish and macroinvertebrates and contributed to declines in freshwater grades.

The State Government replied that it was working with farmers to reduce sediment run-off, which scientists said was the biggest issue affecting south-east Queensland waterways.



<http://healthywaterways.org/reportcard#/sub-regions/2014/overview>

## Epaulette sharks robust to CO2

**The epaulette shark is one of a small group of species that are expected to thrive on climate change**



The Centre of Excellence for Coral Reef Studies at James Cook University in Townsville has been assessing what the Great Barrier Reef might look like by 2100.

A research team subjected adult epaulette sharks to increased levels of carbon dioxide to test their ability to adapt.

They proved to be one of the hardiest animals on the reef. They are renowned as "shy" and it seems that the meek will finally inherit the earth. Constantly hiding in little crevices in poorly circulated water means that this shark species has evolved to live in marginal areas with elevated CO2.

The timid epaulette shark is one of a small group of species that will thrive on the expected impacts of climate change, north Queensland researchers say.

However, climate change is definitely not good news for the more active and 'out there' fishy personalities. Increased CO2 made most reef fish snoozy and more susceptible to predators [and I suspect less likely to rush after a hook if that is your interest].

It's not really that great for epaulette sharks either in the long run, "If you've got a predator and no prey then sooner or later their numbers will start to decline."



## Spoiling for another dredging fight



**Dozens of protesters in Townsville and the Whitsundays have staged a flotilla to call for an end to the dumping of dredge spoil in reef waters.**

Last month the Federal and Queensland Governments

allowed 3 million cubic metres of dredge spoil from the Abbot Point development to be dumped on land and not at sea. The Great Barrier Reef Marine Park Authority (GBRMPA) also announced that Townsville Port will make changes to its expansion plans so that more dredge spoil will be used for land reclamation.

Protesters said the reef was still in danger because of other development proposals.

"There's five or six other large developments and we really need transparent policy to protect the Reef and also to restore it," a protester said. Queensland Premier Campbell Newman would not say if the Government would consider a ban on dumping dredge spoil in reef waters.

Hmmm...not dumping in a barren area of deep and stable coarse sandy bottom, actually well away from reef habitat, but potentially using it to reclaim a foreshore area? Hopefully not a sensitive one. I'm yet to be shown that we are gaining anything. However, we should assess the science keep an open mind to all options.

## SA News

### Fishermen herd fish out of marine sanctuary?

**Fishermen on Lower Eyre Peninsula in South Australia have been "caught" trying to herd kingfish out of Marine Park zones.**

The ABC reported recently that kingfish were being herded out of a sanctuary zone in order to be caught, but few details were given. It was an uncommonly sparse ABC article that could do with a dose of fact checking perhaps.

It seems that this report relates to a single incident in the Kellidie Bay Sanctuary Zone in the Thorny Passage Marine Park near Coffin Bay. Kingfish have been targeted by fishers in Kellidie Bay for many years as they enter the shallows to spawn, but recently fishing has been banned.

I have to express some scepticism about this report and agree with blogging anglers "...who fail to understand how fast moving skittish pelagics such as kingfish can possibly be "herded"."

Marine Parks regional coordinator said the 'herding' activity was illegal because the zones protect fish from "any" interference. However, even the spokesperson didn't sound too sure about the origin of this mysterious incident. "Kingfish are a highly mobile species, so they would be quite hard to herd," she said.

The bloggers then herded themselves off and became hopelessly entangled in an equally left-field complaint about shark cage diving as a worse example of 'interference'.

Is this exchange just another trans-dimensional thought bubble that seems to pop out whenever normally rational people we get hot-blooded about marine parks and fishing 'rights'? Will this rent in the space-time continuum ever mend? I'm certain it will and we will then wonder what all the fuss was about.



## NSW News

### Marine Park Goings on in NSW

Sydney was recently the host to the World Parks Congress which attracted more than 5000 delegates, including 30 environment ministers, from 167 countries. It set the rather ambitious target of seeking to have at least 30 per cent of the world's oceans and coastal waters protected by 2030. This is a large jump from the current 2.1 per cent of ocean that is currently protected. If they meant meaningful parks likely to clash with fishing interests, don't hold your breath. I actually dislike those arbitrary hectare targets anyway, if the conservation need is there in a bioregion make it 31%, if there isn't that need make it 3.1%. That figure will be used in a scare campaign soon, if it hasn't already started.

Perhaps more easily and immediately achievable was a call for a Sydney marine park. It is the only marine bioregion in NSW that has no marine park.



Emma Johnston, inaugural director of the Sydney Harbour Research Program at the Sydney Institute of Marine Science (SIMS), said protection should be granted to the Hawkesbury-Nepean bioregion stretching from the Hunter to Wollongong. "We very much support the process of zoning a bioregion like Sydney Harbour," Professor Johnston said. Such a process would

need two years to consult with communities and for scientists to determine which areas should be "no take" areas.

Environment Minister Rob Stokes wasn't going to be drawn on the issue. Research is being undertaken by the NSW Marine Estate and SIMS.

In September, Labor announced that if elected at next year's elections it would create a Sydney Marine Park stretching from Pittwater to Port Hacking, including the harbour, Botany Bay and Parramatta and Lane Cove rivers.

The newish Marine Estate Management Authority (MEMA), established by the conservative government, arguably in response to the concerns of the Hunters and Fishers Party, was instead recently polling more than 1700 people on their attitudes to the coastline. A worthwhile endeavour perhaps, as long as it doesn't degenerate into conservation by opinion poll. No surprises, the community wants to see the NSW coastline kept clean, rich in marine life and accessible (does that mean fishing?). The MEMA Chairwoman, Dr Wendy Craik, said establishing more Marine Parks is not necessarily what the public wants to see.



