
MARINE Life
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Andrew Newton

Our Goal

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

The Crew

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***NT Advisor* – Grant Treloar**
SA *Advisor – Peter Day*
WA Advisor – Mike Lee

Cover photo, Point Lonsdale Lighthouse, Port Phillip Bay, Victoria by Andrew Newton

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Go to Page 26 if you want to save our fast disappearing shore birds

When Humans Declare War on Fish

Review by Mike Jacques

John and Jane Elek have forwarded a link to a New York Times article reflecting on industrial fishing in the aftermath of WWII. It doesn't pull any punches and here is an appetiser.

The journalists have typified post-war fishing in very strong terms as a "campaign of violence" against another species. World War II brought a leap in human ingenuity. Ships become larger, faster and more numerous with increased fishing power. Sonar, developed for hunting submarines, could now hunt fish, "...the modern fishing vessel became a kind of war machine". Some pretty strong metaphors there.

This point is taken further and even "Japanese fighter pilots adept at spotting subsurface Allied submarines were later retrained to look for whales". It is a great image, but I'm not sure it would be brought out in a statistical review of the life histories of spotter pilots.

With a bit more clarity they point out that fishing was transformed from a local endeavour into a global one. Industrial fishing is,"…maybe the first globalized economic enterprise". Apparently, postwar super trawlers scooped up everything in their path, "a sort of scorched-earth approach". Global reported catch rose from 15 million metric tons at war's end to 85 million metric tons today. "To be sure, the postwar assault on fish mostly sprang from an honorable intention to feed a growing human population that boomed in a prosperous postwar world".

Recent times are referred to differently and more positively, not as a success story of better management (as we often hear in Australia), but as a result of "...signs of exhaustion and failure in global fisheries".

Marine protected areas, "…an environmental version of a demilitarized zone" now cover some 3.5 percent of the ocean. Better regulation has been attempted. "Collateral damage" to sharks, turtles, whales and sea birds is increasingly becoming unacceptable.

The writers want "...a broader Marshall Plan, which would further restrain our destructive tendencies and technological powers...".

I suspect the even the writers covertly recognise that this article is a polemic, intended to get past the editor on a day when the issue was only running VE Day memorials. It is designed to jolt us into thinking about our score card after 70 years of peace. At the least, everyone in the industrial fishing debate agrees on one thing, that our citizens should read more and find more out about the science. Hopefully this article will get you thinking and reading, whether you love it or hate it.

Before you all write in and complain, yes we do manage our fisheries better than that in Australia, which wouldn't be hard as the record up north is pretty appalling and remains so.

For copyright reasons, I can only review this article, but you can see the whole article on,
http://www.nytimes.com/2015/05/10/opinion/sunday/when-humans-declared-war-on-fish.html?emc=edit_ae_20150509&nl=todaysheadlines&nlid=30774450

My Holiday Snaps

I will however shamelessly use this article as a prop to sneak in some holiday photos. On a recent trip to Elba in Italy, I dived in some lovely clear and warm water, but on reefs devoid of fish of any size and covered in algae. A disaster for fish, fishing and recreation. After the dive I asked where all the fish had gone. Apparently you have to go to Portofino to see fish. Let me guess, it's a marine reserve? Despite being overfished for a thousand years just like Elba, apparently Porto has reasonable sized fish and less algae after only 16 years of being protected.

Fish less, Earn More

Well enforced fishing areas can boost the incomes of fishers by up to 50 per cent more than in unregulated 'anything-goes' areas.

Source, "Accounting for enforcement costs in the spatial allocation of marine zones" by Katrina Davis, ARC Centre of Excellence for Environmental Decisions (CEED)

Ms Davis explains that uncontrolled industrial and consumer demands are driving over-fishing in the world's oceans, threatening the survival of reefs in places such as the Coral Triangle. To manage this threat, governments are setting up reserves and regulating fishing in certain locations – all of which allow fish stocks and fisheries to recover.

However, the effectiveness of these systems depends on support from coastal fishing communities. Around one billion people rely on fish for protein, and tens of millions fish for their income.

The researchers used Chile – one of the world's top 10 exporters of fish and fishery products – as a case study to identify how fishing incomes can be protected while anti-poaching rules are enforced. This includes limiting the catch, surveying the population of key fish species each year, and paying for all management costs used to monitor and stop poachers. The study shows that fishers earned more in enforced zones than they did in open-access areas.

The increase in revenue stems directly from the increase in fish numbers which occurs when poaching is eliminated. By leaving enough fish in the ocean to reproduce the can now reproduce at the maximum rate.

On the other hand, fishers operating in open-access areas are much more likely to exceed safe catch limits – and drive down fish abundance. "Even if an individual fisher wishes to leave some fish in the sea, he can't guarantee that his neighbour will do the same," Ms Davis says. "So everyone takes as much as they can from the common resource, and this ends up depleting the fish stock. As a result, fishers spend more time fishing for fewer fish..."

The researchers interviewed fishers and divers in the area, who were aware of the benefits of fishing sustainably, Ms Davis adds. "They are aware they spend less time fishing and have a lower risk of running out of catch compared to open-access areas."

Tropical Oceans Most at Threat

An international team of scientists has used the 23-million-year fossil record to calculate which marine animals and ecosystems are most at risk of extinction today.

Source: ARC Centre of Excellence for Coral Reef Studies at the University of Queensland.

The researchers found those animals and ecosystems most threatened are predominantly in the tropics. The researchers found that the predictors of extinction vulnerability, geographic range size and the type of organism, have remained consistent over the past 23 million years. They were able to use fossil records to assess the baseline extinction risk for marine animals, including sharks, whales and dolphins, as well as small sedentary organisms such as snails, clams and corals. They then mapped the regions where those species with a high intrinsic risk are most affected today by human impact and climate change.

"These regions are disproportionately in the tropics, raising the possibility that these ecosystems may be particularly vulnerable to future extinctions."

"Marine species are under threat from human impact, but knowledge of their vulnerabilities is limited," says study co-author, Professor John Pandolfi. The scientists say that identifying the regions and species at greatest risk means conservation efforts can be better targeted.

"… there is a lot more work that needs to be done to understand the causes underlying these patterns and their policy implications," says Asst. Professor, Seth Finnegan.

Herring science

Research has revealed that a combination of environmental factors and fishing pressure has diminished the Australian herring (*Arripis georgianus*) stock in southern Australian waters.

Environmental factors including a steady rise in ocean temperatures and unusual flow patterns in the Leeuwin Current are thought to have contributed to a drop in herring recruitment over the past decade.

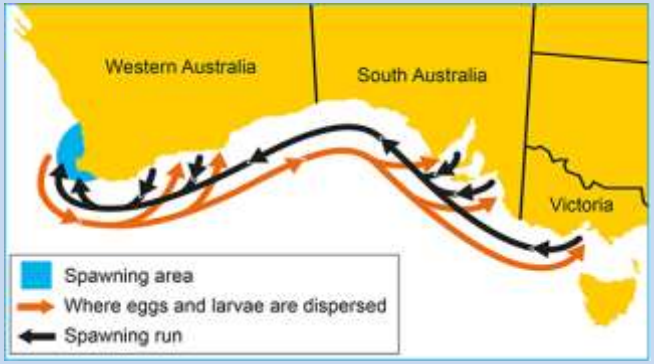
Australian herring are part of a single stock that stretches from the west coast of Western Australia and into Victoria. Adult herring spawn from late May to early June, are only known to spawn on WA's lower west coast, and mainly in the metropolitan area and south to Geographe Bay.

In years when the south-flowing Leeuwin Current is strong, eggs and larvae are carried from WA's lower west coast all along the south coast, and as far east as Victoria. But in years of a weak current, more eggs and larvae stay on WA's west coast.

Herring life cycle

Herring can live for 12 years but most caught are aged one to four years. As herring mature sexually at two to three years, most are caught before they spawn or after only breeding once. Just two or three consecutive years of recruitment failure can create a serious problem.

The level of fishing mortality has increased over the past 10-15 years and is now well above the sustainable level for herring. Commercial and



recreational catches from South Australia and WA's south coast add up to about 75 per cent of the annual catch – so high numbers of herring are removed before having a chance to spawn.

In addition, fishers on WA's west coast are targeting the remaining fish that have made it into the adult breeding stock. West coast fishers usually target herring during autumn when they aggregate (gather) before spawning. For reasons that are not clear, breeding females are particularly vulnerable to being caught by line at this time. The west coast recreational catch during the spawning season is dominated by females – roughly 80 per cent of the total catch.

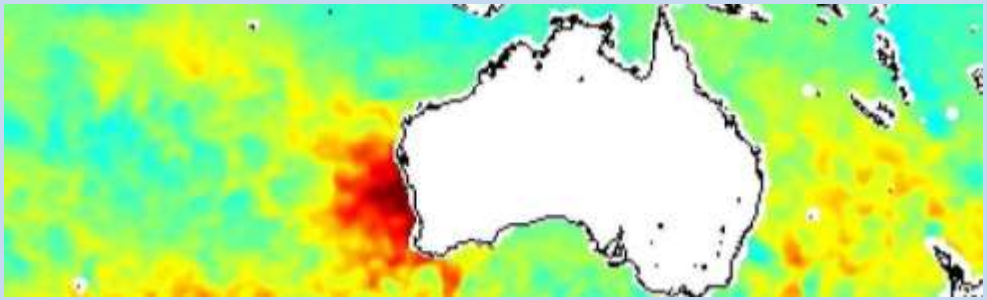
Fishers may catch many herring in one particular area, which may give the impression of a thriving stock. And the fact herring travel in schools can add to this perception. But this is deceptive. Herring prefer cooler water and many have failed to migrate to the west coast to spawn in recent years due to exceptionally warm ocean conditions, which have disrupted their migration and spawning patterns.

This has meant plenty of herring on WA's south coast, but very low numbers on the WA west coast. The unfavourable ocean conditions have also resulted in low spawning success.

If fishing pressure is reduced to allow more herring to grow to maturity and spawn, some evidence of recovery would be expected after five or six years with a fuller recovery expected in about 10 years. Measures have been taken to reduce the catch.

Marine heat wave - 2 years on

The WA heat wave produced conditions not dissimilar to those expected by the end of the century due to climate change.



