PROTECTING MARINE HABITAT

A handbook for Victorian waters

PROTECTING MARINE HABITAT

VICTORIAN NATIONAL PARKS ASSOCIATION

The Victorian National Parks Association (VNPA) helps to shape the agenda for creating and managing national parks, conservation reserves and other important natural areas across land and sea. The VNPA works with all levels of government, the scientific community and the general community to achieve long term, best practice environmental outcomes. The VNPA is also Victoria's largest bushwalking club and provides a range of information, education and activity programs to encourage Victorians to get active for nature.

REEF WATCH

Reef Watch is a Victorian National Parks Association program run in partnership with Museum Victoria. The Reef Watch program was launched in 2002 with the aims of increasing knowledge, awareness and protection of Victoria's marine biodiversity. Marine citizen scientists are provided with monitoring kits to survey their favourite subtidal reefs, contributing both data and images to an online database and the Atlas of Living Australia. Other Reef Watch projects include 'Feral or in Peril', Buddy up with a Blue Devil and the popular annual Great Victorian Fish Count.

PROJECT PARTNERS

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ABOUT THE AUTHORS

The content for each of the habitats within the Protecting Marine Habitat handbook was researched and written by John Ford. John is an independent consultant at Mezo Research with a background in marine and fisheries ecology. John has spent the last six years at Melbourne University researching rocky reef fish in and around Port Phillip Bay. He has conducted almost 500 dives and become expert on the underwater world around Melbourne and the Victorian coastline.

Reef Watch Coordinator Wendy Roberts contributed the text for the introduction, insets and what you can do. Images provided by Museum Victoria, Julian Finn, Mark Norman, John Gaskell, Chris Rowley, Rudie Kuiter, Tim Allen and Bill Boyle.

Front cover image: Magpie Morwong and Seastar at Popes Eye, photo courtesy Andrew Newton.

Back Cover image: Zoanthids at Beware Reef Marine Sanctuary, photo courtesy Julian Finn.

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VICTORIAN NATIONAL PARKS ASSOCIATION
Be part of nature

CARING FOR OUR COUNTRY

Port Phillip & Westernport CMA

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Zebra Fish form schools in estuaries and coastal reefs.

All photos on this page by John Gaskell

Six-spined Leatherjacket in algae.

Juvenile Scalyfin shelters under a rocky reef.

Looking after our unique marine life

Victorians are fortunate to live on the ocean doorstep of an underwater world rich in species diversity.

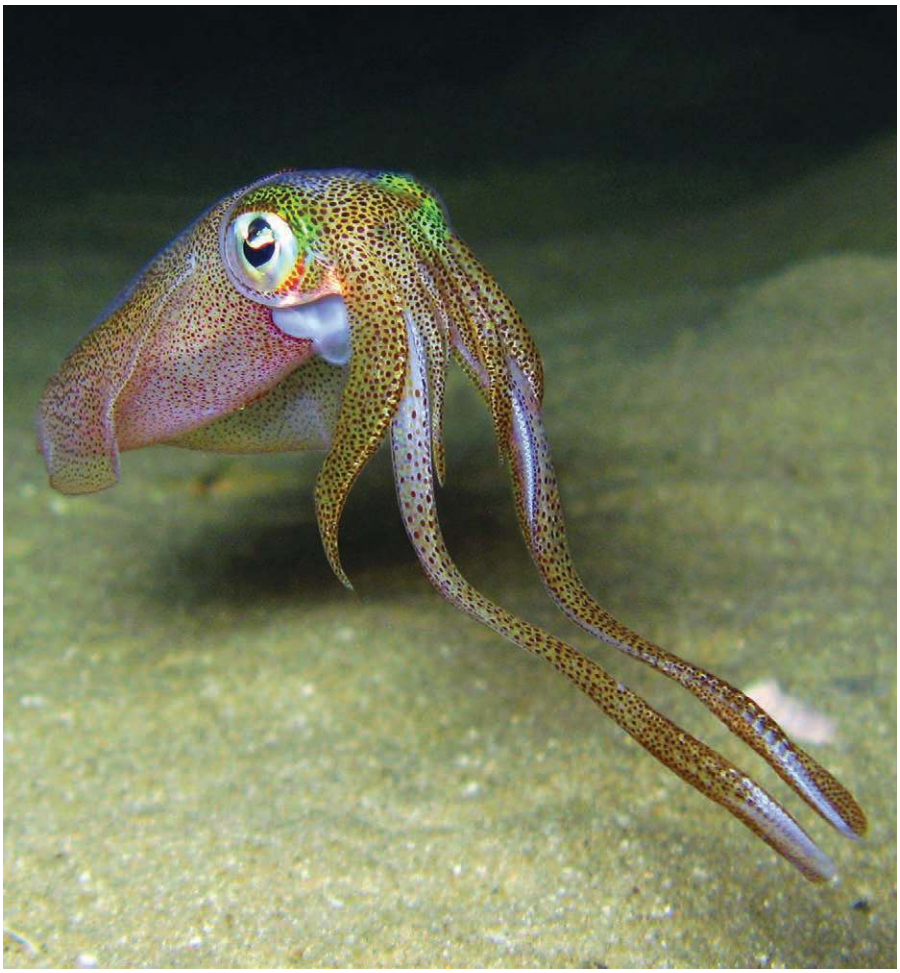
Cool temperate waters combined with a variety of habitats support a high percentage of endemic species not replicated in other areas in the world or in northern waters such as the Great Barrier Reef.

From tiny seastars to majestic Humpback Whales, our waters are home to more than 12,000 known species, and more are being discovered each year.

Seagrass meadows, rocky algal reefs, sponge gardens and mangrove forests are just some of the marine ecosystems that provide habitats for marine life. Needless to say, healthy and diverse habitats support a greater diversity of marine species, so if we want to protect marine biodiversity in Victoria we need to reduce the negative impacts on and threats to our marine habitats.

Many of these threats are from catchment activities, such as pollution, land clearing, dredging, invasive marine species and overfishing. Others are from the global increase in greenhouse gases such as CO_2, and we are now starting to see changes in the distribution of marine species as a result of increasing seawater temperatures.

To help the long-term protection of marine life we need to work towards minimising the threats to marine habitats. This guide is a starting point where you can find out more about the different types of marine habitats, some of the species that live there, the threats to each habitat and how to minimise these threats.



Southern Calamari with feeding tentacles extended. Photo: Evan Coker

There are many ways of being involved in protecting our unique marine life. This guide outlines some examples, such as photographing your local reef, writing to local councillors about the impact of litter or stormwater pollution, holding a beach clean-up day, and even reducing your electricity bill!

We can all 'be part of the change' to help our marine environment to remain diverse and healthy for future generations.