Chairperson Dr Craik said there are a wide range of perceived risks to the coast that people want to see managed. "Pollution was identified as the most important one," she said. "Loss of natural areas, anti-social behaviours and things like that were also

identified". I hope that doesn't mean that we are now going to manage marine threats simply by picking up litter and expelling drunks, while we fish the bejesus out of the place. We'll have to wait and see what they do with it (is it just me, or is it widely understood that the crux of it the fishing restrictions and we pretty much agree on, or don't care about the rest?).

MEMA also wants to undertake "an assessment of threat, and risk to the marine estate", develop more policy and strategy papers "for coordinated management to balance economic, social and environmental values" (more fishing?), and piloting the new approach to

marine park management in Solitary Islands and Batemans marine parks (Let me guess, maybe more fishing?).

The member for Bega on the New South Wales far south coast and State Treasurer says management of the Batemans Marine Park in the past had been difficult and had led to distrust between fishermen and government. Then he said what he thought the changes to "balance environmental, economic and social outcomes" meant . "This notion and concept that environmental damage is done if someone fishes off a beach is absolute garbage," Mr Constance said. "I mean, if someone can point to me how the environment is affected because someone puts one line off a beach, I'd like to know. "But at the same time, if we have particular threatened species which are off our headlands which need protection, obviously we need to ensure that there's the appropriate zoning."

Meanwhile the Government passed the *Marine Estate Management Bill* and used the opportunity to again criticise the opposition's allegedly less 'scientific' approach to marine parks. The Bill didn't attract much interest, being full of largely vague and impenetrable policy statements. Any bite will be left to the Regulations. The Nature Conservation Council said, "It was introduced to Parliament after less than three hours of stakeholder consultation...". The only saving grace is that the Premier is not an MPA denialist. However, there is some concern that the new Act gives the Primary Industries Minister veto power over any new parks. Conservation groups commented that, "historically we've seen the Environment Minister have carriage of Marine Parks". Perhaps the new balance is to be more about fishing than the environment. The real balancing act might be to attract the votes of the many urban conservatives who support marine parks and the recreational hunting and fishing lobby who now have absorbed into their DNA, the need to fight any marine park proposal of any kind to a standstill.

## Fishermen Picket Parliament

While the NSW Government was appeasing recreational fishermen it was a different story altogether with professional fishermen.



The last five years have seen a number of changes to professional fishing with a series of reviews, and a buyback scheme. They were also critical of marine parks, but the really big ticket issues are increasing restrictions more generally, rising costs and competition from cheap imports.

About 80 per cent of the national supply of fish is now imported and two-thirds of fishermen in NSW have left the industry, leaving just over 1,000 still working. Not much of a voting block and their influence has declined accordingly. It is expected another round of exit grants may see as many as 500 more quit the industry. Fees have also been put up with the intention of forcing part-time fishermen out of the industry.

Commercial fishers, who have been angered by changes proposed in the Fisheries Management Amendment Bill 2014. To increase their clout they have united with recreational fishers (people who ironically compete with them for quota). They are currently lobbying to fight the amendments which puts new restrictions and costs on recreational anglers and charter fishing boat operators.

## NSW local beaches clean, mostly



***Remember the old days, when Sydney beaches were treated to an untreated tide of sewerage, well hopefully those days are becoming a thing of the past.***

Today, water quality at Sydney's beaches is 98% cleaner thanks to

initiatives such as the establishment of deep ocean sewerage outfalls off North Head, Bondi and Malabar. However, due to the impacts of stormwater pollution and sewage overflows, poor water quality can still be measured following rainfall.

Recent beach condition reports for NSW show that the Port Stephens region was the outstanding performer. Four beaches were assessed - Zenith, Box, Fingal and One Mile - all classed as very good.

In Newcastle, four beaches were rated very good - South Stockton, Nobbys, Newcastle and Bar Beach. There were good ratings for Merewether, Burwood North and Burwood South.

Lake Macquarie's coastline was also rated highly, with Dudley, Redhead, Blacksmiths, and Caves Beach all classed as very good. As one might expect in a highly developed area with restricted water exchange, the results were not as clear for swimming spots within Lake Macquarie. Eleebana, Swansea, Speers Point, Bolton Point and Kilaben Bay were also all rated as poor. Sydney's ocean beaches were all good in November.

Elevated enterococci levels, indicating faecal contamination, are still common following heavy rain especially in heavily urbanised areas. Rainfall triggers discharges from wastewater treatment systems, some not being properly maintained and repaired by their owners.

## Tas News

### Octopuses heading south

***The common Sydney octopus is thought to have migrated and started breeding in Tasmania because of rising ocean temperatures*** (ABC News)



Jorge Ramos, a PhD candidate from the Institute for Marine and Antarctic Studies (IMAS), has been studying hundreds of octopus samples from near the east coast of Flinders Island.

The common Sydney octopus is usually found between southern Queensland and southern New South Wales. Mr Ramos found the species could reproduce in

Tasmanian waters, had a fast growth rate and rapid population turnover. That meant numbers could be set to increase.

Craig Johnson from IMAS said it is unclear what ecological impact the common Sydney octopus was having. "Most of the species that come down here are just going to sit in the background and aren't necessarily going to have a major impact on diversity or production or fisheries or any of those things we're concerned about," he said. "Unfortunately, some of them do."

Mr Ramos believed it could result in more catches for the commercial octopus industry but it could also prey on other commercial species like rock lobster," he said.