In February/March 2011 a heat wave hit W.A. with sea surface temperatures (SST) in some areas reaching 4-5 degrees above average. It was a result of a combination of things. A record strong Leeuwin Current caused by prolonged easterly wind anomalies with weak winds on the south coast. It occurred during an intense La Niña period, as well as anomalously high air-sea heat flux into the ocean. The heat wave effect was felt throughout the water column to depths of 100 m.

SSTs were higher than normal by at least 2°C during the last three summers in Exmouth Gulf, Shark Bay, and Abrolhos Is. This caused a number of effects on local marine life,

• There was a boom in tiger prawns in Exmouth Gulf with one of the highest recruitments recorded in 2011 followed by the lowest in 2012.

• scallops and blue swimmer suffered and both fisheries were effectively closed for 2012.

• Finfish recruitment along the west and south coasts during 2011 and 2012 varied. Warmer water species like Spanish mackerel, rabbitfish, smudgespot spinefoot, sand bass and silver bream boomed. Cool temperate yellow-eye mullet and Australian herring recruitment fell.

• In Jurien Bay canopy-forming seaweeds (e.g. kelp *Ecklonia radiata*) diminished, there is little sign of recovery of canopy seaweeds.

• There were also first sightings of seven tropical fish species, well south of their normal ranges. Some tropical crab species, *Scylla serrata, Charybdis feriata,* and *C. natatory* were found in the temperate Swan River, as well as new records from WA waters of *C. granulata* and *C.annulata*.

• Heat stress attributed to the marine heat wave, caused the defoliation, flowering collapse and abortion of seagrass meadows in Shark Bay. Cockburn Sound over the last 10 years has seen decreasing seagrass shoot densities.

• *Acropora* coral bleached within areas of Ningaloo and Abrolhos Is. in 2011.The coral cover in some areas within Ningaloo (Bundegi and southern areas of Ningaloo) has continued to decrease.

• Breeding success of Little Penguins on Penguin Is fell.

• Mass mortalities of the abalone *Haliotis roei* occurred in the northern reaches of the species.

Abrolhos Islands: Volunteers clean-up

Source ABC

Over decades, rubbish has accumulated in parts of the archipelago, which is a breeding ground for millions of seabirds.

Sea lion finds an abandoned couch

The Abrolhos Islands are a group of 122 coral cays, west of Geraldton. The Friends of the Abrolhos (PFA) have been visiting these coral islands off Western Australia for several years.

Usually they return with dozens of rubbish bags, but this year they would be returning with hundreds. So far the clean-up has focussed around islands in the Easter Group.

Mr Hanrahan, a former plastic surgeon, said plastic was the main threat to the islands' birds. "The plastic breaks down into small particles. The smaller birds probably go pick it up and ingest it ... that fills them up and doesn't get digested, so [it] accumulates and they eventually die."

The Abrolhos Islands were once the base for the bustling rock lobster industry, but now only a fraction of fishing shacks are inhabited. Abrolhos Islands resident and Silver Chain nurse, Andrea Campbell, said she has gradually noticed the impact of the rubbish collections. "So over the years, there definitely has been a big improvement."

Mr Hanrahan hoped the clean-up would inspire others to hunt for trash in their local areas. "We've got some really great places in Australia, really great places in Western Australia but some are really not as good as they should be, because of the rubbish," he said. "I hope that the momentum we create from this will inspire at least a few other people to pick up some of the stuff that they see when they come out here."

Vic News

Rebuilding shellfish reefs in Port Phillip Bay

Shellfish reefs in Port Phillip Bay will be reconstructed to improve fish habitat and recreational fishing opportunities.

The project was initiated by Fisheries Victoria and the Albert Park Yachting & Angling Club, whose members had identified through club fishing records the loss of productive snapper habitat in and around Hobsons Bay.

Australia's first ever shellfish reef restoration effort is a $270,000 pilot project.

Native flat oysters and mussels raised at the Victorian Shellfish Hatchery (Queenscliff) will be attached to discarded empty shells (and other substrate) that will act as platforms for initial settlement.

Shellfish reefs will be re-established at three locations in 8-12 metres of water: Geelong, StKilda (Hobsons Bay) and Chelsea.

The Nature Conservancy's work on this project will be part of its larger 'Great Southern Seascapes Program' to restore marine habitats in southern Australia. Around the world, considerable progress has been made to restore estuarine shellfish reefs, which increase biodiversity, improve fishery productivity and filter the water.

Planning is underway and the seeding of new reefs is expected to occur over the next three years. This pilot stage will enable researchers to assess the survival, growth and biodiversity of the developing reef.

Where have all the Sharks Gone?

We have heard a lot about unwanted sharks in WA, but in SA some are crying out for more.

South Australia has a growing tourist attraction based around cage diving with sharks off Neptune Island seal colony. However, sharks have not been seen off the Neptune Islands since killer whales arrived and killed one of them in February. Ten weeks later, great whites have only just started to return in small numbers. Shark cage diving operators now want to expand elsewhere. Of course, everyone has a hot blooded opinion about everything to do with sharks.

Presently three companies are licensed to run shark cage diving tourism operations at the Neptune Islands. The operators are seeking approval for temporary access to one or more additional sites when cage diving is not feasible at the Neptune Islands. The State Government has nominated at least 16 other potential sites, which include Dangerous Reef and Greenly Island.

Abalone divers fear a move to expand shark cage diving sites off the Eyre Peninsula in South Australia will increase the danger for divers and people in the area. Mr Woolford was sceptical of the industry overall. He said studies had shown baiting sharks could change their behaviour. "Nowhere in the world are you encouraged to feed the wild animals," Mr Woolford said. "I mean they're an apex predator - and they've learnt - there's been studies done - berleying them up changes their behaviour and potentially makes them more aggressive."

More than 60 submissions have been received during the initial consultation phase. Further information about the shark cage diving industry proposal can be found online at www.marineparks.sa.gov.au

When Orcas Attack

Reports said it involved a family group of orcas, including two calves. Charter operator Matt Waller said the whales were launching themselves out of the water and slamming down upon the great white.

Crew member and marine biologist Gina Dickinson said the shark was eventually killed under the surface but she could see the orca pod's movements. "They were teaching the young, rounding it up in order to attack," she said."The intelligence behind it was just fantastic."It was definitely the highlight of my career. Not much is probably going to top this."

New Artificial Reef Planned

A new artificial reef off South Australia's coastline might restore shellfish bed habitat.

The State Government is stumping up $3.25 million to boost recreational fishing and tourism opportunities in areas possibly affected by new marine parks. One idea is for a new artificial reef, which will involve a $600k spend.

The Minister said "We will be looking to the public to assist us in deciding the most appropriate design and location for the reef, bringing in the most up-to-date scientific knowledge to help assess and determine the best solution."

The artificial reef trial is being led by PIRSA, with a working group with representatives from environment, planning and tourism departments along with RecFish SA.

A forum was held at the Adelaide Sailing Club to discuss a range of artificial reef options and their benefits.The forum was presented with information and case studies about different types of recent artificial reef projects in Australia. The talk mentioned that 85% of natural shellfish reefs have been lost worldwide and that the figure for SA is worse than that global average (around 99% lost). SA native oyster reefs are considered "functionally extinct". Recent Adelaide University research has revealed that SA Gulfs used to have over 1500Km of natural oyster reefs and now none of that remains. It is likely that if a reef project was to be built in SA, oysters may need to be seeded on new reef structures to keep them above the sand.

Oyster and mussel reefs play an important part in the marine ecosystem; not only do they attract fish and provide an important food source, they also filter enormous volumes of water and can play an important role in the nutrient cycle, including providing better conditions for sea grass.

A second Community forum is expected to take place later in 2015, after the online consultation has concluded.

Cuttlefish Population Looking Up

It is a bit too early to say yet, but it would seem that the population crash of some years ago is likely to have been due to natural cyclical factors.

Tony Bramley from Whyalla Diving Services said plenty of cuttlefish bones were washing up and that was a good sign ahead of the breeding season that began in about a month. Mr Bramley was surprised last year when higher than expected numbers turned up for the start of the breeding season. He had not been expecting many cuttlefish because the population had been in severe decline and there had been little signs of them gathering offshore.

This year, however, it was looking very positive, he said, although it was too early to predict numbers.

"They'll be out in the deeper waters at this stage off Whyalla," Mr Bramley said. "We don't expect them to come in to the shallows where they're visible as an aggregation until the water cools down a bit more. "But to get reports of the number and frequency that we've been getting in the last couple of weeks is very, very encouraging."

NSW News

Trial to Reduce Turtle Deaths in Port Stephens

A trial will attempt to reduce the number of turtles being caught in crab catching equipment in the Port Stephens area.

Since 2011, about 16 turtles have been found drowned in Port Stephens as a result of entanglement mostly in recreational crab trapping fishing gear, known as witches hats and rectangular collapsible traps."Recreational fishers in Port Stephens will be required to modify witches hats and some crab traps to limit unintentional interactions with turtles.

"While crabbing is a popular and important recreational fishing activity in the Port Stephens area, the higher than usual incidence of turtle drowning calls for some innovative action," Minister Blair said.

This new trial will require simple but effective modifications to some gear. Hoop or lift nets will not be permitted to be set between sunset and sunrise, which will reduce the potential for this gear to be lost overnight.

Crab traps with wide entrances have also been associated with a number of turtle drownings and there is now a requirement for the maximum entrance width of crab traps not to exceed 32 centimetres.

This means crabs can enter the trap but will restrict entry of such non-target species as turtles.

The new rules commence immediately, with a one-month advisory period to ensure fishers are aware of the changes.

Qld News

Fishing impacts on the Great Barrier Reef

New research shows that fishing is having a significant impact on the make-up of fish populations of the Great Barrier Reef.

Source: ARC Centre of Excellence for Coral Reef Studies (Coral CoE) at James Cook University, Predators drive community structure in coral reef fish assemblages by A. E. Boaden and M.J. Kingsford

A stable and healthy reef includes a high abundance and diversity of predatory fish and a relatively low number of herbivorous and small prey fish. Predatory fish are extremely important for maintaining a balanced ecosystem on the reef, yet predators remain the main target for fishers.