Subtidal Rocky Reefs

Key features

Rocky reefs come in all shapes and sizes, from spectacular underwater walls and bommies to more modest platforms or boulder fields. Their unifying feature is hard substrate – the rock itself – that gives so many plants and animals a surface on which to live.

The walls and bommies can support a dazzling array of colourful encrusting invertebrates and algae, with the overhangs and caves homes for a great diversity of fish and crustaceans.

Rock platforms can be completely covered by large brown algae, often the Common Kelp (*Ecklonia radiata*) in exposed conditions, Bull Kelp (*Durvillaea potatorum*), *Phyllospora comosa* and *Macrocystis angustifolia* in the surging surf zone, and *Sargassum* and *Cystophora* species in the more sheltered bays and inlets.

Victoria is also home to some deep canyon reefs, most notably in Port Phillip Heads, but also in the drowned river canyons off the coast.

Little is known of the deepest areas of these canyons, but remote underwater vehicles have catalogued many species living at depth, most notably sponges and hydroids, which do not need light to survive.

A number of species are common across almost all Victorian rocky reefs and provide a very 'Victorian' feel. These include: the Eleven-armed Seastar (*Coscinasterias muricata*), Common Sea-urchin (*Heliocidaris erythrogramma*) and the Southern Hulafish (*Trachinops caudimaculatus*).

The food web in rocky reefs can be very complex and divers and snorkellers are often in a position to watch predator-prey relationships unfolding before them.

Algae provide foods for territorial herbivorous fish such as the Scalyfin (*Parma victoriae*) and Herring Cale (*Odax cyanomelas*), mussels and barnacles eaten by more transient bottom feeders such as Pink Snapper (*Cyrsophrys auratus*), Morwong (*Chielodactylus species*) and Zebra Fish (*Girella zebra*), while small shoaling plankivorous fish such as the Southern Hulafish are eaten by resident Southern Cuttlefish (*Sepia apama*) and visiting Australian Salmon (*Arripis species*) and Southern Calamari (*Sepioteuthis australis*).

The small cracks and crevices in the rock provide shelter for many animals you may not see, such as Bullseyes (*Pempheris multiradiata*), or even the elusive Rockling (*Genypterus tigerinus*) or dangerous Blue Ring Octopus (*Hapalochlaena maculosa*).

Distribution

Subtidal Rocky Reefs can be found within Port Phillip Bay, Port Phillip Heads, Williamstown, Barwon Heads, Mushroom Reef, Honeysuckle Reef, Crawfish Rock, Point Addis, Point Danger, Wilsons Promontory, Beware Reef, Point Hicks and Cape Howe, Merri Marine Sanctuary.

Rocky reefs support important commercial fisheries such as Southern Rock Lobster. Photo: Julian Finn

You little blue devil you

A fish with attitude is something to behold, but don't be put off by the grumpy face of the Blue Devil.

Their beautiful iridescent blue spots make them a favourite among photographers, but few would be aware that the often solitary fish lives in the same spot for up to 60 years.

We now know that the distinctive spots on their gill cheeks enable them to be individually identified.

There's still much to learn about these fascinating fish and divers can help unravel some of the mysteries about their population size, distribution and life history. So why not 'buddy up with a Blue Devil'?

Blue Devil homes can be affected by catchment activities such as dredging, stormwater pollution and sediment input.

Conservation efforts to monitor and protect populations and the habitats in which they live will benefit both Blue Devils and their neighbours.

Southern Blue Devil fish make rocky reefs their home for up to 60 years. Photo: John Gaskell

Importance to us and the ecosystem

Rocky reefs are biodiversity hotspots, supporting an amazing array of brown, red and green algae, encrusting invertebrates such as sponges, ascidians and bryozoans, crustaceans and molluscs both large and small, and many, many fish species.

In fact, rocky reefs support Victoria's two highest value commercial fisheries – rock lobster and abalone – and are important nursery areas for recreationally targeted fish such as Pink Snapper and Short-fin Pike[1].

Kelp and algal beds are extremely productive, almost on par with seagrass beds, and are valued extremely highly for their ecosystem services and nutrient cycling[2].

Rocky reefs are also a source of wonder for scuba divers and snorkellers, each reef with its unique movement of colour and light, resident fish and cuttlefish providing personality and intrigue.

Threats and vulnerabilities

Rocky reefs are incredibly diverse and productive communities, although they are under threat from human disturbances[3].

In sheltered bays and inlets, pollution in the form of stormwater, sewage and agricultural runoff is changing our reef communities. Sediment smothers juvenile macroalgae, preventing the formation of an algal canopy that provides biological structure on a reef.

Turbid water reduces light reaching algae, stunting their growth and making them less resilient to disturbances. Excess nutrients in runoff promote the growth of faster growing algae such as ulva, which can smother other algae and starve them of light. Dinoflagellate and blue-green algal blooms can starve the water of oxygen and cause mass deaths of fish.

In the face of these threats, rocky reef communities close to cities tend to have less species and fewer stands of kelp beds.

Invasive species are also a major threat to rocky reefs[4], with species such as the Japanese kelp *Undaria pinnatifida*, the fanworm *Sabella spallanzannii* and the ascidian *Ciona intestinalis* outcompeting native species in the more disturbed reefs of Port Phillip.

Physical damage or removal of reefs by coastal development is a more direct threat, and the smothering of reefs by dredging spoil is anecdotally reported in many areas of the bay in past decades. While these latter threats could be considered to be no-brainers and easily avoided, history has told us this is not always the case.

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Soft Bottoms & Sandy Flats

Key features

Soft sediment bottoms are formed by the accumulation of fine particles of sand, mud and silt. The most dominant marine habitat type in Victoria, they include the high-energy sandy beaches with surging surf zones, the flat tranquil mudflats of Westernport, and the giant mud basin that comprises the majority of Port Phillip.

While we may not spend much time diving or snorkelling over them, soft sediment bottoms are an extremely important ecosystem due to their size and diversity. They are often overlooked as habitats of interest, considered nondescript or unexciting, but soft sediments hide many secrets below their surface.

Underneath the top layer of sand or mud are complex warrens of worm-holes, clam caves and burrows for small crustaceans.

Camouflaged under a thin layer of sand, flathead wait for unsuspecting prey, flounder hide from predators above, and rays shuffle slowly around, looking for buried food.

Old scallop, mussel and oyster shells form small anchor points for a variety of invertebrates such as ascidians or occasionally macroalgae like *Cystophora, Sargassum* or the vivid green *Caulerpa*.

Occasionally large areas of drift algae form over soft sediments[1], lasting weeks (such as filamentous algae on mudflats in Corner Inlet) or entire seasons (red algal mats in northern Port Phillip during summer).