## Portfolio

Geelong photographer Andrew Newton has graciously allowed us to use his photos and you'll be seeing more of his images in future issues, Thanks Andrew,



*Blenny*



*Warty Prowfish*



*Wreckage P.S. "Ozone"*

## Natures Real Survivors Pt III

### Paleozoic Era - Cambrian Period (542 - 488 million years ago).



***The basic body plans of all modern animals were set during the Cambrian Period. Not every Cambrian body plan was successful. But those that did succeed set the pattern for every animal that followed.***

The oceans became more oxygenated and this was the fuel for further evolution. Cambrian was a

time of great evolutionary innovation, with many major groups of organisms appearing within a span of only forty million years. It wasn't until the Cambrian that there was a sufficient reduction in the number of oxygen-depleting bacteria to permit higher oxygen levels in the waters. Most of the major groups of animals, especially those with hard shells, first appeared in the fossil record.

There were new behaviours and strategies — such as active hunting by new specialised predators. As hunters were more efficient they forced their prey to adapt or die out. Other animals developed specialisations for burrowing deeply into sediment, and making complex branching burrows. The Cambrian saw marine plants diversify with the appearance of mineralized algae, such as the coralline red algae and green algae.

Important new animals that weren't destined to keep going were the archaeocyathans. These are strange cup-shaped animals that are possibly related to sponges. They made the ocean bottom a lot more structured by managing to build quite significant reefs, well before corals had evolved.

Time machine travellers might find it good for a holiday. World climates were mild there were no glaciers. Landmasses were scattered with

extensive shallow-water reefs. None of the continents were located at the poles so land temperatures were balmy. In fact, global climate was probably warmer and more uniform than it is today.

This does not mean that life in the Cambrian seas would have been familiar to a modern-day SCUBA reef diver. Although almost all of the living marine phyla were present, most were represented by classes that have since gone extinct or faded in importance. Cambrian echinoderms were strange-looking things. Early in the Cambrian Period the first bivalves (seashells) and arthropods appeared followed by other shelled animals like the first molluscs, and brachiopods. The more familiar starfish, brittle stars, and sea urchins had not yet evolved. Crinoids (featherstars) were rare. The sea level rose significantly making new habitats for odd invertebrates, such as trilobites. And while jawless vertebrates were present in the Cambrian, it was not until the Ordovician that fish became common.

Also on the down side there were no dive resorts, in fact, plants had not yet evolved. The terrestrial world was devoid of vegetation and inhospitable to life as we know it. The ocean was the place where all the action was happening.

There were some pretty big climatic changes at the end of the period, as with all periods. The surviving Cambrian species and body forms we can find today are pretty small, and very weird.

### Forams

Some very tiny planktonic and bottom dwelling animals called forams may have survived.

Modern forams are primarily marine, although some can survive in brackish conditions. Foraminifera are found in the deepest trenches of the ocean.

Dying planktonic Foraminifera continuously rain down on the sea



floor in vast numbers, their mineralized bodies are then preserved as fossils. Beginning in the 1960s, scientific and oil exploration deep-sea drilling have been bringing up sediment cores bearing Foraminifera fossils by the millions. These have been used to date the seabed geology and find oil pockets.

### Graptolite Plankton



Graptolites were colonial plankton-like animals with multiple cups on a long central rod, each cup housing a tiny filter-feeding animal. Graptolites started in the Late Cambrian and became abundant later. Graptolites were thought to have become extinct during the late Paleozoic. Recently, however, living creatures resembling graptolites were found in sediment dredged from the deep sea off New Caledonia.

In 1992 Noel Dilly, sorting through a pile of smelly sludge retrieved by French oceanographers from the seafloor off New Caledonia, found himself looking at a graptolite last seen alive around 300 million years ago.

Some graptolites attached to the seafloor, and those looked either like a bushy seaweed or like a flattened bagpipe.

Because graptolites were floating organisms, they were widely distributed by ocean currents and settled in between layers of ancient rocks. Why are these tiny things worth knowing about? For one thing you can use graptolite fossils to date rocks and find gold deposits. Prospectors in colonial Australia used this technique often during the "Rush".

### Horseshoe Crabs



The ancient relatives of horseshoe crabs were present 520 million years ago. Only the horseshoe crab form is actually a survivor. The surviving species are a remnant and have only been around for about 20 million years.

Horseshoe crabs are one of the few animals that has no predators. Horseshoe crabs are omnivorous scavengers, feeding upon small bivalves, molluscs, worms, dead fish and algae.

Sexual maturity is not reached for nine to 12 years. The larger female horseshoe crab can weigh up to 5 kg. Mating season for the horseshoe crab takes place during the spring and summer full moons. The female comes ashore to deposit between 2,000 and 30,000 eggs in each nest in the sand. When the moon is full again, the 1 cm long larvae hatch and return to the water. In about 1 year juvenile horseshoe crabs will reach about 4 cm in width.

The spike-shaped tail, functions as a tool for digging in sand and a lever if the animal finds itself upside down. The horseshoe crab is equipped with 4 pairs of jointed walking legs each ending in a claw. The fifth pair is larger and allows the animal to lurch forward. The middle segment of each leg is covered with spines used to chew food before it is passed forward and into the mouth located at the base of the legs. The animal can chew only when it moves.



Horseshoe crabs have 10 eyes located all over their bodies, most located on the back or sides of the animal. In spite of the number of eyes, horseshoe crabs still have poor eyesight.

