



# 'Victoria's Biodiversity – Our Living Wealth'

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## Contents

<b>Foreword</b>	2
<b>Introduction</b>	3
<b>The Past</b>	4
<b>The Future</b>	5
<b>Natural Ecosystems</b>	
The Alps	6
Grasslands	8
Heathlands	10
The Mallee	12
Dry Forests and Woodlands	14
Wet Forests and Rainforests	16
Inland Waters and Wetlands	18
The Coast	20
Intertidal Rocky Shores	22
Subtidal Rocky Reefs	24
Seagrass Beds	26
Beaches and Soft Substrates	28
Pelagic	30
<b>Human-created Ecosystems</b>	
Living Areas	32
Agricultural Areas	34

## Foreword

Biodiversity conservation is a vital component of the Victorian Government's long-term strategy for improving the quality of life for all Victorians. 'Biodiversity' is a relatively new word, but in essence it means the natural diversity of all life: the sum of all our native species of flora and fauna, the genetic variation within them, their habitats, and the ecosystems of which they are an integral part.

It is this biological heritage that Victoria's *Flora and Fauna Guarantee Act* seeks to maintain and enhance, because it is essential for our economic, cultural, social and spiritual well-being. Whether we live in metropolitan areas, regional towns or rural areas, our biodiversity assets and their conservation and management are a critically important element in our quality of life.

*Victoria's Biodiversity – Our Living Wealth* is the first of three documents that together form the Victorian Government's strategy for conserving biodiversity in this State.

The second document in the series, *Victoria's Biodiversity - Sustaining our Living Wealth*, describes the legal, economic and social parameters which determine how biodiversity conservation will be implemented.

The third part of the biodiversity strategy, *Victoria's Biodiversity – Directions in Management*, provides details of the biodiversity in each of Victoria's bioregions, and outlines the management responses required to protect, enhance and restore them.

*Victoria's Biodiversity – Our Living Wealth*, and the strategy as a whole, will encourage Victorians to better understand and appreciate our rich and diverse biological heritage, and to take an active part in its conservation.

Jeff Kennett  
Premier

Marie Tehan  
Minister for Conservation  
and Land Management

## Introduction

Australians are the custodians of some of the most diverse ecosystems on the planet. Our continent is one of the world's 12 biologically 'megadiverse' regions, with a high proportion of endemic species — those that are found nowhere else in the world. For example, 93% of our marsupial species and 88% of our native rodents are endemic. Victoria's land area supports a wider range of broad ecosystems than any area of a similar size in Australia: alpine, mallee, grasslands and grassy woodlands, forests, heathlands and heathy woodlands, inland waters and estuaries, and coasts. These ecosystems have evolved over many thousands of years as a result of the effects of variations in geology, geomorphology, rainfall and climate on the flora and fauna present in 'Australia' when ancient Gondwana separated into the modern continental land masses. The uplifting of the southern highlands around 3 million years ago and the subsequent long period of erosion, stream-building and deposition, provided the conditions for the development of the diversity of terrestrial ecosystems now present in Victoria.

Victoria's marine ecosystems occupy the shallow margins of the northern edge of Bass Strait. At its limit (three nautical miles offshore) the water depth varies from 30 m to just over 100 m. Many of the features of the current coastline and sea floor reflect the cumulative effects of processes that began with the breaking up of Gondwanaland 50 million years ago, especially changes in sea level over the last 100,000 years. The 30 or more bays, inlets and estuaries along the coast were formed by the inundation of coastal river valleys after the end of the last Ice Age. The western Victorian coast bears the full brunt of the southern ocean storms and experiences some of the highest wave energy in the world. The eastern coast is sheltered from these storms by Tasmania and the shallow waters and islands of Bass Strait, and receives some of the warmer currents that flow south along the eastern Australian sea board. Victoria's natural ecosystems support at least 3140 native species of vascular plants, 900 lichens, 750 mosses and liverworts, 111 mammals, 447 birds, 46 freshwater and 600 marine fish, 133 reptiles, 33 amphibians, and an untold number of invertebrates, fungi and algae. This richness — in the number of different ecosystems and different species, and the genetic variety they exhibit — is what we call biodiversity. It is a scientific, cultural, spiritual and economic inheritance that is distinctly Victorian, and one that we must conserve and manage for future generations.