They compared fish communities in designated marine reserves (green zones), recreational fishing areas (yellow zones) and sites that allowed both commercial and recreational fishing (blue zones). "We found that the fish communities on reefs differed greatly according to the level of fishing that they were subject to," Ms Boaden says. "Predator numbers were severely depleted in heavily fished areas, while smaller prey fish such as damselfish, and herbivores such as parrotfish, had increased greatly in number..."

Major disturbances such as cyclones, coral bleaching, climate change, Crown of Thorns Starfish and river run-off are thought to be the primary agents of change on the Great Barrier Reef. Despite this, great differences in the abundance of predatory reef fish, and of their prey, can be attributed to humans. "The good news is that the data demonstrate that the current system of marine reserves on the Great Barrier Reef is effective in preserving predator numbers, and in doing so we can learn more about the processes affecting reefs in the face of multiple impacts," Professor Kingsford says.

"Fishing impacts are something that we can manage fairly easily compared to other threats such as climate change and run-off pollution, which are threatening the Great Barrier Reef," adds Ms Boaden.

NT News

Developing the Tiwi Islands

Tiwi Islanders are reluctant to damage their land, but also impatient for development.

An economic downturn on the Tiwi islands has seen many people lose their jobs. "People often forget that there were 52 business on the Tiwi Islands that have failed and gone bankrupt or people have walked away."The devastation left on the community has been huge" a local representative said. High rates of unemployment on the Tiwi Islands remain a source of community frustration and anger. The NT member for Arafura, which covers the Tiwi Islands, Francis Xavier, said people had grown frustrated and angry with inaction.

Although the island has a long history of forestry it has been controversial. In 2001 the Australian Plantation Group sought approval to establish and operate up to 26,000 hectares of forestry operations on Melville Island. A local councillor said "I think a number of Tiwi regard their sacrifice with regard to their land on Melville Island to be very substantial. "They have given huge tracts of land over to forestry development. It's in a sense changed the ecosystem of Melville Island. "I'm sure the Tiwi think that that was a very significant sacrifice that they were prepared to undertake for their children for a better life.

Great Southern went bust in early 2009 in suspicious circumstances and after overcutting into a sensitive area. Great Southern was acquired by Sylvatech. The new plan was to harvest about 3,000 hectares of timber a year from 2013/14. In February this year a Japanese company signed a memorandum of understanding to export and sell woodchips from the Tiwi Islands. It was then delayed by the lack of suitable port infrastructure.

MZI Resources has been mining mineral sands on the Tiwi Islands since 2009. The sands are rich in zircon (used in ceramics) and rutile (used in the production of pigment for paints and plastics). MZI just wrapped up two projects on Melville Island, which are being rehabilitated, and made $46 million in sales to China. It has submitted a notice of intent to mine on the neighbouring Bathurst Island, an even bigger project, which could be worth about $800 million. Kilimiraka is more than 20 times larger than the other two projects. It could have an eight to 10-year mine life. Again this was dependant on better port facilities.

A $50 million (or $130M depending on the source) port development was built by Singaporean firm AusGroup . A proponent said "I know there's pineapples being talked about, market gardens and everything else... having this port available, I think, makes it endless as to what could happen here," he said. It is said to be worth up to $200 million in export revenue and was recently completed after long delays. Cyril Kalippa said, "We wanted to do something for ourselves and with the help of some outsiders with a good heart, we're trying to get the Tiwi people away from getting handouts from the Government.

The port appears to have pushed ahead without completing the environmental impact studies that were required by law. It is in an area of the Northern Territory listed as internationally significant for threatened wildlife, and they were building large oil tanks as part of the development. Environmental consultant Adam Smith said "Basically you need at least several years of ecological studies to look at the habitat in the surrounding area that might be impacted - so mangroves, seagrasses, fishes, protected species". It sounds like a way too complicated process, and no-one wanted to wait for that. They all looked the other way. The Environment Protection Authority's (NTEPA) has confirmed it is in the preliminary stages of assessment, but the port has already been built.

It sounds mean to ask people with nothing to be more patient, but more than a few laws are getting clear-felled here. A bit of expedited background research into the area would have improved the port and can be recycled for later projects. I suspect that habituating developers into expecting 'corner cutting' is just asking for trouble later on. I hope it does work out, because the Tiwi are gambling all they have on these new endeavours.

Adele Penguins

per Antarctic Divn,Animal News blog, bioexpeditons.com, ejphoto, oceanportal, penguinsworld.cz

The Adélie is a medium sized penguin, weighing between 3 and 6 kgs and standing 70 cm tall.

Adélies have been recorded swimming as far as 300 km (150 km each way) to forage food for their chicks. Adélie penguins are capable of diving to depths of up to 175 m but usually feed within the upper 70 m of the water column. The adult birds catch fish, krill and other small crustaceans, which they regurgitate for their chicks.

Adélie penguins breed around the entire coast and small islands of Antarctica, in places where there is exposed rock.

Adélie penguins build nests out of the pebbles they find on dry land during spring. Feeding is a problem in early spring when the pack ice has not yet broken up. They may have to walk 50 km or more over the ice to reach the sea before feeding.

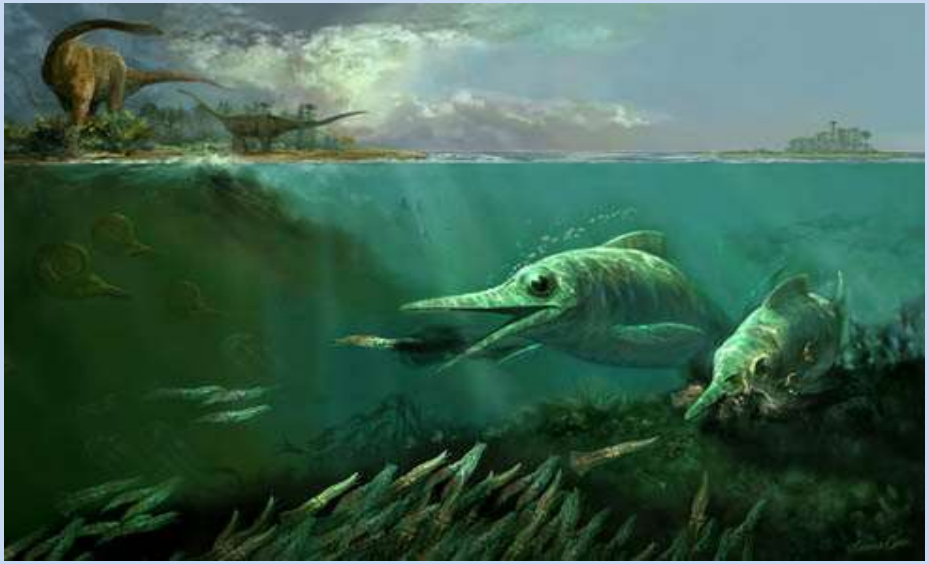
Their main predators are leopard seals, and skuas take eggs and chicks from breeding colonies.

Adélie penguins have a life expectancy of ten to twenty years.

Natures Real Survivors Pt VI

Jurassic Period

(199.6-145.5 million years ago),



Well if size counts, then this is the era for you, when many animals picked the "Supersize Me" option. They seem to have skimped on diversity though. Biodiversity during this period seems to have decreased around the globe.

At the start of the period, the supercontinents started breaking apart. New oceans flooded the spaces in between. Mountains rose on the seafloor, pushing sea levels higher. All this covering of water gave the previously hot and dry climate a humid subtropical feel.

The marine ecosystems showed signs of recovery from the major mass extinction that occurred at the Triassic-Jurassic boundary. This extinction eliminated about half of marine invertebrates and left some groups with very few surviving species. Diversity increased rapidly for the first four million years and then slowed through the next five million years.

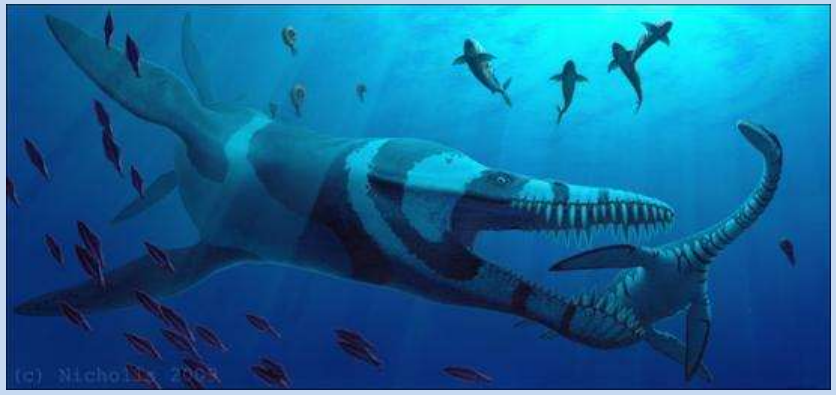
At the top of the food chain were the long-necked and paddle-finned plesiosaurs, giant marine crocodiles, sharks, and rays. In the seas, the fishlike ichthyosaurs were at their height. Also prominent in the seas were cephalopods -- relatives of the squids, nautilus, and octopi of today.

Free-floating plankton proliferated and may have turned parts of the ocean red. Coral reefs grew in the warm waters, and sponges, snails, and molluscs flourished. By Late Triassic, scleractinians corals were building complex reefs.

The Jurassic and Cretaceous seas contained shell-crushing animals that may have been responsible for the disappearance of many species of brachiopods. These shell-crushing predators included crabs, lobsters, sharks, rays, certain marine reptiles and some species of fish. Starfish, which use suction tipped tube feet to pull clams apart, appeared in the Jurassic. Ammonites developed jaws capable of spearing or crushing prey. Unlike brachiopods, however, clams and snails were better able to survive this hostile environment by burrowing into the substrate.

Time travellers can have the Hollywood experience of dodging large dinosaurs. But it proved to be all too much evolutionary hype in the end. The world changed again and it was little and efficient designs, not brawn, that ruled the earth.

The extinctions may be related to an onset of low-oxygen conditions in the seas. Whatever happened, by the end of the period, the stuff of nightmares monsters were all a thing of the past, and small efficient designs lived on.