Horseshoe crabs have weird blood that contains hemocyanin, which contains copper. This causes the blood to turn blue when exposed to air. A protein found in the blood of horseshoe crabs is used to detect impurities in intravenous medications. Horseshoe crab blood has also been used in cancer therapy research, leukemia diagnosis and to detect vitamin B12 deficiency.

Because of the time it takes for horseshoe crabs to reach sexual maturity, it is important that population densities remain high. Horseshoe crab harvests for bait and biomedical purposes have been restricted. In Asia it is caught for food.

There are 4 species of horseshoe crabs found in the world today. *Limulus polyphemus* is the only species found in the Atlantic Ocean. The remaining three are found in SE Asia. They are only found in Australia as fossils.

## Ostracods



Ostracods are microscopic, shrimp-like crustaceans sometimes known as seed shrimp. They live inside bean-shaped shells. Ostracods feed within the surface plankton, or on the bottom of marine and fresh waters. They have a wide range of diets, and the group includes carnivores, herbivores, scavengers and filter feeders.

Ostracods first appeared in the Cambrian and evolved during the Ordovician, some reaching almost a centimetre in length. Modern ostracods, however, are microscopic in size.

Some 70,000 species once existed but today there are only 13,000 species that have been identified. A large portion of diversity is still undescribed and Australia is one of the world's ostracod biodiversity hotspots.

## Sea Spiders

Sea spiders are soft-bodied arthropods, found widely in modern oceans. Sea spiders look much like the common "daddy long leg" spiders. For two-centuries there has been a controversy about the relationship of sea spiders to land spiders. They have long been a mystery. The earliest possible fossils are of larvae from the Cambrian era.

The fossil record of their relationship is sparse because of their delicate nature. One later adult specimen has been found from volcanic ash that trapped ancient sea life, rapidly encasing the creatures in a concrete-like cast. Trapped in stone with all the animals it lived with, this species appears to have lived in a similar way to modern ones, on the seabed, or perhaps on sponges. They were everywhere. French scientists have found Jurassic fossils from an area that was 200M deep. The modern examples can also be found from the shore region down to the deep sea.

University of Oxford paleobiologists have so far found the oldest and most complete sea spider fossil to date in Herefordshire. The fossils are often too delicate to excavate, so U.K. researchers took digital images of the fossil at 20-micrometer intervals as they ground through the surrounding rock. The team reconstructed the slices in a computer.



Modern Sea spiders tend to be slow-moving creatures, which crawl among seaweed or across the sea floor. Pycnogonids typically prey on sessile (non-moving) organisms such as sponges, sea anemones or bryozoans. The proboscis is simply stuck into the victim and the fluid contents are sucked up — a feeding strategy resembling that of a parasite.



## Captain John Stein and the "Emma Kemp"

***This small walnut-like vessel circled the globe under the command of Australia's least known and most adventurous captain***

When Australia was settled as a penal society, the authorities were initially reluctant to allow any local shipbuilding, in case it encouraged escapes. This was unsustainable in an era when the seas were the only highways between settlements, and eventually the restrictions were relaxed.



Local colonists began building small wooden vessels. Little cutter-rigged boats with bluff bows and square sterns were popular. They were cheap to build and could be crammed with a surprising amount of cargo.

The "Emma Kemp" was just such a vessel, built in Sydney in Feb 1827 by shipwright Robert Dryborough

Cunningham and a sailmaker and free settler named Richard Kemp. The cutter was named after Kemp's daughter.

The entrepreneurs loaded her up with whatever could be sold at a profit and traded around south east Australia, especially between the 'big' settlements of the time, Sydney and Hobart.

She hadn't been trading for long when on 11th February 1827, the cutter went up on the Sow and Pigs Reef at South Head, Sydney, in a gale. She was badly damaged and the mast had to be cut down to save her. Repairs took three months.

In July 1827, nine escaped convicts took to a small boat with the intention of seizing the "Emma Kemp" while at Hobart. In the meantime the alarm had sounded back at Hobart Goal. Soldiers guessed where the

convicts were headed and as the escapees approached the cutter, they were challenged by an armed guard. The convicts fled and landed at Sandy Bay, robbed a hut, then proceeded to South Arm and robbed more settlers. They loaded up with guns and became bushrangers. It wasn't long before they were recaptured. Six hundred convicts were lined up to witness them being executed by hanging.

Captain John Kent had left the colonial Government service to take command of the *Emma Kemp*. From mid-1828 he traded her between Port Jackson and New Zealand with the occasional speculative voyage to the Pacific Islands. Seal skins from the southern coasts, spars from Hokianga, flax and pork and potatoes, she went wherever a few tons were offering. Kent shipped them across the Tasman for his Sydney employer, Francis Mitchell. He had a shore base at Koutu Point, Hokianga.

The *Fairy* and the *Emma Kemp* sailed from Sydney in February, 1830 bound for Preservation Bay in N.Z. They returned to Sydney after four months seal hunting with a cargo of 113 seal skins, 8 tons of flax and 4 tons of pork.

About the end of 1832, Captain Stein, then a young man of only 22 years of age, embarked on his biggest adventure, as master of the "Emma Kemp".

Captain John Stein, was one of the "most romantic marine figures in the young Australasian colonies". He was born in Australia in 1810 and had taken command of his first vessel at only twenty. He had taken the brig "Dragon" over to N.Z. and picked up 100 barrels of oil.

In June 1832, he had taken the small Tasmanian barque "William IV" to New Zealand and explored between Queen Charlotte Sound and Cloudy Bay. He got on well with the Maoris and took Tamoc, Ahuda and



Chewack, on a visit to Hobart Town. He later took them back home on another voyage.