## The Past

The arrival of people on the Australian continent across the northern land bridges from Asia tens of thousands of years ago heralded the beginning of human-induced changes in the Australian landscape. The arrival of Europeans in the 18th century and the consequent urban development, extensive clearing for agriculture, and forestry, brought vast and sometimes adverse changes to the continent, but it took nearly 200 years to appreciate fully the extent of the change. As the perspective of the new Australians developed, the knowledge and sense of value and place increased the appreciation of our continent's unique biodiversity.

In Victoria, this changing perspective has been at the heart of important government and community initiatives. The establishment of the Land Conservation Council in 1972 enabled the systematic development of a comprehensive, integrated land-use system, including a parks and reserves network that today covers 16% of Victoria's land area. And community-based conservation programs such as Landcare, Land for Wildlife and Botanic Guardians have succeeded in arresting much land degradation and protecting threatened species and their habitat through local community action.

The *Wildlife Act*, enacted in 1975, recognised the importance of protecting native wildlife and controlling exotic species. But the establishment of the Flora and Fauna Guarantee in 1988, with its legislative base, went further: it marked not only the formal recognition of the importance of protecting native species, but also the need to protect entire communities and manage processes that could threaten their survival. By 1997, twenty communities and over 350 species had been given special protection, and 22 processes had been declared to be potentially threatening.

## The Future

Victorians are already doing much to tackle the risks to biodiversity conservation in the state, but much remains to be done before we can truly say that we are caring for our environment. Despite our recognition of past failures, many species and communities are still in severe danger of extinction, and many processes continue to put species and communities at risk. Land degradation continues to be a major problem, especially in our rural areas.

The protection of streams and their catchments has been recognised as being of critical importance for the protection of water quality and the maintenance of our aquatic plants and animals. Biodiversity conservation is a key component of the integrated approach to natural resource management introduced by the *Catchment and Land Protection Act 1994* and the *Coastal Management Act 1995*. This management system will be overseen by bodies representing the community, business and government.

Research also continues to be of great importance in gaining a better understanding of our ecosystems. For example, in most of Victoria's terrestrial ecosystems, little is known of the distribution and ecology of invertebrates and non-vascular plants, although both clearly play important roles in the recycling of nutrients, and as prey or food for vertebrate animals. Our knowledge and understanding of aquatic ecosystems is also rudimentary, and we need to know much more about the processes that threaten them.

This booklet is the beginning of the path to the future. It sets the stage for Victoria's Biodiversity Strategy by describing the broad ecosystems of the State through their geology, flora and fauna, and natural history, and briefly touches on the major risks to the communities and species within those ecosystems.

Understanding this magnificent natural heritage and learning the lessons of the past are the first steps towards ensuring that native plants and animals retain their full potential for evolutionary development in the wild, so that the future of our rich biodiversity is guaranteed.

The community — every one of us — has the opportunity to take an active role in the conservation of our rich natural heritage. Its future is in our hands.

## Natural Ecosystems

### The Alps

A mere 0.5% of mainland Australia is truly alpine. This region, above 1500 metres altitude, is one of the lowest alpine regions of the world. The Victorian Alps cover 500,000 ha in the east and north-east of the state, extending from the isolated plateaus of Lake Mountain and Baw Baw to the vast plains around the headwaters of the Murray River.

Formed during the Palaeozoic Age around 500 million years ago, the granite and sandstone peaks have been sculpted by glaciers and eroded by rainfall and snowmelt to form rounded mountain tops and plateaus. The gentle slopes are clothed in grasslands, herbfields, heathlands, woodlands and sphagnum bogs, each adapted to a particular combination of topography, soils and micro-climate. The highest regions of the alpine country support a rich mosaic of heathland, grassland and alpine bog communities, each adapted to particular combinations of topography, soils, water availability and microclimate. At slightly lower altitudes these 'treeless islands' give way to subalpine snow gum woodlands of White Sallee and Black Sallee. Climatic conditions are harsh, and the area is typically snow-covered for more than four months of the year. In spring and summer, nature explodes into the short growing season. Many species, such as the Flame Robin, migrate to the alps to exploit the abundant food resources, while millions of Bogong Moths complete one of the longest insect migrations in the world, to spend the summer in the cool of the alps. These become meals on wings to a wide variety of animals and link the ecology of the alps to areas hundreds of kilometres away.