Urchins

Urchins are really old, even older than dinosaurs, but the changes wrought after the Jurassic Period saved them from a long decline towards extinction and gave them a 'second wind'. The earliest echinoid fossils date to the upper part of the Ordovician period (*circa* 450 Mya). During the Carboniferous period, urchins declined in diversity. They neared extinction at the end of the Paleozoic era, with just six species known. Only pencil urchins and the spiny urchins survived from the once diverse range of urchins. By the upper part of the Triassic period, their numbers began to increase again. Pencil urchins proved to be a very robust design and have changed very little since the Late Triassic. From here they went on from strength to strength. Sand dollars are a really new model (*circa* 66 to 1.8 Mya) and form the latest branch on the still active echinoid tree.

The Basics - Anatomy

The sea urchin is a good example of a modest but robust design that survives when the going gets tough. It is built like a little armoured tank which protects not a lot more that a mouth and gonads. They are effectively simple eating machines. That said, they have a pretty interesting anatomy. The real artwork has been saved for the mouth, so complex its been given a special name, a "lantern". This strange hard structure contains the jaws, a 'heart' that pumps water around the urchin, and a nerve centre (too small to call it a brain). A circulatory fluid fills the general body cavity and they even have blood. They save on a back end by eliminating waste through their gills and tube feet. So they effectively go to the toilet through their toes.

Sea urchins also breathe mostly through their tube feet. If they get low on oxygen they can use five pairs of little gills located around the mouth. Heart urchins and sand dollars live under the sand most of the time and have done away with these gills.

Although sea urchins don't seem to have any problems avoiding predators or finding comfortable dark corners to hide in, they don't have eyes. Genetic analysis of sea urchins has revealed they have light-sensitive molecules, mostly in their tube feet and in tiny stalked appendages found in among their spines. Although they do not have eyes as we know it, their entire body might function as one big compound eye (like a fly). Sea urchins are also sensitive to touch and chemicals and can tell up from down. They have all the functionality of a more superior organism, but without all the complex systems.

Todays common temperate urchins

Slate pencil urchin - *Goniocidaris tubaria*

This is a very old animal from which many other urchin designs evolved. These kind of urchins are very common around southern Australia from shallow depths to 630 metres. On reef, the Slate Pencil Urchin uses its spines to wedge firmly into holes and crevices during the day. The Slate Pencil Urchin is a herbivore. It comes out to feed at night. The mouth is on the underside of the body and is equipped with five sharp teeth used to scrape algae from the rocks. The spines of this urchin are often covered with encrusting invertebrates.

Two species of *Goniocidaris* are now thought present in southern Australia—*Goniocidaris tubaria*, which possesses spiky primary spines and has wide red areas extending down the test between the spines, and *Goniocidaris impressa* , which can possess spiny or smooth primary spines and has small white spinelets distributed across the red test.

Purple or native urchin (*Heliocidaris erythrogramma)*

The native or 'purple' urchin *Heliocidaris erythrogramma* is about the most commonly noticed marine invertebrate on sheltered reefs in the southern coasts. They are basically everywhere.

Because urchins are so good at eating algae, their numbers make a big difference to the health of local seaweed beds. If their numbers get out of balance, the area can be turned into a barren desert.

The first noticeable thing about purple urchins is that they usually aren't purple. They come in a vast array of colours, white, purple, dark red, brown, green, or occasionally pink. This big colour variation is not very common among urchins.

The urchins contain pigments called spinochromes and echinochromes. They extract the ingredients for these pigments from food and some of them are based on iron minerals they gain from the environment. The final colour variation is determined by genetics and where they live. If the area is very exposed to wave action a white colour is most common.

During the winter and spring the purple urchin eats and builds up its condition ready to breed. Its gonads become large and swollen. The urchin is ready to spawn when its shell, called a "test", is 4-5 cm in diameter. *H. erythrogramma* usually spawn in summer.

When the urchins are ready to breed it seems like the females may try to snuggle up to as many males as they can to improve her chances of one of them being a star fertilizer. The released sperm and eggs mix in the water column and develop into little larvae that settle on the bottom.

Like a lot of marine animal larvae they are very fussy about where they land. Urchin larvae appear to have strong preferences for particular kinds of seaweed and are even attracted by particular types of bacterial film growing on the rocks.

A stop motion video at the University of Tasmania shows urchins spending much of the winter sheltering in crevices. The winter storms keep them well-supplied with broken bits of drift algae which they wrap around their spines and munch at their leisure. They barely move from the safety of their crevices, especially in shallow exposed areas where the bottom is being lashed by macroalgae in the swell. As the summer progresses and drift algae runs low, they will take more risks and roam around the reef, especially at night, to tackle anything they can get their hands on.

The University of Tasmania also has excellent night video of urchins being attacked by crayfish who also roam around the reef looking for exposed urchins. As soon as the crayfish comes near, the urchin bristles its spines and points them towards the crayfish. A battle is then on with the cray trying to flip the urchin onto its back. A small cray will struggle to do this with a large urchin. Studies of black urchins suggest that excessive cray fishing by humans is severely reducing the size and numbers of crays. This is helping urchins to increase to excessive numbers until they eat the reef down to bare rock. Native urchins also form barrens, but generally only in sheltered areas.

You may have noticed that native urchins will also be found with lots of shells and other objects lodged in their spines. Like many other species of urchin they will pick up anything to use as a shield including human litter. It was thought that they did this just to cover themselves from 'sunburn' by UV rays, or even as a shield from predators. More recent international studies suggest UV is a factor, but more often they are trying to shield themselves from physical damage caused by the lashing of seaweed. Older urchins tend to do it less than more vulnerable smaller urchins.

The native urchin is an important grazer on our reef. Even small numbers tend to change the amount of weed growth on the rocks and that changes the other types of animals that can live there. Mostly, they cause only small areas of barrens damage to reef compared to the long-spined or black urchin that has recently arrived in Victoria and Tasmania from New South Wales. Native urchins can still be a significant problem in unique areas where some animals are already doing it tough, such as the Red Handfish habitat at Primrose Sands in Tasmania, which has been severely damaged by urchins.

Long spined or Black urchin (Centrostephanus rogersii)

This species has found it's way down the east coast from NSW and Tasmania and is seen as a pest in Tasmania. When found in large numbers, these urchins can eliminate kelp and other macroalgae and form urchin barrens of 'white rock'. They differ from *Heliocidaris* by having hollow spines rather than solid spines. In NSW they have converted 50% of the reef into a barren area. Climate change is allowing them to breed further south than ever and they are beginning to seriously damage the cold temperate zone.

Egg Urchin

Amblypneustes ovum is found in sheltered and moderately exposed reef; 0 - 70 m depth form SA to Victoria and around Tasmania. This is a short-spined urchin, often found amongst the fronds of seaweeds. It must spend a long time climbing up the seaweed thallus and then get whipped around in the swell. Hard work, but it ensures a permanent supply of algae to munch on.

The inflated egg urchin *Holopneustes inflatus* is a similar sea urchin that belongs to the Temnopleuridae family. This species is found in the waters of south eastern Australia and is known to occur from the Richmond River in northern New South Wales down to the Derwent estuary in Tasmania. This species looks very similar in appearance to the *Holopneustes purpurascens* sea urchin. The test (body) of *Holopneustes inflatus* is generally always brightly coloured and most the common colours observed are orange, red, yellow, pink and mauve. The *Holopneustes inflatus* sea urchin may grow to a maximum width of 5cm. It can be found on in shallow seagrass meadows and is sometimes associated with kelp and is known to feed on seagrasses.

Heart urchins -
Echinocardium cordatum

In Australia, it is observed as odd specimens along the shoreline of calm estuarine, among the flotsam and jetsam, and occasionally seen in disturbed sand by divers. Depending on the temperature, the species digs a few centimetres to about 20 cm deep into the sediment. A respiratory channel (chimney) leads from the hole to the surface. The animal is isolated from the sediment by a mucus veil, which plasters the burrow, basically it lives inside a ball of snot. It collects food particles from the sand. It will live in the shallows or in water as deep as 230 metres. In some parts of the world it can reach densities of up to 200/m2.

Breeding occurs in summer. The pelagic larvae are sometimes found in enormous quantities. Occasional population explosions have been seen in SE Australia where thousand will wash ashore. In mid-October 1994 in Henderson Lagoon at Falmouth, Tasmania, thousands bred up after a long period of dry weather, probably as salinity became higher in the lagoon, favouring the urchins. When food was exhausted a month later they all perished, causing the locals to unnecessarily worry that something was poisoning the lagoon.

The species can live for 10 to 20 years. It is found world-wide in temperate seas. It's the only sea urchin with a world-wide distribution. The species is only found in sediments with a low mud content (< 20%) and medium-sized sand grains (200 to 300 µm).

TAS Feature

The Tamar River

One of Australia's largest and most altered estuaries is also a natural wonder

The 70 km long Tamar Estuary is a drowned valley formed during a faulting event in prehistory. Tectonic, volcanic and glacial activities have continued to shape this flooded 'crack' in the earth into what we see today.

The Estuary receives three major river systems: the South Esk; the North Esk; and the Meander. These three main catchments form a large drainage basin, which covers approximately 18% of Tasmania's land mass.

The Tamar is no thready little estuary with a blocked outlet to the sea. It is one of Australia's major rivers. The water depth of the Tamar estuary ranges from 3 metres at Launceston to over 60 metres. The tide rips through the estuary and creates carved channels, ledges, rocky outcrops and even whirlpools. Near the heads, clean ocean water bathes rich seaweed beds. As you proceed upriver the waters gradually become siltier and darker. Each area creates a unique habitat for a variety of life.

History

The area around the Tamar Estuary was occupied by various bands of Aboriginal people, who were later called 'The Northern Midlands Tribe' by Europeans. Unfortunately little about their life was recorded by early settlers, making their surviving cultural sites all the more important. The population of perhaps 500 people seemed to be mostly based around George Town opening to the sea. They gathered molluscs from the sea and also hunted around inland swamps.

A small European agricultural settlement started at the beginning of the eighteenth century and struggled to grow enough food in a valley often noted for unreliable permanent water and poor soil. Only the alluvial plains at the upper end of the river (Launceston) supported reliable crop harvests. For much of the 19th century the Tamar Valley was largely woodland. However, before the days of macadamised roads and cars, the sea was a highway. The Tamar snaked through the wooded hills and connected the world to the settlement at Launceston, a gateway to the rich alluvial soils of the Norfolk Plains hinterland. Isolated farms and small settlements supplied a growing wool industry based on a rough road system and the small Launceston wharves.