Perhaps desperate for a profitable voyage, Hobart merchant William Orr came up with the idea of a premium cargo of coffee and tobacco. Stein must have offered to go to Rio De Janeiro, eager to make a name for himself, despite the fact that the "Emma Kemp" was too small for such a hazardous voyage. He managed to find 5 young Tasmanian seamen who were crazy enough to go with him.

On his outward journey he called in at Cook Strait and met the Sydney cutter "Lord Liverpool". He then sailed to Rio de Janeiro round Cape Horn. The voyage would have involved a very long journey across the largest and emptiest expanse of water in the world. Starvation, scurvy and storms must have made it a gruelling expedition, but no journal was kept by the captain. Everyone on board was illiterate.



At Rio the "Emma Kemp" took in a cargo. On 14th April 1833, the little craft left Rio on the return journey. Following the trade winds she returned to Hobart by way of the Cape of Good Hope. She reached Hobart on 12th August. The papers did not record

any details of the voyage, perhaps trying not to encourage these young upstarts. It was only much later that the voyage was recognised as "probably the most daring circumnavigation of the Globe ever undertaken by an Australasian captain".

On his return he was planning an even more adventurous trip to the Antarctic Circle, perhaps looking for islands rich in fur seals. They were planning to do it without special rations or equipment. It seems like the voyage never occurred, perhaps due to the lack of a backer.

Stein moved on to bigger and better things as the captain of several different whaling vessels. Whalers were always short-handed and would risk taking on absconders, despite this being a serious criminal offence. In 1835, a disgruntled seaman informed on him and Stein was arrested. Despite the evidence suggesting he was up to something, it was a jury trial, and his notoriety as a heroic captain got him acquitted.

On Nov 14 1839, John Stein married Emma Church at Sydney. It is not known if he had a family, but he is believed to still have descendants in Australia.



In 1840, Stein employed a "crimp" to recruit a crew for the whaler "Mary" and nearly ended up in hot water again when they turned out to be convicts. The "Mary" left Port Jackson on 22 September 1840 and went whaling in the South Seas. On 12 December 1840, about thirty-five miles east of Woodlark Island, they ran into a huge cyclone that



smashed the rigging and swept the helpless vessel on to a coral reef. Six lives were lost. The remaining crew reached shore and over nine months, built a schooner from wreckage, as they slowly succumbed to malaria. They were about to leave when the natives attacked, killing Captain Stein and his crew. Only one crewman survived, escaping from captivity 5 years later.

Meanwhile, the cutter "Emma Kemp" was having a less adventurous career under several masters. As larger vessels became available for intercolonial trade, she was relegated to Tasmanian coastal waters, running supplies to outlying settlements.

By the end of her career, the "Emma Kemp" had been converted into a schooner of 67 tons. On 23 June 1840, the schooner anchored at Waubs Bay (Bicheno) on the Tasmanian east coast. While getting underway the following morning the wind died away, the anchor would not hold and the vessel drifted onto rocks and sank. The crew escaped with some difficulty.

So ended the career of one of the smallest, least remembered, and most adventurous small vessels in Australian history.



### Photo of the Month



*A relaxing day at the beach in India*

### TREASURE SHIP - LOSS OF THE "ENCHANTRESS"



#### ***A "treasure ship" lies undiscovered off Tasmania's coast***

The four-gunned 376 ton merchant ship "Enchantress" and Captain David Roxburgh were well known to the citizens of Hobart. She had already completed two voyages to Hobart from London and was a welcome sight. The sturdy vessel brought hard to get manufactured goods and news from 'home', to what was then a very small and remote outpost of empire.

On the 16<sup>th</sup> July 1835 she was approaching the entrance to D'Entrecasteaux Channel at night after a long voyage from London. At that time there were no lighthouses marking the entrance. The western side of the Channel was studded with rocks and islands. The South Break had recently claimed the "Wallace", and a rock off Southport Bluff had caused huge loss of life on the convict transport "George III". Plans

had been hatched for a light on Cape Bruny and for an improved pilot service, but nothing had been started yet.

The ship was short of water and the crew eager to finish the long voyage, so there was no waiting for daybreak. A strong wind was blowing from the N. E. and N. N. E. About ten p.m., the "Enchantress" approached within "half a mile" of the western shore. This seems unlikely as in many places she would have been running aground that close to the mainland shore. It's more likely that the surf on the Actaeons was mistaken for the Tasmanian mainland. The "Enchantress" turned away from danger on a port tack.



Capt David Roxburgh

Seven minutes later, the Captain took the chief officer below to consult the chart. The charts weren't especially detailed and it seems they presumed they had much more sea room than was the case. Three minutes later they were back on deck, just as the man stationed at the head of the vessel called out that they were close to the land. An instant later the vessel struck rocks "running a considerable way from the shore, and about six or eight miles below Partridge Island, on the Brune side of the channel". There are no such rocks, all rocky outcrops like the Pineapples are close to shore, but it was a helpful bit of spin to tell the papers. "Six or eight miles" also seems to say that they really had no idea where they were.

On heaving the sails aback the vessel came off the rocks seemingly unharmed. They were about to continue on their way when the report came back that there was already three feet water in the hold. After only two minutes there was five feet, then nine feet. At this point the vessel was dead in the water and obviously sinking fast. Captain Roxburgh gave orders to launch the ship's boats.

The sailors hurriedly launched the smaller boats which were quickly filled with passengers. Captain Roxburgh looked over the side and told the boats to wait a moment while the seamen were busy with the long-boat. He ran down into the cabin, which was filling with water and saved his papers and the chronometer. He then jumped into the cutter, "calling to and encouraging the sailors to use every exertion" as he rowed away, obviously not a great morale booster as they struggled to clear the heavy long boat. Prominent settler, George Anstey, had to jump into the water after being left behind.