Distribution

Soft sediments and sand flats are common in sheltered bays, estuaries and inlets. As well as some large areas of open coast such as Ninety Mile Beach.

Our vanishing sea forests

We're used to hearing about rainforests disappearing in tropical regions, but few people would know that towering algal forests are also vanishing in our own southern waters.

Home to myriads of marine creatures, these 30m high algal communities are declining at an alarming rate (Tasmania has only 5% of original kelp forests remaining).

The Australian Government recently listed them as a protected community under the EPBC Act. Among the reasons for the decline are rises in sea surface temperatures, an increase in foraging herbivores such as the sea urchin *Centrostephanus rodgersii* as a result of the decline of large predator fish, and competition for habitat by the invasive Japanese kelp, *Undaria pinnatifida*.

Giant Kelp at Popes Eye. Photo Mark Norman

Longsnout Flounder is the most common flounder in Port Phillip Bay. Photo: Julian Finn

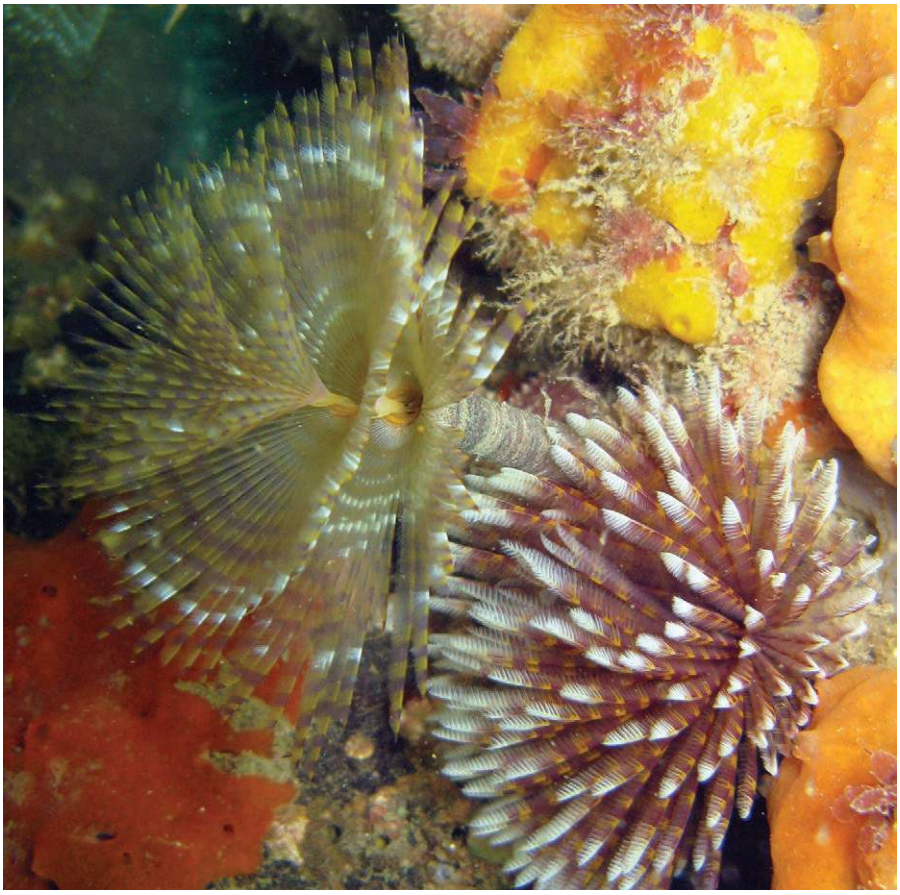
Importance to us and the ecosystem

The most important aspect of soft sediment environments is what we can't see with the naked eye – the microscopic layer of bacteria that grow on the surface of the sand and mud. These bacteria are responsible for locking up much of the nutrients that enter the marine environment, and without them we would expect more harmful algal blooms and dead zones devoid of oxygen and life.

In Port Phillip Bay these bacteria are especially crucial to the cycling of excess nutrients entering the bay through sewage and stormwater[2].

The mussels, oysters, scallops, clams, fanworms and ascidians living in the sediments are also incredibly important in keeping our water clean and healthy. They are all filter-feeders, meaning that they filter out the larger food particles from the water.

This combination of bacteria and filter feeders forms the lungs of our



An introduced fanworm, *Sabella spallanzanii*, invades the space of a smaller, more colourful native fanworm (*Sabellastarte australiensis*). Photo: John Gaskell

A swimmer crab scuttles along the sandy seafloor. Photo: Julian Finn

bays and inlets, so don't forget about them!

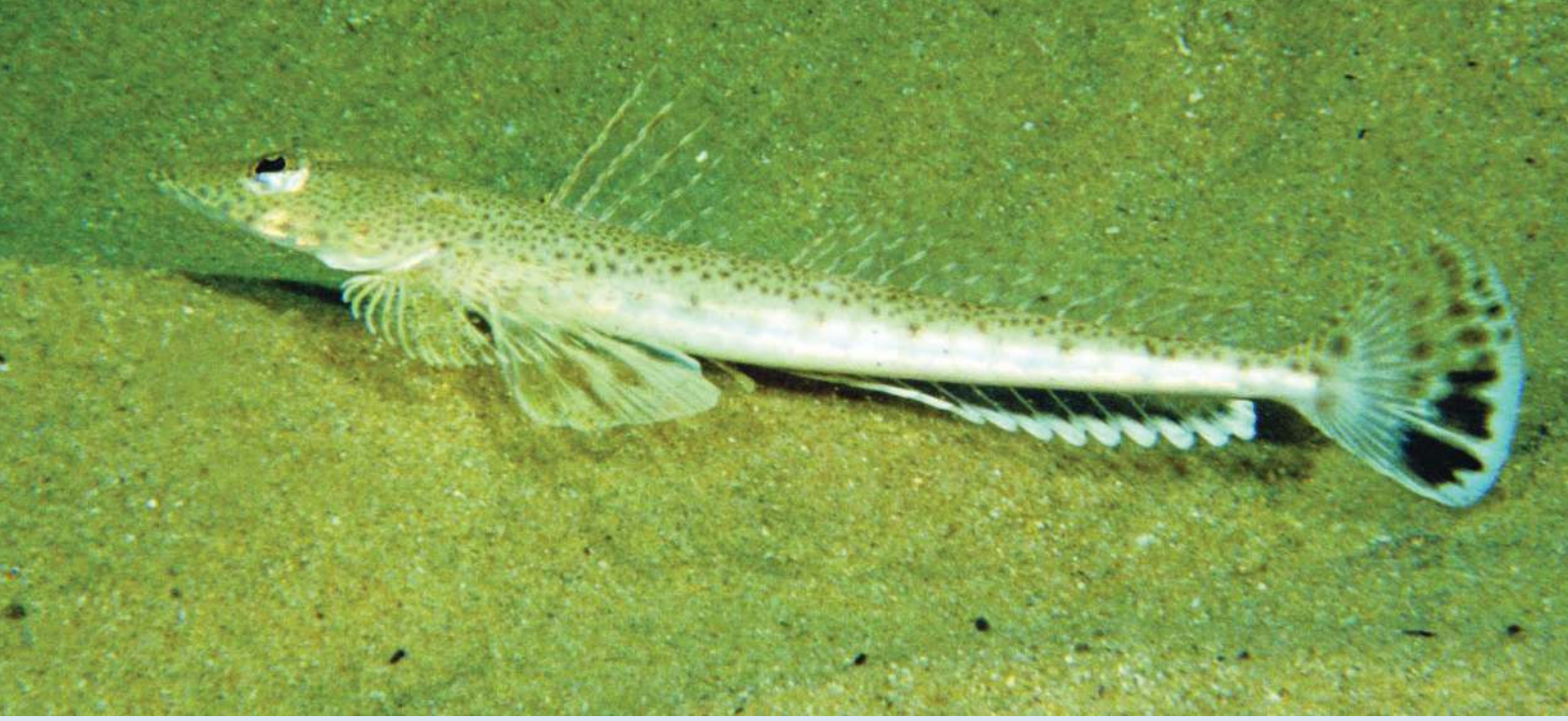
Soft sediments are also a very productive feeding ground for many of our iconic marine species and some of our more valuable commercial finfish. Stingrays, from the small Banjo Ray to the massive Eagle Ray, all feed on the molluscs and worms found just below the surface. Gummy Sharks cruise for a feed, along with big Snapper aggregating to breed.