There were flour mills in both the Supply River and at Windermere, and lime works at Middle Arm. By the end of the century, little farms had sprung had up along the riverside, served by small sailing ketches and river steamers. The access to easy timber stands started an extensive shipbuilding industry from at least the 1830s, mostly building small river ketches.

The building of the railway system in the 1860s gave Launceston a geographic advantage, placing it at the junction of three rail routes. Access to water, electricity, rail and sea sparked off heavy industry including precision engineering, brickworks, textile mills and a tin smelter. Regular gold shipments from the Beaconsfield gold mine also lined the pockets of Victorian era investors.

They spent their profits on the elegant commercial buildings and leafy parks that are still a feature of Launceston's CBD today. They also improved the wharves and started blasting and dredging the many obstacles in the river estuary. These rocks and tidal flats made a sea journey up the Tamar a potentially dangerous undertaking. Gradually the trees were cleared and the rivers choked with sediment and industrial effluent. Choking the river with mud further hampered

shipping and massive works filled in mud flats and reshaped the riverbanks.

As prosperity grew there was also time for leisure. The river supplied opportunities for fishing, hunting, sailing and picnicking. On public holidays, industrial workers crammed into the river's steam ferries. In a time when no-one had cars, over 1000 people a day would go by steamer from Launceston to Beauty Point and George Town. Today tourists still carry out these rituals, but only on short hops around the city sights. Now the car is king.

The Tamar Today

The Tamar Region is now home to over one quarter of the Tasmanian population with the combined population of the Launceston, George Town and West Tamar municipalities being in excess of 92 000 residents. The shipping and industry has moved down river to Bell Bay and the rail services have shrunk, but the Tamar Region is still the Northern Tasmanian centre for industry and commercial activity. Forestry has waned and the industrial plant, now located near George Town at the river mouth, faces an uncertain future. At the other end of the estuary tourism, education services, specialty food processing and other services are taking over as new industries for the region.

While many things change, others remain the same. The major land use in the region is still grazing. Other major land uses include forestry and viticulture.

The clearing of native vegetation and development has led to a loss of biodiversity. Remaining bush is often under pressure from fire, overgrazing, wood cutting and weeds. However, a large amount of what remains is now protected in conservation reserves. Despite an active industrial history the Tamar Region is still quite 'natural', including retaining in excess of 65% of its vegetation cover. Its feeders rivers, creeks and streams don't always run clear thanks to sediments (some of which is natural), but it is mostly clean. Water quality and stream condition tests in 2005 found these systems are generally in good condition, although some areas are still experiencing high levels of turbidity and pollutants.

Despite interference from humans the Tamar estuary is intact enough for it to be considered a class A estuary in terms of its biological significance. The Tamar estuary was a problematic inclusion as a Class A estuary. It got the guernsey largely because it is the only estuary of its type in Tasmania (mesotidal drowned river valley - estuaries with wide river mouths, rocky headlands and deep channels). However it still possesses extremely high plant, invertebrate and fish diversity, and a large component of species not recorded elsewhere.

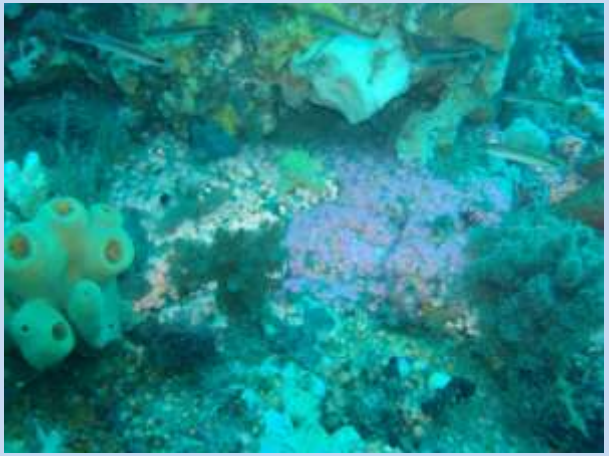
Biodiversity Hotspots

Low Head

The eastern outlet of the Tamar Estuary at Low Head has been identified as a significant waterbird habitat with high scenic qualities. The Tamar River Mouth Reserve contains saltmarsh flats and coastal vegetation important to waterfowl. Seals, dolphins and whales are fairly regular visitors. There is a major penguin viewing platform at Low Head.

In sampling done recently of marine fauna, Low Head sites ‘scooped the pool’ and possessed substantially higher species richness than most other sites, with 116 species collected at Low Head compared to 71 at the next richest site (Welcome Inlet).

There are rich seagrass beds (*Heterozostera*, *Posidonia* and *Amphibolis* seagrass) near the estuary mouth, a habitat that possesses extremely high biodiversity, including numerous species not protected elsewhere. A marine protected area has been proposed here. Fishermen wanted a limited area from Low Head to Dotterel Point. Environmentalists also wanted to add the seagrass beds in Lagoon Bay extending 500m offshore for a distance of 3 km along the coast from Low Head to She Oak Point, including unusual deepwater habitats off Barrel Rock. This debate is yet to be resolved.



Barrel Rock and Farewell Beacon

The rock lies near the Low Head lighthouse and has been a shipping obstruction since the early days of settlement. It was once marked by an old barrel-shaped buoy. This has been replaced by a steel marker with a fish-shaped weather vane on the top. Therefore the rock is known as both Barrel Rock and the Fish Beacon.

Because of the strong tide, the rock is covered in filter feeding marine life. The reef structures, both natural and man-made, have attracted a lot of fish. Although the bottom is fairly muddy the dive is still very colourful with a vast array of interesting sponges to look at and photograph. The area around the Farewell Beacon has even more fishlife.

Straight out from the Low Head Lighthouse there are also some large reefs that are often covered in luxuriant growths of Kelp.

Hebe Reef

Another area which is often visited by divers is Hebe Reef. This reef offshore of the heads sits almost in the centre of the shipping lanes and thus has claimed many vessels. One of these is the Barque "Eden Holme". The "Eden Holme" was on a voyage from London loaded with general cargo for Launceston. On the 5th of January 1907, Captain Dulling asked for a pilot to enter Tamar Heads. The "Eden Holme" was under the command of Pilot Mullay when the wind dropped away and the vessel was becalmed. Without the power of the wind she drifted slowly onto Hebe Reef and bumped lightly. Although the barque was undamaged the tide was falling. Soon the vessel began to groan under her own weight and eventually the plates gave way. By the time a tug arrived it was too late to save her. She lay intact on the reef for some time and was heavily salvaged before finally breaking up. The vessel was owned by the famous company of Hine Brothers. The "Eden Holme" rests in a depression in the rocks and the hull plates above this

depression have been broken off and scattered. Much of the cargo was salvaged, but divers can still find fragments of glass, china and shot. Deadeyes, full bottles of wine and vinegar bottles have also been located in the past.

Divers mostly stay in the shallows where there are wrecks, but apparently the deeper areas of the reef also offer very high fish species biodiversity. Rocky crevices are home to invertebrate life and the reef is covered in seaweed.

The Hebe Reef is still a menace. In 1995 the Iron Baron went up on the rocks and spilled oil into the river. After several years, fortunately the marine life recovered.

Tamar fish life

Everyone loves fish and many of us love fishing. The river still offers good fish populations, thanks probably to the regions low human population, the constant streams of pelagic fish coming in from the ocean, and some sound management.

The Tamar is a Shark Refuge Area, protecting the river as a nursery for Gummy Shark, stingrays and seven gill sharks. Bottom dwelling sharks and rays are still plentiful in the Tamar River, where they have been heavily depleted in other urban areas. They seem to love the muddy ooze even in the upper reaches and Gummy sharks can be seen as far up as Rosevears.

The deeper sections of the river between Windermere and the Heads have better fish life. In the darker sections of the river Rock Cod, Ling, Gurnard are common in the rocky crevices.

The shallower sand and mud flats are home to Flathead, Flounder, Mullet, Whiting and Garfish. Mullet may be caught up the river as far as Windermere. Garfish seldom venture past Swan Point. Whiting prefer the clearer sea grass beds closer to the river mouth.

Leather Jackets, trevally, luderick, wrasse, Magpie Perch, boarfish, sweep and many other fish species cluster around any rocky reef or structures such as channel markers, piles, reefs, breakwaters and headlands. Australian Salmon, Mackerel, Pike, Couta, Snapper, Kingfish, Bream and Snotty Trevally move in and out of the Estuary on a seasonal basis. Schools chase bait fish around the mouth of the river and as far up the river as Egg Island.

While we often focus on the species in the river that we fish, but by far the greatest number of species are the tiny ones that are often hard to see. The mud and sand is also home to countless gobies and blennies and other weird and cryptic fish species like Warty Prowfish.

The Tamar Goby is actually common in SE Australia, but was first described here. Males grow to a larger size than females and have larger mouths, and very bulbous cheeks. They are small and can be seen scuttling along the sand in the shallows.

Tamar Goby, Afurcagobius tamarensis. Source: Rudie H. Kuiter

The hardiest of all fishes are perhaps the eels found in the upper reaches. They spawn in freshwater streams and then make for the sea, adapting to the rising salinity as they head downriver. These days they often find natural watercourses blocked by dams and low water levels, but they can wriggle out on to the grass at night to get around them. This species has been re-stocked upstream of the Trevallyn Dam when its former distribution was blocked by the large dam wall. Eel ladders have now been installed on the dam face. The young eels, the elver, are eaten by all sorts of birds, sea eagles, herons and cormorants. Their poisonous skin coatings sometimes deter predators. They settle onto the muddy bottom of the upper estuary as far up as Cataract Gorge and live on small fish and insects. Here pollution can often make the water rich in bacteria that then depletes the oxygen. Recently, a spell of warm weather caused quite a few to die of stress and float to the surface.

Tamar Island Wetlands Reserve

The area from the Tamar Island Wetlands Reserve to the Batman Bridge is part of the Tamar River Wildlife Sanctuary. It is identified as an important area. From here 43 local and 21 vagrant bird species have been sighted.