Alpine plants and animals have evolved to cope with the extremes of their environment — low temperatures, high winds, snow cover for long periods, and seasonal inundation. As a result, many species and ecological communities are found only in the alpine area. They include several species at risk of extinction, such as the Baw Baw Frog, Alpine Water Skink, Mountain Pygmy-possum, Stirling Stonefly, Cushion Caraway and Small Star Plantain.

Today the Victorian Alps remain largely intact, with the majority of the area set aside as National Park. The uses need to be carefully managed so that alpine vegetation (particularly herbfields, sphagnum bogs and streams) are not damaged and fauna are not placed at risk.

As with much of Victoria, environmental weeds and pest animals pose a risk to the natural alpine environment. Climate change through global warming is a potential long-term risk to the flora and fauna of the alpine environment.

### Grasslands

When the first Europeans arrived in western Victoria, the undulating plains supported grasslands. Other extensive grasslands occurred on the plains between the Murray Valley and the Great Divide (the Northern Plains) and in Gippsland. Where soils were deeper and more friable, or where burning had not been so frequent or severe, open grasslands gave way to grassy woodlands of River Red Gums, Yellow Gums, she-oaks, bulokes and acacias. Aborigines used fire to maintain the open nature of the grasslands, and to stimulate the growth of useful plants and attract animals for hunting.

The grasslands lie over generally heavy clays which become waterlogged in winter but dry and crack in summer. In Gippsland and the Northern Plains they also lie over alluvial deposits. They are floristically rich, not only in grasses such as Kangaroo Grass (which is dominant south of the Divide) or wallaby-grasses and spear-grasses (abundant north of the Divide) but also in the colourful orchid, daisy, pea and lily families. In winter many grasslands form ephemeral flooded native meadows, silently waiting spring, when they burst into colour and ring with the voices of frogs and birds. A suite of rare animals, including the

## Natural Ecosystems

Bush Stone-curlew, Eastern Barred Bandicoot and Striped Legless Lizard, are adapted to life in these changeable environments.

Many grassland plants are adapted to frequent, low-intensity fire and grazing by native animals, and to wet winters and dry summers.

The rapid drying of the soil may help to explain the flush of spring and early summer flowering. The ability to withstand dry summers makes native grasslands and grassy woodlands on private land potentially beneficial in whole-farm management, as they are likely offer a more reliable source of feed during dry years than can introduced pasture species. Many native grasses may be suitable for seed production and pasture reinforcement. The biodiversity of native grasslands is therefore likely to be an important asset for agriculture in the future.

European settlers found that the expansive grasslands provided good grazing and were easy to convert to cropping and improved pasture. And because these grasslands carried almost no timber and had little or no value for gravel or water supplies, few areas were reserved. Today less than 1% of these magnificent grasslands remain, in small patchy remnants, and many are so small that their long-term viability is doubtful. Some of the larger remnants are on private land, especially where ploughing, fertilising, and sowing of exotic pasture plants have not occurred.

The major challenges in managing grassland remnants include weed invasion, subdivision and clearance, increased nutrient levels, lack of fire, accidental damage from vehicles, and sheep and cattle droving. Larger remnants, which are particularly important for animal populations, are at risk from subdivision and clearing, and from changes in agricultural practices, particularly pasture improvement.

## Heathlands

Heathlands are widespread in Victoria, particularly near the coast and in the south-west. The characteristic appearance of this ecosystem — dense, low shrubs with scattered, twisted trees — is a function of the harshness of the environment where it occurs. The soils are usually acidic siliceous sands of low fertility, although some heathlands also occur on limestone, peats and clays. Nutrients in the soil are typically scarce, or are unavailable to plants because of soil acidity or waterlogging. Wide seasonal variations in soil moisture are also typical of heathland sites.

Heathlands tend to occur where drainage is poor, so their distribution is often locally patchy. This may be seen to good effect in the Carlisle Heathlands, north of the Otway Ranges, where closed heathlands on impoverished sandy soils derived from Tertiary sediments are interspersed with woodlands and forests which clothe the deeply dissected hills. This mosaic occurrence often makes the boundary between heathlands and heathy woodlands unclear, and the two often merge.