An ambush predator, the Stargazer waits beneath the sand. Photo: Julian Finn

Threats and vulnerabilities

As they are so large and varied, soft sediment environments tend to be very resilient, although they are often at danger from localised threats. In Port Phillip Bay and other inlets, the greatest threats are those from invasive species, the decline of native filter feeders, in particular mussels and oysters, and an excess of nutrients from sewage and runoff.

The Northern Pacific Seastar *Asterias amurensis* is possibly the greatest threat, although now it is so abundant and widespread in Port Phillip that there is little that can be done to eradicate it. However, preventing its spread to other bays and inlets is an extremely high priority.



Southern Sand Flathead populations in Port Phillip have declined by 90% since 2000. Rudie Kuiter

Flat out trying to survive

Southern Sand Flatheads were once a common catch for recreational fishers, but since the year 2000 scientists have been concerned about their continued decline to around 10% of the original population.

Possible impacts are thought to be from both recreational and commercial fishing, as well as environmental changes in river discharge and long-term climate fluctuations.

Divers are more likely to see females as they are found in shallow waters – juveniles and males live in deeper waters (over 17m) in the Bay.

The fanworm *Sabella spallanzanii* has outcompeted native species on muddy bottoms and on rocky reefs, decreasing biodiversity and changing ecosystem function. Introduced ascidians such as *Styela* and *Ascidiella aspersa* have colonised deeper areas, although these environments are seldom visited and we may never know their real impacts.

The loss of biodiversity in soft sediment environments, whether from competition with invasive species or historical depletion through dredging, reduces the capacity to cycle nutrients and keep Port Phillip Bay clean.

The deeper fine sediment basins receive very little disturbance from waves or currents, making them particularly vulnerable to dredging operations.

Low numbers of mussels, oysters and scallops in Port Phillip are also of concern, and with fewer shellfish it follows that there will be a lack of old shells to provide habitat for other organisms, or even their own young.

Lastly, the stability of the important bacterial communities is fragile and we must be careful not to overload the system with more nutrients than it can handle. This can encourage more harmful anaerobic bacteria, which do not require oxygen, to flourish, and can create dead zones where other organisms cannot live.

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Seagrass Meadows

Key features

Seagrasses are the true flowering plants of the sea, forming large green meadows from the intertidal to depths of about 10m. They grow on mud and sand by anchoring themselves with roots, unlike most of our familiar algae that require a hard surface to attach their holdfast.

We are most familiar with the shallow seagrasses in our bays and inlets that may be fully or partially exposed at low tide.

These seagrasses are of the Zostera and Heterozostera genus and are often referred to as fineleaf seagrass or eelgrass, and in slightly deeper areas we may see Paddleweed (*Halophila* sp.). These seagrasses are quick growers and can colonise new areas very quickly from broken-off fragments that drift to new locations.

However, they are also known for their natural widespread diebacks, evidenced by the large amount of seagrass that washes up on beaches in places like Port Phillip. In more exposed areas such as the south of Port Phillip and the open coast, we find the very different *Amphibolis australis*, which more closely resembles leafy plants from land. Broadleaf Seagrass or Strapweed (*Posidonia australis*) is found in only one place in Victoria – on the shallow sand banks of Corner Inlet. It has a deep root structure and, much like a daffodil bulb, grows strongly through spring and summer before dying back to stubble in winter.

Distribution

West Coast: Portland Bay, Port Campbell Bay, Peterborough

Central Coast: Port Phillip Bay, Swan Bay, Mud Island, Corio Bay, Flinders Pier in Westernport Bay, Newhaven on Phillip Island, off Williamstown Beach, Port Phillip Bay. Kirk Point, Point Wilson, Point Cooke, Jawbone Marine Sanctuary.

East Coast: Corner Inlet.

Importance to us and the ecosystem

Seagrass meadows serve a number of very important ecological roles in our marine environment, and are considered the second most valuable habitat on earth for ecosystem services[1], worth a total of $1.9 trillion globally[2].

Firstly, they provide important structure and shelter for a broad range of other animals and plants, particularly in shallow sandy environments. They are important nursery grounds for juvenile fish and crustaceans, most notable whiting and bream, by providing refuge from larger predators and strong tidal currents.

Secondly, seagrasses are primary producers, just like grasses on land, and are important food sources for creatures such as Garfish and swimmer crabs. Seagrass systems are extremely productive, in some cases rivalling or exceeding productivity of terrestrial farming[3].

Thirdly, the root structure of seagrass holds together sand banks, preventing erosion and reducing water turbidity.

Lastly, seagrass meadows are a massive carbon sink, with carbon uptake rates on average higher than terrestrial systems[4]. They represent an estimated 10-18% of the total carbon burial of the oceans[5].

Threats and vulnerabilities

Seagrasses are one of the most threatened ecosystems on earth, declining at a rate of 110km^2 a year and with an estimated 29% of total cover lost since 1879[2].