It used to be open to the tide, but dozens of disused vessel were scuttled at either end of the mudflats to divert the tide and allow more sediment to settle there. Now it is covered in marshy vegetation and nutrient rich mudflats, in some ways replacing tidal flats that have been lost in other parts of the river. A wooden platform and a visitor centre make it a great recreational site within easy reach of the city of Launceston.

The dredge "Ponrabbel" is a visible symbol of the changes that have occurred in the estuary. She was bought during the First World War to dredge the channel near Launceston to facilitate shipping access. Today she is abandoned, used at the end of her life as a training wall to block off the tidal flows around the Tamar Island mudflats. Ironically, she is slowly disappearing into the choking the mud that she spent her life trying to keep at bay. As the industrial past literally sinks into the background the tidal flats are now a major bird wetland.

Problems of a Developed Landscape

While Low Head is flushed by ocean currents and is a very rich marine environment, it’s a mixed result overall. Some areas are not in great shape with Paper Beach dominated by species typical of heavily disturbed areas.

The estuary is severely impacted by introduced species including ricegrass *Spartina anglica*, East Asian bag mussel *Musculista senhousia* and pacific oysters *Crassostrea gigas. They* are hard to manage simply by creating a reserve on paper, but more concrete efforts have followed with ricegrass and gambusia control programs enjoying success.

Pollution isn't the major issue thanks to extensive programs to treat sewerage and industrial effluent. The stormwater drains still have a coat

of slimy algae around them, but the pollution is typical of a populated area along a narrow waterway. The Tamar River Recovery Plan is aimed at further improving the health & amenity of the Tamar River Estuary by removing and reducing the inputs of sediments and nutrients from the combined sewage and stormwater overflows and other areas of the catchment. Launceston has an usual drainage system where stormwater flows into sewerage pipes. It's hardly desirable, but it only causes overflows when the river is in flood and the sewerage is heavily diluted. The cost of replacing the entire drainage system is currently prohibitive.

Many of the Tamar's pollution issues are legacies of past bad practice. In the industrial era there were few controls and highly persistent pollutants like heavy metals were dumped into the river. Things are on the mend. Cod, flounder, flathead and mullet were collected recently and analysed for metal concentrations. Concentrations in fish were below the FSANZ standard and not considered to be of concern to public health. It is still recommended that fishers limit fish servings from the Tamar River estuary to 2-3 serves per week.

However oysters showed significant levels of copper, zinc and cadmium and are considered unsafe for people to eat.

Mud, Inglorious Mud

Most of the chatter about the river focusses rightly or wrongly on one issue. Siltation of the upper Tamar River has long been an issue and has caused annoyance to local water users with narrowing shipping channels and smelly mudbanks blocking boat ramps and jetties.

Dredging activities have been undertaken there since as early as 1859, a program that has now continued for almost 150 years. It has been estimated that just in the period from 1947 to 1966 alone, about 255,000 tonnes of silt were removed annually from the area between the top end of Home Reach and Stephensons Bend. This amounts to 360 tonnes per tidal cycle to maintain the depth of the river channel. It was never enough to 'fix' the issue. In a report to the Marine Board of Launceston in November 1899, Mr C. Napier Bell noted that gains made tended to be lost in a very short time.

Since the mid-1960s, when a major deep-water port was established at Bell Bay, dredging activities in the wider river have been more intermittent, with most effort concentrating on maintaining water depths alongside Kings Wharf at Inveresk.

As ships no longer berth at Launceston, the dredging in the upper reaches slowed. Space for spoil dumping was used up and costs increased dramatically relative to the small commercial gains to be made from dredging. A study from the 1980s suggested spilling water from Trevallyn Power Station in phase with the tides and using silt traps instead.

The Tamar Siltation Study in 1986 found that the build-up of sediment in the upper Tamar River was controlled by two major factors. Essentially, major flood flows from the two rivers flush the sediments from the upper Tamar (through scouring) down into the lower reaches of the estuary, while the tidal mechanism acts to return this sediment during periods of low river flows.

The main cause of the mudflats in the upper Tamar are natural processes related to the tide and flood patterns. Sediment flows into the Tamar River are considered fairly low for such a large watershed. Damming has caused a drop in river flows which has also slowed down the scouring of Home Reach in the upper estuary, but in some ways this has just been to the benefit of the lower estuary. The river at Launceston was always a narrow-channeled mudflat. In many ways the Tamar is simply returning to its ‘natural’ condition.

The issue is still very sensitive for river users, and intermittent dredging is likely to continue. "The silt seriously destroys the amenity of the river, it doesn't look the best at low tide, it seriously limits the efforts of rowing clubs and sailing clubs and (is bad) for tourists," a local told “The Examiner” newspaper.

The silt is also significant not just as an inconvenient eyesore, but also because it can act as a trap for heavy metals including high levels of zinc, chromium, lead and cadmium. In 1993 it was found that 30-50% of all the dredged mud doesn’t meet health guidelines for use as landfill due to zinc, lead and cadmium. Chromium was above the accepted limits in all of the samples. The cadium is especially unstable and likely to leach out of any soil made up from old dredging spoil.

These are a legacy of the Tamar catchment’s history of mining and heavy industry. This is especially so in the Upper Tamar and no shellfish should be eaten from the estuary.

Raking

To kick off the new approach, 2.5 cumecs of released water from Trevallyn Dam was promised by Hydro. Someone then came up with the idea of raking the mud while the river was in flood to keep it moving away from the city. The Federal government threw in $5 million for silt 'reduction'. In 2013 the program removed 240,000 m3 and then 101,330 m3 of sediment in 2014 from the Upper Tamar (Yacht Basin) and North Esk Rivers (in the vicinity of Seaport). Sediment raking targets high flows or is centred around the full moon tide and each campaign will rake for 10 days or nights on each ebb (outgoing) tide.

The raking used existing fishing vessels and has been a cheap way of moving the mud elsewhere, perhaps further down river where it might create fresh issues. The Flood Authority commenced a Sediment Tracing Program in order to better understand sediment behaviour in the Tamar Estuary. The program involved the placement of a non-harmful tracing medium in the mudflats around North Bank. Bathymetric surveying of the river is also ongoing and to provide information on where the displaced sediment settles.

New Development

The Tamar Valley is an area of slow economic growth that needs new industries and new ideas. Some of these ideas are related to low key 'green, clean' industries and others are 'bigger' and a bit more based around traditional industries. A plan for a huge wood pulp mill on the West Tamar attracted massive protests, and was eventually sunk by a combination of financial and political difficulties.

Another idea that is both radical and quite traditional is the idea for creating a Tamar Lake. A not-for-profit association has privately funded the investigation of the technical, environmental and economic feasibility of installing a barrage on the Tamar River at Point Rapid, just south of the Bell Bay Port. The $320 million project would create a 60-kilometre-long lake that extends upriver to the city of Launceston at the Cataract Gorge. Tamar Lake would supply freshwater for residential, industrial and agricultural developments throughout the valley.

Proponents say the lake would be a permanent solution to the problem of silt accumulation in the Tamar River by apparently ending the asymmetrical tidal action that remobilises silt on the high tide.

There are several issues to work through. It is admitted that "the key to the proposal would be TasWater carrying out its strategy to stop sewage flowing into the estuary". That would mean massive additional works to Launceston's drainage systems. The water table level in the low-lying suburb of Invermay would also have to be managed at a constant level by controlling the lake level. The studies state that the barrage will not negatively affect flood levels in Launceston.The environmental impact assessments apparently also states that "while there will be some displacement of natural ecological values, no listed species will be threatened and the freshwater habitats (including the Tamar Island Wetlands) will be greatly expanded". "The only species to die will be the imported rice grass". However, other material from the proponents also states that, "Migratory wader species may suffer displacement due to loss of intertidal zones – habitats will need management while they adapt."

With a permanent mid to high- tide water level, "…tourism and aquatic sports are obvious beneficiaries with 24-hour navigation for pleasure and tourist vessels from their berths in Launceston downstream to Low Head and passage through a lock in the barrage".

Its certainly a novel idea and what a sum to raise when its added to the drainage upgrade costs. I'm yet to be convinced that it will work either practically or environmentally, but keep those ideas coming. I have a suspicion that less capital-intensive and controversial proposals will form a larger part of the region's economic future.

Augmented Reality app

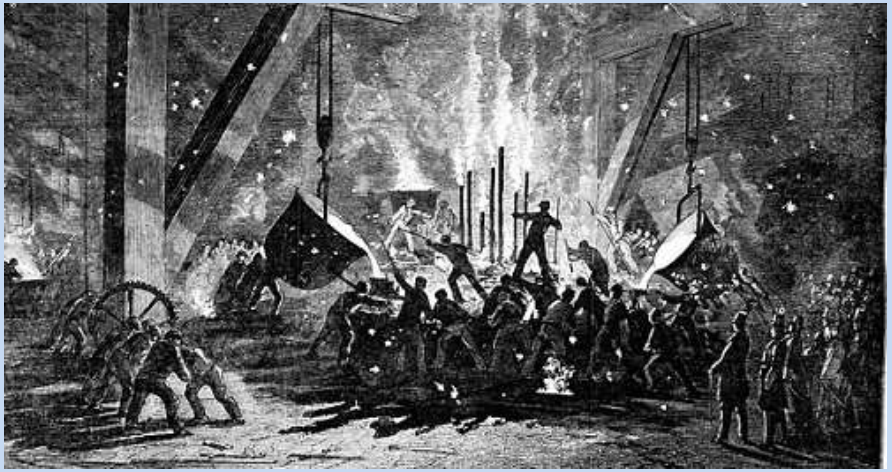
Have you ever wondered what lives beneath the water in the Tamar estuary?

Now you can tour the Tamar estuary in 3D using augmented and virtual reality to explore the habitats, flora and fauna, and issues affecting the health of the estuary. You will find swimming seals, flying eagles, big-bellied seahorses, and fish hiding in the kelp forests and sponge gardens.

TamAR is an augmented reality app version of the 2012 report card produced for the Tamar River estuary in Tasmania, Australia. The report card describes the health of the estuary and provides a grading from A to F for five zones along the 70 km estuary.