The boats had not got more than twenty yards off when they saw the ship sink by the head and entirely disappear, taking with her the sixteen crewmen and one steerage passenger still on deck. The "Enchantress" had sunk within 15 to 20 minutes of striking. Of the ordinary seamen, only the steward and three cabin boys had been saved. The passengers made it to Partridge Island and were rescued by the sloop "Friends".

A boat was sent to search for the crew, but only remained a day or two, without discovering the sailors. No floating bodies were seen. One of the rescue boats claimed that messages scribbled on wreckage and footprints ashore on a nearby beach meant the crew survived, only to die later of exposure. There was criticism that not enough had been done to look for the crew. Despite the unconfirmed nature of the story,

for one journalist it was only to be expected in an uncaring penal society,

*"Horrible things are so common in Van Diemen's Land, that the finer feelings of human nature are blunted. We witness men loaded with chains, we see their backs lacerated, and we hear of the total destruction of scores and scores of our fellow creatures, without one feeling of sympathy such is the effect of prison discipline, such materials are we made for torture!"*

The cargo of the "Enchantress" is said to have been exceedingly valuable with some papers claiming a cargo worth £45,000. They also said it sank in 40 fathoms, which seems unlikely. A myth has grown up that she was full of treasure. At best, this was in the form of family silver being taken out by the wealthier settlers.

So where to look? It's pretty clear that the crew had no idea where they were and didn't see the wrecking location in daylight. By the 28<sup>th</sup> July, a boat crew claimed they saw the pig-sty of the "Enchantress" floating up within three miles of Partridge Island, and about a couple of hundred yards from the shore. They thought that the wreck must break up soon, *"as the ground swell, at the place where she went down, is terrific after a south-west gale, which is now blowing"*.

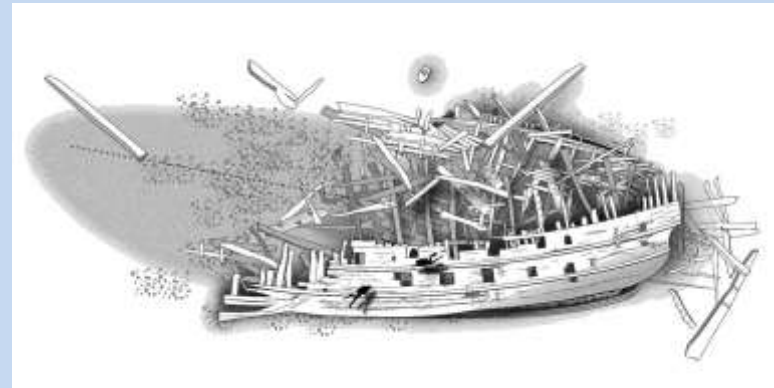
In mid-August, the lighthouse committee visited the area in the small vessel "Eliza". They went to the Actaeons and then across to Cape Bruny. The shore was followed up to Partridge Island,

*"they could not discover the least appearance of any reef or rock, nor indeed any damage at any distance from the shore, and their inference is that the Enchantress ran against the main land of Cape Bruny, at a place which was pointed out by Captain Roxburgh, about 4 miles outside Partridge Island and which presented a cliff of considerable height...not a vestige of the vessel was to be seen, nor any thing which could enable the Committee to form a judgment as to the exact position in which the wreck now lies. The weather being rather unfavourable for sounding..."*

Roxburgh claimed it had sunk a mile from the shore. In an official report the committee was even more emphatic,

*"we all felt perfectly satisfied that there is no danger at any distance from the shore where any ship ought to be, that is, within one or two cables length of the cliffs or beach [cable = 1/10ths of nautical mile]. Our soundings while running down were at least 25 fathoms. Besides, I am assured by the boatmen who have been sounding and dragging since the loss of the Enchantress that there is no reef out from the shore as set forth by Captain Roxburgh's protest"*.

In March 1836, during a heavy gale it was reported that the "Enchantress" broke up, *"and for some time afterwards the sea in the immediate neighbourhood was covered with goods of all description. The whaling season being over, few boats were near the place, and but few articles saved. As the goods were all insured, no one took the least concern about the vessel or goods"*.



A letter about Ross' 1836 chart of the channel complained that, *"...the most dangerous error is that close to the spot where the Enchantress was supposed to be wrecked; there are several rocks, one above and others under water, about a mile from Bruny, which are not only left unnoticed, but thirty-two fathoms are given as the soundings."*

This would appear to be a reference to the area of the Hen and Chickens Rocks in Standaway Bay. Happy hunting, and remember, this is a protected wreck and can't be tampered with. As she went down intact and was never salvaged, it's a treasure trove, not of gold, but of colonial artefacts belonging to everyone, report any finds.

## Meat Eating Sponges

***Most sponges are filter feeder but recently a few species have been found, with a new taste...for meat!***

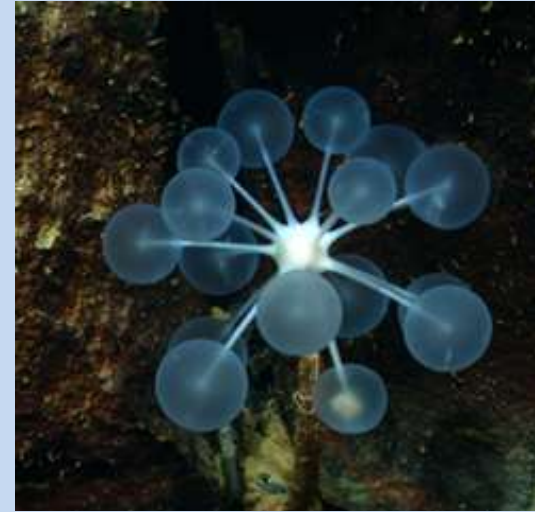


The meat-eating sponge species are pretty small, about the size of a pencil eraser. Most live in really deep water, although some live in shallow underwater caves in the Mediterranean Sea. In these areas food is hard to come by. So these sponges trap larger, more nutrient-dense organisms.