Locally, Westernport lost around 70% of its seagrass during the 1970s and declines have been observed in areas

A Spotted Pipefish hides in seagrass, St Leonards. Photo: Julian Finn

of Port Phillip and Corner Inlet over the past few decades.

Seagrasses naturally experience growth and decline associated with changing environmental conditions including drought and flood cycles, algal blooms and long-term climatic change. However, human activities have increased the severity of many natural environmental cycles and seagrass has suffered as a result.

The increase in nutrients and sediment in coastal waterways from human alteration of catchments is the most common and significant cause

What's not to love? A heart-shaped sponge at Flinders. Photo: John Gaskell

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Paddleweed can colonise new areas quickly, offering habitat to a myriad of marine creatures. Photo: Mark Norman

of seagrass decline[3].

Turbid water starves seagrass of light and buries small plants. Excess nutrients cause algal blooms over seagrass meadows, reducing light and oxygen in the water.

Development of the coastline can directly destroy seagrass through the building of seawalls or piers, and dredging activities can either destroy seagrasses directly or increase turbidity and starve them of light.

These are all real and current threats to seagrass systems in Victoria, and more needs to be done to ensure we do not lose such an important ecosystem.

Seadragon heaven

A highlight for any diver, Victoria's marine faunal emblem the Common Seadragon can be found searching for mysid shrimps and other small crustaceans in seagrass meadows and kelp forests along the coast.

In late spring, males brood up to 300 bright pink eggs along their tail. Living for 6 to 10 years, seadragons are known to live within a home range, so any threats to their habitat have an impact on local populations in the area.

Threats to seadragons are both natural and human-induced. As they are weak swimmers, they are often washed up in flotsam by storms. However, pollution, seagrass loss and collection for aquariums are thought to be the main threats.

Seadragons can be seen at Flinders, Portsea, Rye, Queenscliff, Point Addis, Warrnambool, Portland Wilsons Promontory and Gippsland.

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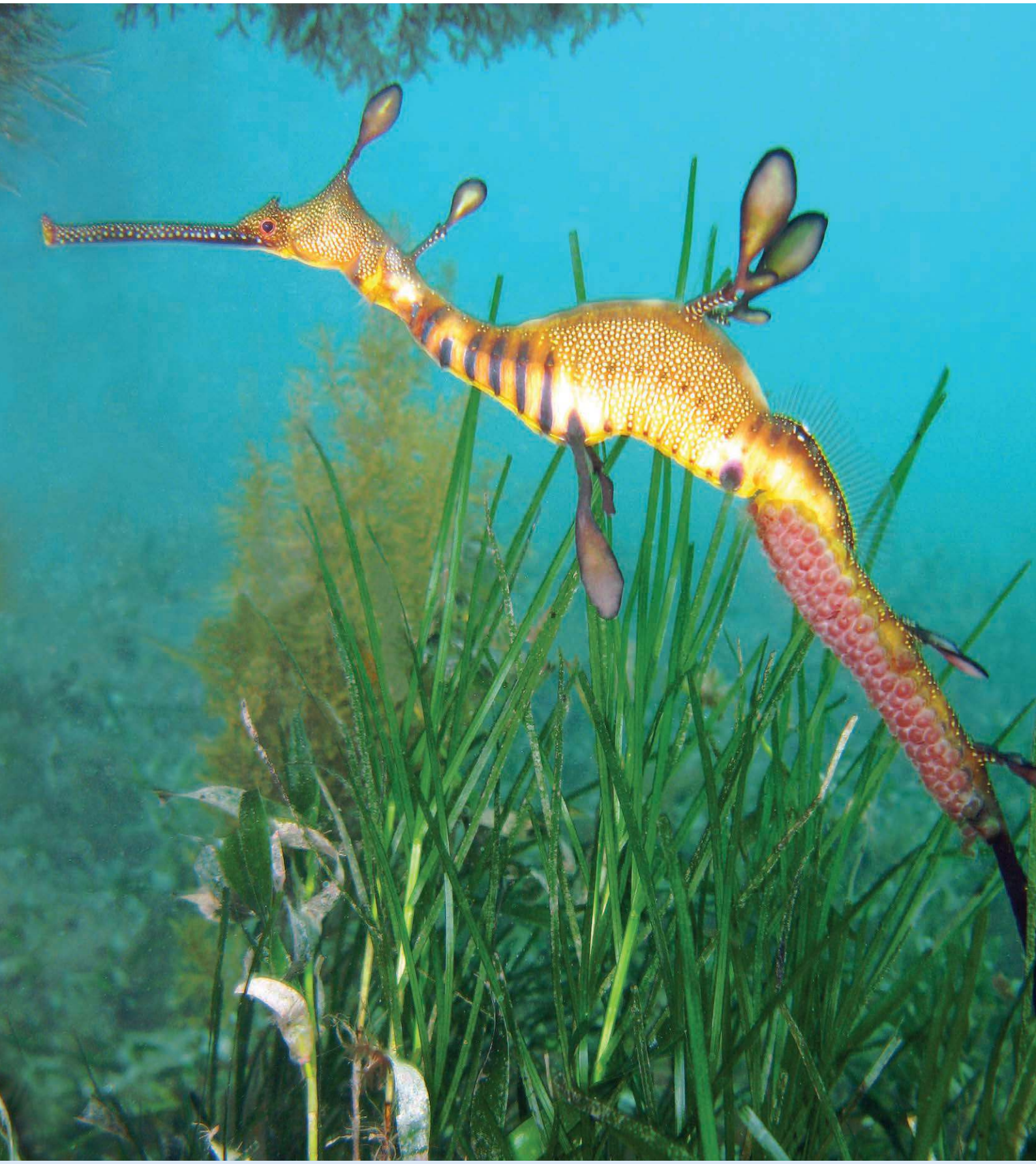

A male Common Seadragon with eggs. Flinders.

Photo: John Gaskell

Rocky Intertidal

Key features

Rocky intertidal areas are probably the most familiar and well-loved of Victoria's marine habitats. We have all at one stage fossicked through the tidepools, overturned rocks looking for crabs and tried to catch those little fish that were always a little too quick.

These rocky shores support an amazingly hardy community of animals and plants in what is an extreme environment – pounding waves, flooded at high tide and exposed to the hot sun in low tide[1]. All the plants and animals are adapted to hold on fast and not dry out in the heat, and have some creative ways of doing so. The familiar limpet (*Cellana tramoserica*) holds on to the rocky surface using the strength of its muscular foot, totally sealing itself away to stop any water loss in the heat.

Shore Crabs (*Paragrapsus quadridentatus*) wedge themselves in out-of-the-way cracks, while the alga Neptune's Necklace (*Hormosira banksii*) holds water in its bead-like structure and grows clumped together to hold moisture – the perfect refuge for many smaller creatures.