*HTTP://WWW.NRMNORTH.ORG.AU/TEER-TAMAR*TamAR

Iron Sailing Ships



In the 1870s iron started to be used in small amounts for shipbuilding. By 1885 new industrial processes were producing lots of cheap steel. It rapidly became the major construction material for international trading vessels. As international trade increased, bigger ships were required. Passengers also demanded more room and more luxury. Wood was too hard to work for very large vessels, and it also took more men to maintain it.

There was a downside, iron was heavy and hulls sat lower in the water and were wetter onboard. Iron hulls were also more easily fouled than copper-sheathed wooden hulls. However, these disadvantages were easily offset by the strength of iron. Massive masts could be made and reinforced with wire rather than hemp rope. Huge amounts of canvas could now be carried to propel these weighty ships. Iron ships could also pound into heavy seas at great speed, without causing excessive strain on the hull. Iron hulls could also carry more cargo and were safer in a fire. It gave sail a chance to compete with steam vessels. Steamers were starting to compete for trade, but steam boilers had low boiler pressure and engines were still inefficient.

The British had been refining iron shipbuilding technology for decades. In 1853, the "Martaban" was the first successful iron sailing vessel, but it took more than 20 years to fully win over conservative British shipowners. Now the British were in a position to outcompete their main shipbuilding rivals in America. The British moved their shipbuilding yards from the Thames, to Liverpool, Glasgow and Aberdeen so they could be closer to the coal mines and ironworks. Soon 75% of the world's international trading vessels would be built and owned in the U.K. The output of Clyde shipyards has been estimated at over 22,000 vessels and in 1876 more iron ships were built on the Clyde than in the rest of the World put together.

These impressive vessels became household names, as did their owners, the "Black Ball Line" of Liverpool, Aitken & Lilburn's "Loch Line" from Glasgow, White Star Line of Aberdeen. Shipbuilders like Evans of Liverpool, Pile of Sunderland, Thomson of Glasgow, Harland & Wolff of Belfast, and Walter Hood of Aberdeen, all made the transition to the new technology and had full order books.

At the beginning everyone went a bit overboard and added too much sail. In 1874 there were 7 ships that lost their masts after carrying too much sail. Many others were posted missing in unknown circumstances.

Even after this issue was corrected, iron ships were still sluggish in light airs, a hazardous trait when becalmed close to shore. In the end the technology and handling techniques were perfected and for a while, great iron and steel windjammers dominated the seas.

Life and Death of the great "Lochs"

In the late 1860s, William Aitken and James Lilburn formed the Glasgow Shipping Company with six 1,200-ton iron sailing clippers. This was no group of absentee investors, the management were all 'old salts' and personally supervised the loading and dispatching of vessels. The Loch Line clippers were held up by seamen as examples of what a well run and comfortable ship could and should be. The company rapidly grew to 25 ships. They specialised in trading from England to south eastern Australia. In 1867 it was not possible to visit the waterfront at the Port of Melbourne without seeing one or more of the Loch Line vessels.

Confusingly, three shipping companies named their ships after Scottish lakes. The "Lochs" of Aitken Lilburn are easily confused with James Sproat or J. & R. Wilson's fleets.

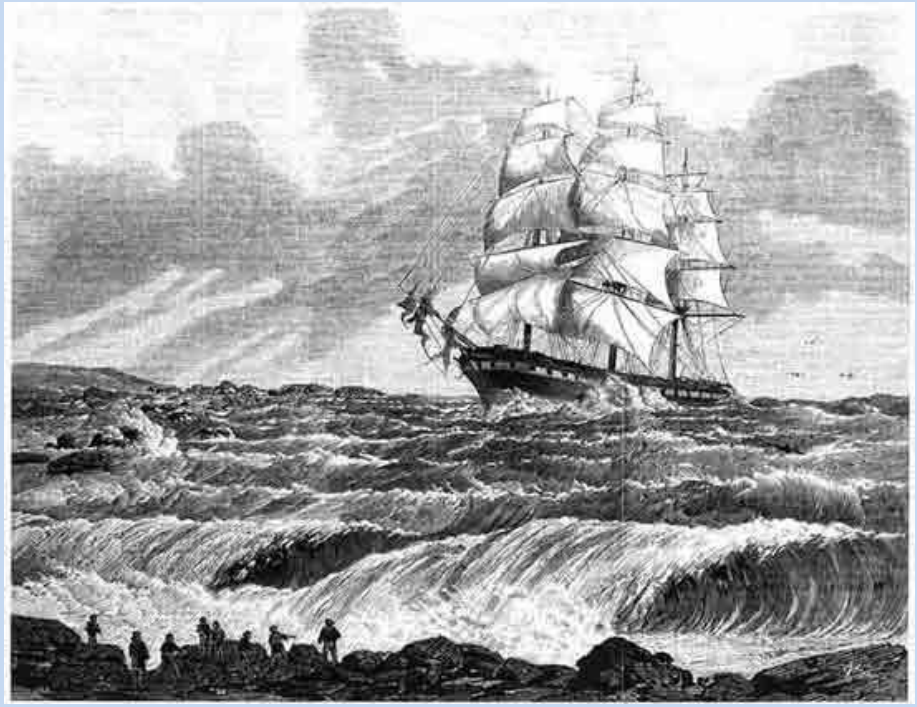
The usual route was to load general cargo and passengers at Glasgow and then sail to Adelaide. They then sailed on to Melbourne or Sydney where they loaded wool or grain, generally for London. The ships usually managed one round voyage to Australia per year, and half of this time was unprofitably spent in port, loading, unloading or waiting for cargos. Passenger fares charged at the end of the 19th century were £40 to Melbourne, £42 to Sydney and £76 for a return trip.

Soon steam-driven vessels began to encroach on their trade as passengers wanted faster ships. The company romantically persisted with sail, and from 1900 consistently ran at a financial loss. The *Loch Line* lost several vessels. Seventeen vessels bearing the *Loch* name sank in accidents, disappeared, were wrecked or torpedoed. Of the 25 ships in the *Loch Line* fleet, only five remained and were sold off when the company finally closed in 1911.

Loch Leven – Drama in the Roaring Forties

Loch Leven was an iron full-rigged ship of 1257 tons, built by Lawrie of Glasgow, Scotland, in 1870. She was owned by the Glasgow Shipping Company.

She left the Clyde on the 30th July and after discharging cargo at Melbourne proceeded to Geelong and loaded up there with a large and valuable cargo of wool. Rushing the first wool clip of the season from Geelong to the early London wool sales, the Loch Leven hurried to sea again. The Loch Leven left Port Phillip and was towed six miles beyond the Heads by a tug. The weather was fine so the sails were set and a SW course was steered.



At nine p m they sighted the King Island light in Bass Strait, and kept it in sight until two a.m, when the weather became thick with fog. Disaster struck only two days into her journey. In boisterous seas, she was caught by the heavy current that rounds the northern tip of King Island and struck the rocks at 2.30 a.m. on 24th October, 1871.

The first intimation they had had of danger was the sound of breakers, but they could not tell the direction from which it came. She grated on the rocks, gave two or three surges, and then settled down. She was lying close to the beach, about 200 yards from high-water mark.

As there was nothing they could do to move her, the 33 crew and 10 passengers left the ship in the boats and headed for Cape Wickham. Later the captain decided to return to the wreck for his instruments and the ship's papers, but on the return trip the boat overturned and Branscombe, who was believed to have been hit on the head as the boat rolled over, was drowned.

Captain William Branscombe was well known and highly esteemed. As a tribute the flags of the shipping in port were lowered to half mast as soon as the news was circulated. Captain Branscombe's body was later recovered and buried at Cape Wickham. You can see his grave at Victoria Cove. Visitors to King Island can dive on the wreck in good weather and she is now only scattered jumble of iron work.

Wallaby hunters shack made from wreckage of the Loch Leven

Help us save our Shorebirds in Crisis

BirdLife Australia reflects on the grim news that **seven of Australia's migratory shorebird species are on a trajectory toward extinction**. Iconic, once common species like Eastern Curlew and Curlew Sandpiper are now Critically Endangered with Bar-tailed Godwit, Red Knot and Great Knot not far behind. While **World Migratory Bird Day celebrates one of the world's great natural wonders, it also serves as a harsh reminder of the damaging impacts that human activity is having on critical habitat across the flyway**. This amazing phenomenon is in danger of imminent collapse because vital staging sites on the migration route are being degraded or lost entirely.

Time to take action

BirdLife Australia is calling on the Australian Government to do more to protect migratory shorebirds both at home and in Southeast Asia. Here's how you can help:

- Sign our petition to Minister Hunt calling on the Australian Government to do more to protect migratory shorebirds both at home and abroad.
- Donate to our Shorebirds in Crisis Appeal, every bit counts!

Follow us on Twitter and Facebook

Loch Ard – "Tell them I died like a sailor"

Built in Glasgow in 1873, the Loch Ard was a three-masted square rigged iron sailing ship and had a gross tonnage of 1693 tons. The Loch Ard was built at a time when steamships were starting to compete with sail on long routes. Shipbuilders were forced to make their vessels as fast and comfortable as possible to attract more passengers.

Loch Ard made three trips to Australia and one trip to Calcutta before its final voyage which ended in tragedy near Port Campbell.

Loch Ard left England on March 2, 1878, under the command of Captain Gibbs, a newly married, 29 year old. The ship carried a general cargo straw hats, umbrella, perfumes, clay pipes, pianos, clocks, confectionary, linen and candles, railway iron, cement, lead and copper. The cargo included oddities such as a Minton porcelain peacock. The peacock was destined for the 1880 Melbourne International Exhibition.

The voyage to Port Phillip was long but uneventful. At 3am on June 1, 1878, Captain Gibbs was expecting to see land but Loch Ard was running into a fog which greatly reduced visibility. At 4am the fog lifted. A man aloft announced that he could see breakers. Captain Gibbs ordered as much sail to be set as time would permit and attempted to steer the boat out to sea.

Gibbs then ordered the anchors to be released but they did not hold. By this time Loch Ard was among the breakers, and the tall cliffs of Mutton Bird Island rose behind the ship. The captain tried to tack out to sea, but the ship struck a reef running out from Mutton Bird Island. Waves broke over the ship and the top deck was loosened from the hull. It took time to free the lifeboats and when one was finally launched, it crashed into the side of Loch Ard and capsized.