The carnivorous sponge throws out lines with hooks that act like Velcro to entangle prey. A tiny shrimp or other invertebrate swimming past will get hooked. New sponge tissue grows around the prey, which is broken down by bacteria and enzymes. The dinner is then slowly digested over the course of several days.

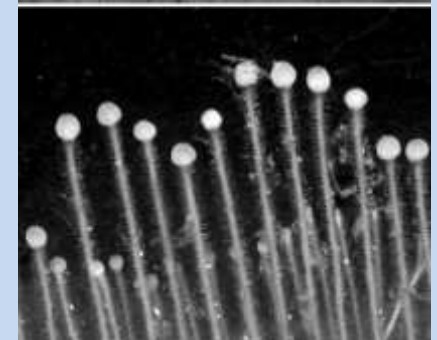
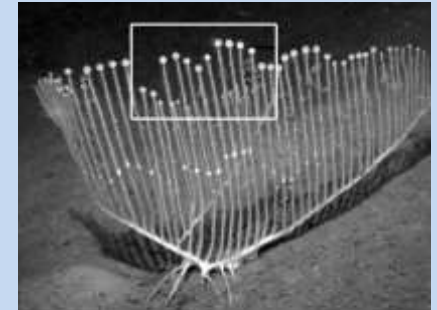
Carnivorous sponges were first discovered 20 years ago and since then several species have been found in the eastern Pacific. Seventeen years ago, Jean Vacelet and Nicole Boury-Esnault from the Centre of Oceanology at France's Aix-Marseille University provided the first real evidence. They had discovered a new species of deep-sea sponge living in the unusual setting of a shallow Mediterranean sea cave.

Since reporting their discovery, 24 new species of cladorhizid sponges, including the incredible ping-pong tree sponge, have also been discovered.



ping pong sponge

The structure of the deepwater meat-eating harp sponge is designed to ensure that they catch the most prey possible, and also maximise their chances of catching spermatophores from other harp sponges.



## Great Family Walk -Luther Point/Spring Beach, TAS



***When the weather is windy and cold, the cliffs near Spring Beach offer an easy walking track in a sheltered spot.***

On a clear day it can be both comfortable and spectacular. Bring along someone beloved and make a special small gesture at the end. Always 'more' than the latest thing on YouTube.

The walk along the white sand beach at Spring Bay is worth a day out in itself, then there is a short climb to the top of the cliffs. The cliff tops were burnt-out old farm land, but the forest of rare Oyster Bay Pines have regenerated to a large extent, and only where private land encroaches near the clifftops does it have to compete with land clearing for seaside McMansions. Along the way there are spots for admiring the views across to Maria Island.

The sandstone cliffs are also a swirl of erosion patterns and layered colours, especially in the lee of Luther Point in what used to be called Quiet Cove. It's still a place for theological reflection, with one gastronomical graffiti artist noting "Jesus loves nachos".

This area was once the settlement of "Strawberry Hill". There was a school, a post office, two shops and lots of houses all built on and around the cliffs. Now, there are signs of abandoned home foundations, what looks like a sheepwash cut in sandstone, and the remains of an old quarry.

According to Orford Primary School's website, in about the late 1860s the Orford Quarry began. It was also known as the Prosser Bay Quarry or Crabtree's Quarry. Orford became well known for its great sandstone. Orford's sandstone was used for some of Melbourne's main buildings like the post office and the town hall. The stone were largely cut away and



shaped by hand. Some of the slabs of stone remaining in the quarry still show the marks of the picks of quarry workers.

Ships came to the cliff-face jetty to load and the rocks were transported down the slopes on small tram cars. Boats could only load at Orford when the wind was

blowing from the west. We don't know much about the vessels that called at the quarry. In June 1872, the small American-built barque "Bella Vista" managed to cram in 120 tons of stone to complete her cargo, even though she was already heavily loaded with timber. She then left for Melbourne, but was wrecked on the north-east end of Prime Seal Island, off Flinder's Island. According to local divers the barque has long since rotted away, leaving the site oddly strewn with square Orford stone.

Quarrying from Orford stopped after the resource ran down and Melbourne refused to accept a faulty load. After that many of the local buildings were moved to other places and reused. Most of the people moved away. The quarry was disused and up for rental in 1877. Individual people continued to cart small intermittent loads of stone for a while.



Apart from the abandoned cushions thrown in there for a beach party, the site is filled with pines and quite photogenic. If that is too tame for you, try the council walkway out to Raspin's Beach. It is a long 13.5 kms return, passing some lovely, lesser known Tasmania beaches. It's also dotted with items of interest including old jetties and windlasses, lagoon creeks, seabirds, playgrounds and good views along the bay. Another unusual feature for a Tasmanian walk is that there is a good café right in the middle. Look, it does sound sooky, but my legs were sore afterwards.