Commonly encountered critters include marine snails (*Austrocochlea* sp., *Bembicium* sp.), and if you're lucky there may also be a Waratah Anemone (*Actinia tenebrosa*), which looks like a red jewel tucked into the cracks and walls of rockpools.

Despite appearing docile and resembling a plant, anemones are predators and fire stinging barbs into prey, paralysing them and making them easy to eat. Luckily for us our skin is thick and to us they simply feel a little sticky!

A Waratah Anemone clings to a rocky intertidal reef. Photo: Chris Rowley

Distribution

This habitat occurs mainly on rocky headlands from Portland to Wilsons Promontory, with some minor occurrences in the far east.

Importance to us and the ecosystem

Rocky intertidal shores are very important to us on an individual level, as they may be the only window into the marine world many of us see[2].

In the broader marine environment, species on the rocky intertidal are an important part of the food web for deeper subtidal reefs and open water communities.

The grazers of the rocky shore – limpets and herbivorous snails – keep vast areas clear of seaweed, much as a grounds keeper maintains a well-manicured golf green.

Larger animals such as fish enter the rocky intertidal shore during high tide to feed and shelter from larger predators. Being warm and full of sunlight, rockpools are incredibly productive areas, making them important nursery areas for many fish species.

The diversity and complexity of the rocky intertidal community is breathtaking – barnacles and cunjevoi filter food from the water, crabs and scavenging snails eat detritus and microscopic algae on the rocks, tiny Red Handed Shrimp break down waste in shallow rock pools, predatory snails drill holes in other snails and mussels to get a feed, and millions of tiny crustaceans

Red handed Shrimps are common in rocky intertidal pools. Photo: Julian Finn

resembling tiny prawns (amphipods) keep the seaweed clean by eating the smaller algae that threaten to overgrow it.

Rocky intertidal shores can also be important haul-out areas for seals to relax, and are feeding areas for many seabirds.

Threats and vulnerabilities

Human disturbance such as collection, fossicking, trampling, and littering can be problems for intertidal rocky shores[1,4,5]. Even turning over rocks can lead to the death of sensitive animals that have found a spot to stay comfortable in during low tide – staying moist and out of the heat is a matter of life and death for residents of a rocky shore.

Poking, dislodging or damaging intertidal plants and animals can make them lose moisture and lead to drying out of many sensitive animals, including lace corals and seasquirts.

People and animals walking across intertidal reefs can also trample algae such as Neptune's Necklace or crush the shells of small snails[6], and scare away feeding shorebirds like oyster catchers[7].

Pollution from nearby stormwater can increase nutrient loads, promoting filamentous algal growth, killing off local seaweed and reducing biodiversity.

Not many marine pests have conquered our rocky intertidal shores, although the European Shore Crab (*Carcinus maenas*) is thought to have invaded over 100 years ago and can often be found under rocks, especially in Port Phillip Bay.

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Mangroves & Saltmarsh

Key features

Mangroves and saltmarshes are both intertidal habitats occurring on the fringes of bays and inlets, exposed at low tide and inundated at high tide. They are often found side-by-side – mangroves on the lower edge of the coast closest to the water, saltmarsh immediately adjacent before the line of trees or scrub, often paperbark (Melaleuca spp.)[1].

Saltmarshes do not require mangroves however, and can also exist on the edge of tidal rivers, behind sandy shorelines or rocky fringes.

Mangroves are highly salt tolerant trees that form dense groves on muddy flats in locations such as northern Port Phillip, Westernport and Corner Inlet. Victoria is home to 5177ha of mangroves[1], including the southern-most limit of mangroves worldwide. In Victoria we have only one species, the White Mangrove (*Avicennia marina*). Unlike the tropical mangrove forests of Asia that can grow up to 10m high, White Mangroves in Victoria usually grow to less than 4m due to our cold winters[2].

Mangroves are characterised by their breathing aerial roots, called pneumataphores, which appear as small, round-ended sticks emerging from the mud. Oxygen levels in the mud are often very low and hence the mangrove will breath instead directly from the air through its pneumatophores.

Saltmarsh consists of a range of small salt-tolerant shrubs, grasses and succulents. They often appear to be very swampy environments, but can be quite dry on the upper edges, which may only be inundated on very high tides. Small pools may form and through evaporation may form salt crusts. Indeed, this forms the basis for salt farming that occurs in areas along the Geelong coastline.

Mangroves during high tide, Westernport. Photo: Bill Boyle

There are hundreds of both native and introduced species recorded as living in saltmarsh, with Shrubby Glasswort (*Tecticornia arbuscula*) and Beaded Glasswort (*Sarcocornia quinqueflora*) being most prominent. Victoria has 19,212 ha of saltmarsh spread along the entire coastline, but saltmarsh is particularly prevalent in western Port Phillip, Westernport and the Gippsland coast.

Distribution

Mangroves and saltmarsh can be found at Williamstown, Corio Bay, Barwon Heads, Westernport, French Island, Inverloch, Corner Inlet, Nooramunga Marine and Coastal Park, South Gippsland and Lakes Entrance.

Importance to us and the ecosystem

Mangrove and saltmarsh are extremely productive buffer communities between land and sea. Not only do they prevent erosion of shorelines, but mangrove roots slow water flow, allowing sediment in the water to drop out and improve water clarity.

Saltmarshes provide a similar service, where sediment is deposited with each high tide. Both ecosystems are highly efficient and effective filtering systems and by maintaining good water quality, are crucial for the health of light-dependent ecosystems such as seagrass meadows and kelp beds.

Mangroves and saltmarsh plants provide food for a great array of organisms – worms, molluscs and crustaceans living in the sediment, as well as fish that feed there during high tides. Juveniles of mullet, flathead, whiting, bream and flounder all use these communities as nursery areas, and adults are often found there feeding. Birds and bats use these intertidal areas as roosting and feeding grounds, with birds like the Little Pied Cormorant roosting in mangrove trees, and White-faced Herons feeding in saltmarshes at low tide.

Westernport mangroves and saltmarsh. Photo: Tim Allen

Threats and vulnerabilities

Mangroves and saltmarshes suffer from a poor public perception, often considered as nuisance mud holes or smelly swamps. While this opinion is certainly changing, mangroves are still under threat, and are often seen as being in the way of expensive coastal development opportunities by occupying the premier foreshore location.

It is estimated that up to 20% of Victoria's coastal marsh and wetlands have been lost since the arrival of European settlers[3]. Regionally the loss is quite variable, with areas such as Port Phillip losing 50% (mainly saltmarsh), Koo Wee Rup Swamp losing 40% (saltmarsh), Anderson Inlet losing 60% (both saltmarsh and mangrove) and Corner Inlet losing 55% (mainly saltmarsh).