The masts and rigging came crashing down knocking passengers and crew overboard. Some of the crew stayed below deck to shelter from the falling rigging, but drowned when the ship slipped off the reef into deeper water. Tom Pearce, who had launched the boat, managed to cling to its overturned hull and shelter beneath it. He drifted out to sea and then on the flood tide came into what is now known as Loch Ard Gorge.

Eva Carmichael had raced onto deck to find out what was happening. In all the chaos, Captain Gibbs grabbed Eva and said, "if you are saved Eva, let my dear wife know that I died like a sailor". That was the last

Eva Carmichael saw of the captain. She was swept off the ship by a huge wave.

Clinging to a spar, the young woman spent five hours in the water until she too was swept into Loch Ard Gorge. She saw Tom Pearce on a small rocky beach and yelled to attract his attention. He dived in and dragged her to shore. Of the 54 crew members and passengers on board, only two survived: an apprentice, Tom Pearce and a young woman passenger, Eva Carmichael, who lost all of her family in the tragedy.

The two shipwreck survivors were taken to Glenample Station to recover. Eva stayed at the station for six weeks before returning to Ireland, this time by steamship. In Melbourne, Tom Pearce received a hero's welcome. He was presented with the first gold medal of the Royal Humane Society of Victoria and a £1000 cheque from the Victorian Government. Concerts were performed to honour the young man's bravery and to raise money for those who lost family in the Loch Ard disaster. Everyone followed the story of Tom Pearce and Eva Carmichael with great interest and were disappointed when the separately returned to England. Tom Pearce died at his Southhampton home aged 49. His two sons became sailors and died at sea.

The wreck of Loch Ard still lies at the base of Mutton Bird Island and much of the cargo has been salvaged. Some was washed up into what is now known as Loch Ard Gorge following the shipwreck. Today, the Minton peacock can be seen at the Flagstaff Hill Maritime Museum in Warrnambool.

Loch Vennachar - A Most Beautiful Lady goes Missing

Loch Vennachar was built in 1875 by Thomson's on the Clyde. The *Loch Vennachar* name was drawn from Loch Venachar, a lake understood to mean "most beautiful lady" in Scottish Gaelic. On her maiden voyage, she was commanded by Captain Wagstaff.

Loch Vennachar was considered an unlucky ship narrowly surviving a cyclone in the Indian Ocean in June 1892. Waves broke on deck with such force that it broke the foremast, mainmast and the mizzen topmast. After 9 days, the weather eased. After 5 weeks of sailing, she arrived at Port Louis, Mauritius. Captain Bennett was awarded the Lloyd's Medal for his leadership and bravery at sea.

Loch Vennachar suffered another serious accident on 12 November 1901, after a collision with the *SS Cato* in the Thames. She rapidly sank in 40 feet of water. She rested on the bottom of the Thames for a month before being raised and repaired at considerable cost.

Despite her unlucky reputation, she sailed between Great Britain and Australia for 30 years without further incident. Captain W.S. Hawkins took command until her final voyage in 1905. *Loch Vennachar* departed on a routine voyage to Adelaide. She was laden with general cargo and a consignment of 20,000 bricks. On 6 September 1905, *Loch Vennachar* was overtaken by SS Yongala about 160 miles west of Neptune Island. It was the last known sighting of *Loch Vennachar*.

Drifting cargo was found near Kangaroo Island. The steamer *Governor Musgrave* was sent on two separate occasions to search for the wreck and any survivors. Weeks of searching by government and local fishing boats produced only flotsam and the body of a young seaman, who was never identified. The search was eventually abandoned. The hero of the *Loch Ard* disaster, Tom Pearce, lost one of his sons when the *Loch Vennachar* was wrecked.

Divers eventually discovered the wreck at West Bay, Kangaroo Island in 1976.Vennachar Point is located on the extreme west coast of Kangaroo Island. The grave and wooden cross (made from the wreckage) of the unidentified seaman can still be seen to this day at Vennachar Point.

Vic Feature

Point Danger Gannet Colony

Photo; 1000birds.com

After the success of using guard dogs at Warrnambool to protect a penguin colony, scientist David Williams moved to Portland to protect Australia's only mainland breeding colony of Australasian Gannets. He brought Maremma dogs, Elma and Reamma with him.

The main colony of about 10,000 Australasian Gannets is on Lawrence Rocks, a flat-topped island about 2km offshore from the tip of Point Danger. With space limited, a few birds splintered off to settle on adjacent Point Danger in 1996.

Gannets are present here during the breeding season, from about early October to February. Breeding coincides with the Bonney Upwelling, an oceanographic nutrient bloom that creates huge quantities of seafood. Plankton-eating pilchards and anchovies are the gannets' main food for raising young chicks and are caught by diving head-long into the ocean. The birds usually raise one downy chick each year. These develop a mottled appearance as juveniles before returning to the mostly white plumage of the adult.

However, in the first year of its existence no chicks were produced because of human disturbance and predation by foxes and feral cats, by 2004 foxes had destroyed all the nests.

The two Maremmas were brought in to scare off the foxes. Unfortunately, they found Australasian Gannet eggs delicious to eat. A farmers' trick of filling a couple of eggs with pepper soon taught these two a lesson. Drawing on the experience of the Little Penguin colony, the dogs were taught from a very young age that the area including the birds, the chicks, the eggs and the rocks on which the colony nested was their territory.

They managed well in an argumentative colony where there's barely two beak-lengths between nests and incursions create instant disputes.

The gannets have also been protected by limiting public access to a viewing site overlooking the colony. Colony size has grown to a few hundred birds and is an important tourist attraction.

There is a live camera at the colony if you want to take a look.

http://www.estuaryblue.com/wildblue_cam_danger.htm

Little Penguins Update

Courtesy Bird Life Tasmania

Surveys and monitoring of Little Penguins continued during the 2014–15 summer, with the focus on mapping colonies in the south-east and on assessing breeding effort. The breeding season was significantly better than the very poor season in 2013–14.

The penguins have friends. BirdLife Tasmania was invited to present the introductory talk at the Little Penguin Community Knowledge Sharing Conference held in Bicheno on 13 March. More than 50 people attended the event organised by Glamorgan Spring Bay Council, Parks and Wildlife Service and NRM South. Attendees were drawn from the local community and farther afield, particularly businesses that provide penguin tours in the area and around the state.

State of the Derwent 2015 Report Card

The Derwent Estuary Program has launched its 2015 State of the Derwent Report. The major changes are that there has been an apparent shift in nutrient loading to the upper estuary associated with increased catchment, industry and sewerage plant loads. Most estuary beaches are susceptible to stormwater pollution, and swimming is not recommended in the Derwent for several days following heavy rain. Recreational water quality of Derwent's bays and coves is variable. Zinc levels remain elevated in the surface waters of the middle estuary and at depth in the upper estuary, but there are some indications that levels have declined across the estuary as a whole. The majority of the Derwent's sediments do not meet national sediment quality guidelines for heavy metals, particularly for mercury, lead, zinc, cadmium and arsenic. The middle reaches of the estuary are particularly contaminated. There has been a decline in some of the extreme values previously recorded at middle estuary sites, and that there have been slight shifts in contaminant distributions, with some reductions at upper and lower estuary sites, but an apparent increase in Elwick Bay. The contamination is largely restricted to the top one metre of sediments, with peak metal concentrations typically at a depth of 20 to 60 cm below the surface.

The long-term decline in migratory shorebirds in the Derwent estuary/Pittwater area persists, and the number of ducks in the upper estuary has also fallen, however gull numbers have increased in recent years.

There have been no system-wide surveys of marine pests in the Derwent since 2002. The Derwent estuary has been extensively colonised by introduced marine species. At least 79 species have been recorded. A major new control program for the New Zealand weed karamu commenced in 2010, with a focus on protecting the high value wetlands in the upper estuary. This weed has been successfully reduced from 11 to 4 km of the foreshore, with further work underway.

The five-yearly 'check up' is available at http://www.derwentestuary.org.au/stateofderwent2015/.

Snares Penguin Released

per Mercury

A rehabilitated Snares penguin, rarely seen in Tasmania, was released into the wild by the Bonorong Wildlife Sanctuary staff.

Staff gathered on a secluded beach in South Arm at dawn to say farewell to a Snares penguin. She came ashore at Cockle Creek in the State's far south and had extensive loss of feathers and injuries. The penguin was placed in their care for about six months. These penguins are rarely seen here and are mostly found in NZ.

"People don't realise but feather loss for penguins, even as small as a 20 cent piece, stops them being waterproof." "Miss Simpson" had been one of their longest-term bird patients.

"The challenge was her feathers didn't want to grow back so we had to wait until she went into moult, which was about two weeks ago."

Upon being released Miss Simpson walked quickly and confidently across the sand to the ocean, "Within minutes of being in the water she was duck diving under and looking for fish."

He said she had required a lot of one-on-one care and food so her rehabilitation had cost about $1500, but she was worth every cent.

Gulls - the Ultimate Survivors

On a recent trip to Europe I noted the paucity of bird life in general. One animal that seems to have survived all the overpopulation and pollution are the larger species of gull.

Large gulls are known to many of us as a pest bird around tips and fish farms. Several species of larger gull, that have learned to profit from our excesses, are steadily growing in numbers. They can survive almost anywhere due to their intelligence and willingness to adapt to any available food source. Local kelp gulls enjoy eating the proliferation of feral mussels growing on the banks of estuaries. They open them by flying up and dropping them onto the rocks. They can catch fish and crabs in shallow water. They will also eat carrion, garbage and anything else too slow to get out of the way. They have even been seen taking chunks of blubber out of the backs of surfacing whales. As a result their range is expanding. It is a similar story for other large gulls in the northern hemisphere, such as herring gulls. In Whitby, Yorkshire the large gulls will enter a house and go through your kitchen if you leave the window open (and they tap on your window at dawn to beg for scraps). On a recent trip to the northern Italian island of Elba I saw them exploiting the desire of tourists for a wildlife encounter. They have learned to glide down to snatch biscuits out of people's hands. Despised by some as a "flying rats", they are nonetheless a marvel of evolution.