## Chemical fire on the "Venus"



***Some of our modern laws on the storage of combustible chemicals date from early incidents like this one.***

The "Venus" was built at Shipwright's Point, Huon River in 1875. She was one of a number of small vessels caught in one of the worst Tasmanian storms on record. She didn't founder but burned despite the howling rain.

There was a good trade between Hobart and the East Coast at that time for small ketches and schooners, collecting wattle bark or carrying quarry stone. The barque "Venus" was carrying supplies including a working party on a mission to build a new jetty at Spring Bay. Some of the cargo was quicklime. The small 75 ton ketch "Venus" ran into an easterly storm just after rounding Cape Pillar. They made it into the safety of the bay, despite the big seas.

The Spring Bay (Triabunna) portion of her cargo was landed and she then went into Orford Bay to land cargo there. The hatches were opened to see whether she was making any water, and the crew went ashore. In those days supply ships lay at anchor in the bay and cargo was taken by boat up the Prosser River. At the bridge, there was a shed on the foreshore used to store supplies.

Some of the cargo was landed and they were going to finish unloading next morning before heading to Swansea. During the early hours of Sunday night it started to blow hard from the east and increased to a terrific gale. The Venus parted her anchor cable and was driven broadside on to Orford beach. There she rested on an even keel with waves breaking over her. Things were bad but salvageable. Then water got into the unslaked lime (quicklime) and the chemical reaction build up enough heat in the cargo hold to set her on fire.

When it became known that the ship was on fire an attempt was made to scuttle her, but the sea was too rough. The upper part was eventually badly burnt and the cargo was damaged. The hull was stranded, "there was a wide space of beach between the wreck and the sand banks, also between the wreck and the sea". She was abandoned.

The savage storm got even worse and also claimed several other vessels. The tiny vessel "Robert Burns" is still missing but must have foundered off Long Beach near Bicheno, where the bodies of three men washed ashore. The schooner "Guiding Star" was driven by the same gale on to the rocks at the Saltworks at Little Swanport and became a total wreck. The whaler "Offley" was wrecked at Recherche Bay. The "Gertrude" went ashore at Bicheno and two of the crew were rescued in a dinghy by Mrs. Harvey, wife of a special constable at Bicheno. It was one of the worst storms on record.

Few remnants of these vessels now remain. The S.S. "Wakefield" anchored in Orford Bay to land cargo and was heaving anchor they found they had fouled the anchor of the "Venus" and recovered it. In the 1940s, the remains of the "Venus" were burnt to provide extra space on the foreshore for work on a retaining wall. A heap of muntz metal was collected for scrap. Hardwood planking 70 years old was found to be sound and some of it was used as flooring in local buildings.

The spot can be passed on a walk along the Orford foreshore and the Prosser River sandbar is worth exploring at low tide. There is usually good birdlife to look at as well, but try not to disturb them and keep away during spring breeding season. Dogs on a leash are welcome on other parts of the beach, but not the bird breeding area.



## Bioluminescence

**People walking on the beach or diving at night are sometimes treated to a free light show, thanks to the many animals in the ocean that emit light.**



You might be thinking some huge car battery-shaped fish, but like a lot of things in the ocean, most of the action is happening at a much smaller level. Masses of tiny

dinoflagellates, little plankton with 'arms' like oars, aggregate in the billions. When disturbed by nearby movement, such as the waves on a beach, they 'light up' in alarm. This is caused by reacting chemicals inside their body.

If you want to be a bit more hi tech, the enzyme luciferase converts a pigment called luciferin into a new compound that emits light. Some animals don't have these enzymes, but swallow bacteria that do, and keep a supply ready for an emergency.

Bioluminescence is common, plankton, shrimp, fish, sea stars, microscopic bacteria, jellyfish and squid all get a feeling that literally turns into an 'inner glow'.



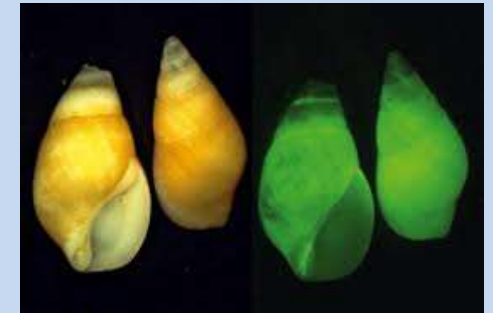
Light can be used for communication, to attract prey, lure a mate, or to scare away predators.

When light penetrates the oceans, it is absorbed quickly — at a depth of 10 metres, 85 per cent of light has been absorbed. The shortest wavelengths of light (blue and green) penetrate the water more easily, which is why bioluminescence in red or yellow is rare.

The jellyfish *Periphylla* uses bioluminescence as a jet fighter uses flares against missiles. If it is bumped into, the jelly releases a packet that

moves away from the animal and bursts into rocket-like sparkles as if it is an underwater fireworks display. Some other jellyfish exude glowing slime that sticks to potential predators.

The clusterwink snail, *Hinea brasiliana*, is found in the intertidal zone along the NSW coastline. It emits a bright flash from inside its hard shell when disturbed. The shell is designed to diffuse the glow, making the signal even bigger. They gather in the cracks and crevasses under rocks at low tide. When lots flash simultaneously, the effect is an amplified light show for passing beachcombers.



Another common use of bioluminescence is counter-illumination, where an animal itself to match the light coming down in the water column. This makes them virtually invisible to predators who may be looking upwards for a silhouette.

Dr Nerida Wilson, senior research scientist at the Western Australian Museum, offers this explanation for why it's a common phenomenon in the ocean. "Large parts of the ocean are dark or dim all the time, and organisms that could produce and manipulate light would have a significant evolutionary advantage.