Fire is a fundamental environmental factor in Victorian heathlands. Some species resprout after fire; others, such as hakeas and banksias, are usually killed, but their woody fruits open shortly afterwards to release their seeds. Some species, including grass-trees and orchids, respond to fire with a flush of flowering, and some species of fauna, such as the Ground Parrot, rely on regular fires to maintain optimum habitat for foraging and breeding. Victoria's heathlands are dominated by tough, hard-leaved plants, especially those in the families Epacridaceae, Proteaceae, Papilionaceae and Myrtaceae. Others include terrestrial orchids, many of which are rare or threatened in the State. In general, weeds are not abundant because of the low nutrient levels in the soils, but some coastal and near-coastal heathlands are susceptible to invasion by shrubs and small trees.

## Natural Ecosystems

The native fauna includes many small marsupials (dunnarts, bandicoots and potoroos) and some of Victoria's native placental mammals, such as the Swamp Rat and New Holland Mouse.

More than 80 species of birds inhabit this ecosystem, including the rare Ground Parrot, the Rufous Bristlebird and the Eastern Bristlebird. The dawn chorus produced by these birds is a feature of heathlands, as the many colourful honeyeaters dart between blossoms in their territories.

Victoria's heathlands are relatively well conserved, with significant areas reserved within national parks and state parks such as the Little Desert, Grampians, Lower Glenelg, Port Campbell, Angahook–Lorne, Wilsons Promontory, French Island, Bunyip, Moondarra and Croajingolong.

The major challenges in heathlands management are the establishment of ecologically sound fire regimes, the control of environmental weeds such as Coast Tea-tree and Coast Wattle, the management of elevated nutrient levels, and the control of plant diseases.

## The Mallee

On the highway west of Nhill the road passes through a red sandstone cutting, one of few rocky features in a wide undulating landscape. This ridge is a reminder that some 4 million years ago this was the shoreline of a vast inland sea, much like the South Australian Coorong of today. This sea once reached as far north as Broken Hill, and as it retreated it left a legacy of salt and shifting sands that characterise the Mallee. Following this period of marine influence, extensive freshwater sediments were laid down in huge lakes, the result of the natural damming of the ancestral Murray River drainage system. For the last 700,000 years there has been a succession of arid and wetter phases. The arid phases were far more arid than the present climate, and the sandy surface was readily moved and shaped by winds.

The blanket of sandy soil which typifies the Mallee has created a gentle topography and superficially simple landscape, with subtle vegetation changes. Dunes are covered in a low mallee scrub: dwarf, multi-stemmed eucalypts which are long-lived and hardy opportunists, overcoming wildfire by resprouting from large underground lignotubers. The deeper sands are dominated by heathlands of Desert Banksia, Scrub-pine and Desert She-oke. In the more saline, older dune systems, low succulent saltbushes grow under the mallee. Where the saline groundwater intersects the surface, permanent saltpans are dotted between plains of spear-grasses and low rises of Slender Cypress-pine woodland.

Although the low rainfall and poor fertility of the sandy soils lead to some parts of the Mallee being called 'deserts', the flora and fauna are surprisingly diverse. There are many species of reptiles and a distinctive range of birds, the best known being the Malleefowl, which constructs huge mounds of sand and litter to incubate its eggs.

Parrots are also prominent, including the colourful Mallee Ringneck, Pink Cockatoo and Regent Parrot. In the understorey, diverse wattles and daisies grow amongst the widespread Porcupine Grass and low, heathy shrubs.

The more fertile areas were selectively cleared, but it is not certain whether this clearing was the main cause of the extinction of at least 12 species of mammals in the area in recent times. Remnants of native vegetation continue to be at risk from the effects of fragmentation, including environmental weed invasion, predation and competition from feral animals, and the effects of increasing salinity. Fire also presents a risk if it is managed inappropriately.

## Natural Ecosystems

Large and significant natural areas on less fertile sands remain in the Big Desert and Sunset Country and have been set aside in conservation reserves. However, some of these areas were once extensive pastoral leases, and the recovery of perennial vegetation (particularly in woodland habitats) from the impacts of grazing and the continuing effects of rabbits, feral goats and kangaroos remains a challenge.

### Dry Forests and Woodlands

The formation of the Great Divide about 3 million years ago created a barrier to the moisture-laden winds that sweep across Victoria from the Southern Ocean. Rainfall is greatest on the southern slopes of the Divide and other mountainous regions, leaving the northern slopes, foothills, coasts and plains relatively dry. In this drier country, a variety of eucalypts, cypress-pines and casuarinas form open forests and woodlands, with grassy, heathy, sedge-rich or herb-rich understoreys. Stringybark forests dominate the near-coastal landscape east of Western Port; red gum forests survive along major rivers in the north of the State; grassy woodlands are scattered throughout the Western District; and the remnants of the once great box–ironbark forests lie in a wide arc from west of Stawell to east of Wangaratta.