Most of these declines are a result of draining wetland areas for farmland (particularly along the Gippsland coast) and erecting seawalls or weirs to prevent tidal movement. There were also many areas where mangroves were directly removed for development in places like Westernport, and for salt and sewerage pond development in western Port Phillip.

Although draining of saltmarsh and clearing of mangroves occurs much less frequently today, there are still many threats to these communities.

Mangroves are still under threat from residential coastal development and from residents clearing them to create views.

Saltmarshes are under threat from reclamation by industrial or parkland developments, and are often the sites of illegal rubbish dumping due to their perception as being 'wasteland'.

Exposure of acidic soils during reclamation and development can also have wide reaching toxic effects on plants and animals both within and outside of the system.

The grazing of cattle strips saltmarsh plants and mangrove leaves, and also compacts the soil, destroying delicate root structures and the many animals living in the mud. This is equally a concern for human foot traffic and off-road vehicle use.

Water pollution, especially oil spills, are a widespread threat, and even too much freshwater can kill off mangroves.

Invasive species such as spartina grasses can dominate coastal marshes, reducing biodiversity and trapping excessive amounts of sediment.

Lastly, mangroves and saltmarshes will be highly susceptible to any changes in sea level associated with a warming climate. As intertidal communities, they will need to migrate to higher areas when sea levels rise. Although in many cases this migration will be blocked by farmland, seawalls and other barriers.

1. Harty et al 2011. Mangroves of Victoria Information Kit. Seasearch and Parks Victoria.
2. Boon et al 2011. Mangroves and Coastal Saltmarsh of Victoria: distribution, conditions and threats. Institute for Sustainability and Innovation, Victoria University.
3. Sinclair and Boon 2012. Changes in the area of coastal marsh in Victoria since the mid 19th century. Cunninghamia 12:2 pp.153-176.

A System Under Pressure

1. Nutrients and sediments from land

Although often not obvious, excess sediment and nutrients flowing into our marine environments represent the major threat to Victoria's marine habitats. Sediment smothers plants and animals and reduces the available light to algae and seagrasses. Nutrients promote the growth of filamentous algae that smother and shade, and also of toxic dinoflagellate and blue-green algal blooms, and give the edge to some invasive species that outcompete natives.

The threat is greatest close to the coast and near rivers, streams and stormwater with human habitation or intensive farming. Our coastal bays and inlets, and especially the 'big four' – Port Phillip, Westernport, Corner Inlet and Gippsland Lakes – are all significantly threatened by nutrient and sediment runoff.

2. Invasive species

Most of Victoria's marine habitats are lucky to have experienced very few introductions of invasive or pest species. Port Phillip, on the other hand, is one of the most invaded marine systems in the world. Many native species have been out-competed for space, light or food, and are associated with lower biodiversity.

Invasive species often thrive because they are better adapted to the environment than native species, and this has generally occurred due to the degradation of the natural state to one that better suits invasives. Open coast marine habitats are therefore at much lower risk because of their largely unaltered state, but we can't be complacent – other bays and inlets are easy targets for future spreads.

3. Coastal foreshore development

The removal or destruction of habitat for development is the most basic and direct threat to our marine habitats.

Development around our foreshores is still a reality, particularly in less well regarded habitats such as saltmarsh and mangrove. We are only now realising the cost of historical reclamation of saltmarsh for building development or farmland, as the marine system loses an important water quality filter and nursery habitat.

Rocky reefs and seagrass are still under threat from marina, breakwall and jetty developments proposed in the coastal zone and often located for human convenience rather than environmental sensitivity.

4. Dredging

Dredging significantly disturbs marine habitats, whether it's for channel and port deepening or for fishing activities. Large-scale dredging releases plumes of sediment that can settle on habitats, smothering plants and animals and reducing light for algae and seagrass.

The immediate effects of dredging are catastrophic for anything living in the material – it is unlikely that anything dredged up and moved will survive the battering. The dumping of dredge material smothers the existing community, whether rocky reef, seagrass or the soft sediment community of worms, clams, mussels and scallops. Surface dredging for commercial fishing is a lower impact but often more frequent disturbance, shifting communities in favour of organisms that prefer finer sediments, more disturbance and often lower light levels.

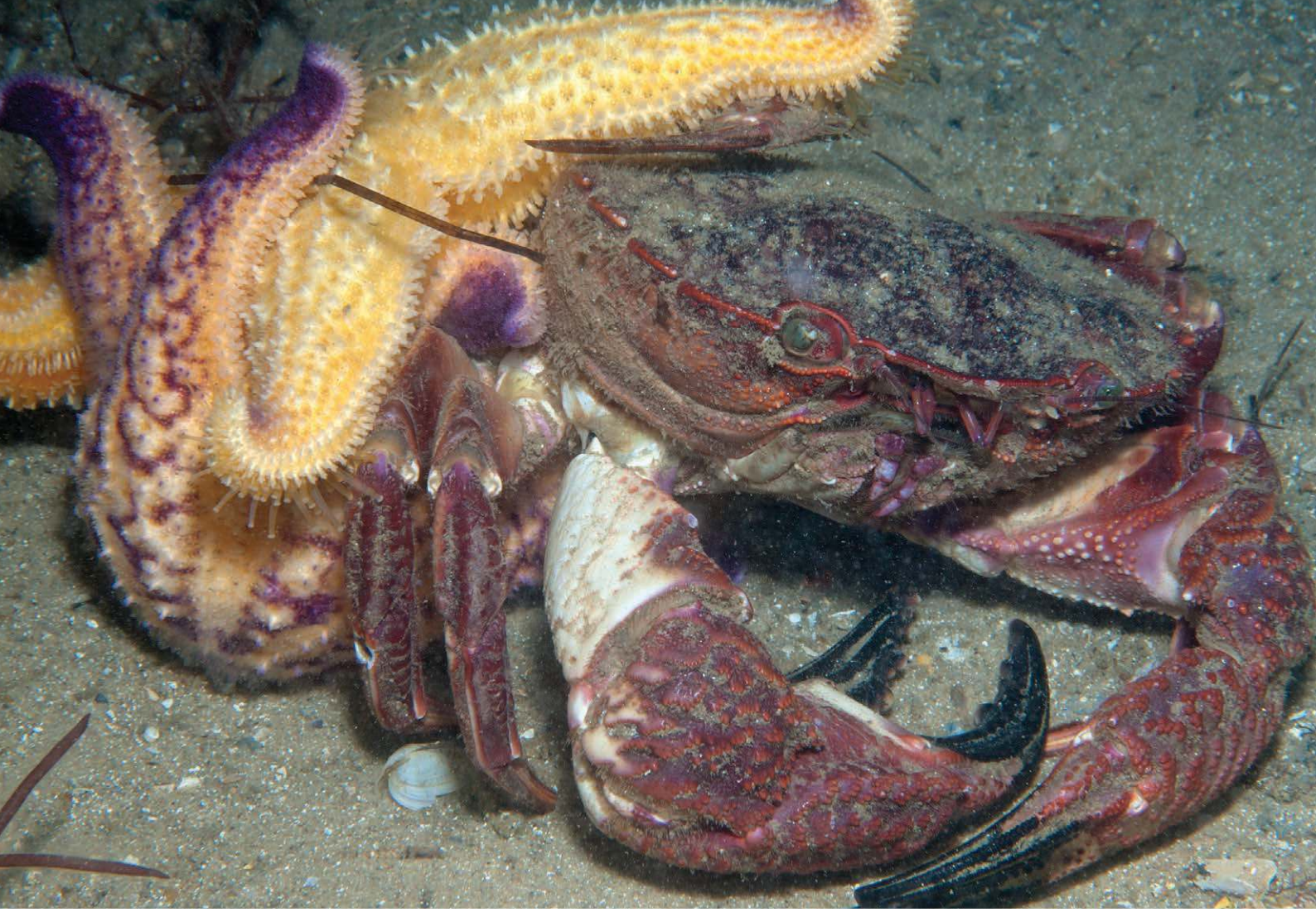
5. Trampling by humans, animals and vehicles