Much of Victoria's dry forests and woodlands are significantly diminished compared to pre-European times. The more fertile areas were cleared for agriculture in the 19th and early 20th centuries, and large tracts were laid bare during the 19th century gold rushes, when timber was in huge demand for mines, railways and townships. Many of the grassy coastal forests were also cleared for agriculture, and more recently for urban and recreation development. The remnants of these once-extensive forests and woodlands form a mosaic of natural vegetation in a vastly altered landscape, following patterns of soils, geology and landform. Dry forest and woodlands are no less rich or biologically significant than their wetter relatives. The box–ironbark forests, for example, support a wide variety of plants and animals, including some of the State's rarest orchids, as well as significant mammals such as the Brush-tailed Phascogale and Squirrel Glider and a range of reptiles. Old and dead trees are essential habitat for a large suite of fauna in dry forests and woodlands, because they provide prolific hollows and nectar, thick bark and fallen limbs. Many birds depend on nectar for food, travelling large distances to feed in trees and shrubs at peak flowering times. For example, the Swift Parrot migrates from Tasmania in winter just to feed on flowering eucalypts in this ecosystem. Many species, such as the Grey-crowned Babbler, Brush-tailed Phascogale and Bearded Dragon, prefer to forage for invertebrates in rotten wood or under thick bark on large dead or living trees. Others find food and shelter among branches and leaf litter. Mistletoes, lerps, honeydew and plant exudates also provide a significant source of food for animals. Ephemeral streams and soaks support frogs, invertebrates and birds.

Agricultural clearing, mining, timber harvesting, firewood collection and gravel extraction have resulted in significant habitat modification. Current management challenges include habitat fragmentation and modification, vegetation clearance, the loss of hollow-bearing trees, weed invasion, feral predators, introduced pathogens, and improving fire management.

### Wet Forests and Rainforests

The slow erosion of Victoria's ranges by water and wind over millions of years has produced deeply dissected ranges in southern, central and north-eastern Victoria — the Otways, Central Highlands, Strzeleckis, Wilsons Promontory, Victorian Alps, and the mountains of far East Gippsland.

In the cool mountains and gullies on the slopes of these ranges, and in other wet areas at lower elevations, wet eucalypt forests and rainforests dominate the landscape. These awe-inspiring forests are among the great natural wonders of the continent. Here the world's largest flowering plant, the majestic Mountain Ash, reaches as much as 100 metres high and 15 metres in circumference.

## Natural Ecosystems

At different altitudes Alpine Ash, Messmate Stringybark, Mountain Grey Gum, Manna Gum, White Peppermint, Silvertop and other eucalypts share the sky.

In the sheltered gullies and rainforests, Myrtle Beech, Sassafras, Blackwood, Lilly-pilly, Kanooka and tree-ferns provide umbrellas of shade for a wide diversity of ferns, shrubs, mosses and a myriad of other life-forms. Many of the understorey plants, such as the Soft Tree-fern and Musk Daisy-bush, survive and flourish after fires, and are often older than the dominant eucalypts. The great diversity of bird life in these forests is well known to ornithologists, and the rarity of many mammals (including one of the State's faunal emblems, Leadbeater's Possum) is well documented. Many of these species, including owls and gliders, have evolved to depend on old, hollow-bearing trees and standing dead trees for nesting.

The eucalypt forests have evolved in response to the gradual climatic changes which have occurred over millions of years, during which Victoria's climate became drier and warmer. Together with the traditional use of fire by Aborigines for tens of thousands of years, this change in climate has resulted in a significant increase in the frequency and intensity of fire, for which most eucalypts are well adapted.

Most other forest plants have also adapted well to fire, having the capacity to resprout or rapidly recolonise burnt areas from seed. Rainforest plants are far less tolerant of fire, and successive fires allow fire-tolerant species, such as eucalypts, to progressively colonise rainforest margins. As a result, rainforest has become rare in Victoria.

The wildfires of 1939 burnt much of the montane forests in Victoria, and the regrowth from these fires provides a valuable source of timber. As a consequence, representative areas of montane forest are protected in National Parks and other conservation reserves, and all rainforest is now protected from harvesting.

## Inland Waters and Wetlands

A long history of subsidence and uplift, volcanic activity, and erosion and deposition in south-eastern Australia has produced a rich variety of inland and estuarine aquatic environments, including flowing waters (creeks, streams and rivers), standing waters such as lakes and swamps, and subterranean waters, such as that in groundwater and cave systems.

Each environment provides habitat for a variety of plants and animals. Many of these (such as fish and frogs) cannot inhabit any other environment, and others (such as the Sacred Ibis) congregate to form large and spectacular breeding colonies like the one at Kerang. Vegetation beside rivers and wetlands is often important to fauna that may breed here but forage elsewhere, such as the Regent Parrot. Old, gnarled red gums, slow, swirling waters and darting kingfishers are familiar to everyone who has camped on rivers in the north of the State.

Wetlands provide important water purification functions. Victoria has over 17,000 wetlands larger than 1 ha. These vary from the coastal Gippsland Lakes system and the extensive inland wetlands around Kerang to scattered examples of small freshwater meadows. Ten Victorian wetlands are listed for their international significance for bird species that migrate to Victoria in the southern summer from the northern hemisphere, and others are being considered for nomination to the list.

Rivers and wetlands also provide opportunities for recreation and sport, especially boating, angling and seasonal hunting. These activities can all have an impact on the native flora and fauna, and are therefore subject to responsible management and monitoring.

## Natural Ecosystems

Rivers and wetlands are difficult to conserve adequately unless they are included in a land use system which appropriately manages the whole catchment area and ensures that the flow of water is sufficient to maintain the natural ecosystems.

About 35% of the State's wetlands have been drained, and many rivers have been dredged or channelled, removing much of their habitat value; others are severely polluted. In areas outside national parks and State forests, the majority of streams are in poor or very poor condition, and only 5% are good or excellent. The management of Victoria's inland waters and wetlands, like those in most parts of the world, faces a number of challenges: excessive water extraction; land degradation (especially sediment deposition and salinity); the loss of riparian vegetation and wetlands; salt disposal to streams and wetlands; the inappropriate construction of dams and other barriers; increased nutrient levels and pollution; the loss of sites for egg-laying and shelter through desnagging, dredging and channelling of streams; and predation, competition and disease caused by the introduction or translocation of exotic species, such as European Carp.

## The Coast

Between 13,000 and 20,000 years ago, at the peak of the last Ice Age, the sea level was about 100 metres lower than it is today, and Tasmania and the Bass Strait islands were connected to Victoria. As the ice retreated the sea level rose, drowning the coastal river valleys and forming the many bays and inlets that are a feature of the modern Victorian coastline. Constant exposure to the often gale-force winds that blow from the Southern Ocean has produced the rugged, eroded landforms that characterise much of the western coastline. Lashed by wind and waves, the coast is dynamic, wild, and continually changing: some features appear and disappear in a matter of months or years, unlike the millennia required for mountains to form and erode.

The critical environmental factors affecting the vegetation of the coast are wind, salt, and the natural instability of many coastal landforms. The grasses and herbs which colonise the foredunes, and the saltmarsh plants and mangroves of the mudflats, bind these substrates. Coastal scrubs develop in the lee of the foredunes and on older, stabilised dunes on the landward side, usually comprising dense stands of wiry shrubs such as Coast Tea-tree, Coast Beard-heath, Drooping She-oke and Moonah. In the more protected swales between and behind the dunes, woodlands of Coast Banksia grow.

The most prominent group of coast-dwelling animals are the birds: Orange-bellied Parrots, which migrate from Tasmania and overwinter in coastal saltmarshes; Little Penguins, which nest in the dunes; and scores of migratory birds that are regular visitors to our bays and estuaries from Japan, Siberia and the northern Pacific. Australasian Fur Seals spend most of their life at sea, but use the coasts and islands to rear their young.

Most of Victoria's coastline is reserved for public use, with extensive sections in national or state parks, so that it is relatively intact compared to the coasts of most other industrialised countries. Much of this consists of windswept sandy beaches, rocky shorelines and cliffs. Where the impact of the waves is reduced in the many embayments along the coast, other habitats have developed, including seagrass beds, mudflats, mangrove communities and saltmarsh complexes. The coastal soils are predominantly sandy, although in some areas, especially where there are cliffs and bluffs, loams and clay soils occur.