Trampling is probably the most overlooked of all threats, often because we feel that the impact of a single person or animal is insignificant. However, the cumulative impacts of thousands of people trampling on a rocky platform during summer, or cattle grazing in saltmarsh every week, can be quite destructive. Plants and animals are physically crushed by the weight, broken off or inundated if the ground is compacted underneath them.

Unfortunately degradation through trampling can create a downward spiral where the more trampling damage there is in a habitat, the lower it is valued and the more our concern over trampling is reduced. This is very apparent in saltmarsh systems, which in any case are often considered wasteland and used for rubbish dumping and off-roading.

6. Climate change

It is very difficult to predict the effects of climate change on our marine communities, but they are likely to be widespread and serious.



An invasive Northern Pacific Seastar attacks a Rough Rock Crab. Photo: Julian Finn

Major threats	Mangroves & Saltmarsh	Rocky Reefs	Seagrass	Soft Sediments	Rocky Intertidal
Nutrients and sediments from land	×	×	×	×	
Invasive species	×	×		×	
Coastal foreshore development	×		×		×
Dredging		×	×	×	
Trampling (humans, animals and vehicles)	×				×
Climate change	×	×	×	×	×

Like ecosystems on land, marine ecosystems will need to migrate to more suitable climates and conditions as temperatures and sea levels rise. However, with intertidal communities like saltmarsh and mangroves there may be barriers to their migration shorewards such as seawalls, or even a road or cafe!

Seagrasses may be affected by higher water temperatures and greater exposure to the sun, and will also need to migrate to appropriate depths. Changing rainfall patterns may affect the sediment and nutrient inputs to coastal waters, although in some cases drought conditions may be beneficial to marine habitats.

Associated ocean acidification is likely to affect many shell-forming organisms such as molluscs and crustaceans, potentially significantly affecting soft sediment communities, intertidal rocky shores, and the productivity of open water diatoms, an important food source at the bottom of the food chain.

What You Can Do

The diver on the opposite page was photographed while taking part in the Great Victorian Fish Count. Along with her dive buddies, she volunteered to survey 25 selected fish species in what has become an annual census of Victoria's temperate reef fish.

Through her efforts she has contributed to building our understanding of the types and numbers of species to be found at different reef sites each year. This is just one of the many ways the community can contribute to increasing our knowledge and awareness of Victoria's marine species and habitats.

Out of the water there are other ways you can be 'part of the change' to protect our marine habitats and species, you don't even have to leave home.

Just by being mindful of stopping the soapy suds from your car wash making it into our drainage system, or fertilisers from your garden reaching stormwater drains you are playing an important part in decreasing the nutrients and pollutants reaching our reefs.

Leaving your car at home or trying to reduce your energy use will also play a part in decreasing greenhouse gas production and the harmful impacts associated with climate change.

If you love being out on top of the water, then there is a lot you can do to limit the spread of invasive species.

Following the Department of Environment and Primary Industries' easy steps when washing your boat and gear, removing all animal and plant matter from the anchor and desposing of it safely. This will reduce the chances of you translocating a marine pest to another area or bay.

Check out the Reef Watch 'Feral or in Peril' program to learn how to identify marine pests that have made Port Phillip Bay home. Oh, and with that boat anchor, be sure not to drag it over reefs or through fragile seagrass meadows!

If your hobby is photography, then why not add your images of the species you see on your dives to a national database that can be used by everyone, including scientists and marine and coastal managers. Yes, you too can be a citizen scientist just by uploading an image with a date and a location to Bowerbird (www.bowerbird.org.au), the social science website of the Atlas of Living Australia. Reef Watch has started three projects with more to come. You can even start your own!

There are countless ways you can be actively involved in protecting our marine life.

Join a local Friends group of a marine protected area or take part in a clean-up day at your local beach.

Share your underwater discoveries with others, such as at your child's school, or write an article for your local newspaper.

If you are really concerned about an issue that is affecting a habitat, species or your local reef, then write a letter to your local councillor or politician. Let them know you think it's important to protect Victoria's marine life.

The VNPA is leading the way in making sure there is a healthy marine environment for future generations, both through the Reef Watch program and our marine and coastal campaign work. To find out more, get involved, become a member or donate, visit www.vnpa.org.au.

Right: A diver takes part in the Great Victorian Fish Count.
Photo: courtesy Jane Bowman


OCEANIC
TITAN
Sonar
Wrasses
Blue-headed Wrasse (10cm)
Blue-spotted
Spotted Wrasse (15cm)
Rock Cod
Hermit Fish (15cm)
Southgoons
Moonlight
Bar Moonlight (60cm)
Banded Moonlight (70cm)
Trumpeter
Mangrove Black Trumpeter (60cm)
Bastard Trumpeter (80cm)
Herring/whiting
Long-finned Bastard (100cm)
Old wife (35cm)
Sea Sweep (60cm)
Sweeps
Leatherjacks
Black Jacks
Sea Leatherjacket (60cm)
Sea Sweep (60cm)
Sea Leatherjacket (70cm)
Wrasses
Western Blue Wrasse (10cm)
Eastern Blue Wrasse (10cm)
Blue-spotted
Spotted Wrasse (15cm)
Rock Cod
Hermit Fish (15cm)
Southgoons
Moonlight
Bar Moonlight (60cm)
Banded Moonlight (70cm)
Trumpeter
Mangrove Black Trumpeter (60cm)
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