Environmental weeds are a significant problem in many coastal areas; some exotic species readily colonise disturbed areas, while some native species have been able to expand beyond their normal range as a result of altered conditions, such as the long-term absence of fire. Pest animals such as foxes and cats are also abundant and can be a significant problem for ground-nesting birds and small mammals. Increasing coastal

## Natural Ecosystems

recreation and the urbanisation of coastal and near-coastal areas presents a challenge for the management of this ecosystem.

### **Intertidal Rocky Shores**

Life on the intertidal rocky shore is tough: the animals and plants must contend with storm waves, desiccation, extreme temperature changes, hypersaline conditions in evaporating rockpools, and predation. Seaweeds fringe the permanent rockpools, hiding the small crabs, seastars, and anemones below. On rocks covered by the tide for only part of the day, grazing snails, mussels and barnacles are the dominant animals. The uppermost part of the shore, receiving only the splash from the highest waves, is home to the hardest of the intertidal organisms, such as tiny littorinid snails and lichens.

A characteristic rocky shore community is present where rock is exposed at the shoreline. In Victoria this habitat occurs mainly on rocky headlands from Portland to Wilsons Promontory, with some minor occurrences in the far east. Although there are some differences in species between the warm temperate waters in the far east and the cool temperate waters of the central and west, the type of rock and the degree of exposure to the prevailing storm waves are especially important. Headlands sheltered within our larger bays will support suites of species that differ from those on sites battered by the waves arriving directly from the Southern Ocean. This difference is often reinforced by the characteristics of the underlying rock. The basalt along the oceanic side of the Mornington Peninsula weathers gracefully, allowing a multitude of creatures to hide under the loose rocks, or within the crevices and cracks that form. The granite around Wilsons Promontory is hard and impermeable, defying occupancy to all but the most tenacious animals and plants. The larger seaweeds that are found on Victoria's intertidal rocky shores include Neptune's Necklace and the large and fleshy Bull Kelp which grows on the lower fringe of more exposed rocky shores. Most animals on the intertidal rocky shores are herbivorous molluscs, grazing algae off rock surfaces. Filter-feeding organisms abound, including tube-building worms, sea squirts (cunjevoi), mussels and barnacles. Crabs and seastars, hermit crabs and shrimps scavenge in rock pools. Predators include snails, fish, and birds such as the Pacific Gull and Sooty Oystercatcher.

The conservation of our rocky intertidal shores depends on the control of habitat destruction, illegal harvesting, pollution, and physical disturbance. Recreational collection of intertidal organisms was beginning to have such an impact that it is now prohibited along much of Victoria's coast. Exploited species included warreners, abalone, elephant snails, dog winkles, limpets, top shells, crabs and cunjevoi: some of the once-common snails are now rarely seen.

Rocky intertidal shores are protected within parks and reserves along the coast, although the extent and nature of the protection varies. Work is currently being undertaken to determine future shoreline reservation and protection needs.

## Natural Ecosystems

### Subtidal Rocky Reefs

Victoria's subtidal reefs occur either as extensions of intertidal rocky shores or as isolated offshore reefs. They can take the form of banks of stones or cobbles, large underwater boulders, cascading shelves of rock, or as canyons, caves and arches carved out of the seafloor. They are scattered throughout Victorian waters from the low-water mark to a depth of 100 metres.

The rocky reefs of southern Australia support a highly endemic marine flora and fauna. Over 1400 species of algae have been recorded from southern Australia; 70% are endemic to the area. The fauna is derived from ancient Gondwanan species and more recent Indo-Pacific species that have invaded Australia as it has drifted slowly northwards.

Typically the shallow reefs (0–20 m) are dominated by kelps or other kinds of large brown seaweeds. Bubble Kelp (*Phyllospora* sp.) and Leather Kelp (*Ecklonia* sp.) combine to cover many of the exposed reefs. *Sargassum* and *Cystophora* dominate in more sheltered areas. The Southern Giant Kelp (*Macrocystis* sp.) forms small 'forests' up to 10 metres tall at several moderately sheltered localities throughout the centre and west of the state. An understorey of smaller plants and animals occurs beneath these kelp canopies. Abalone, seastars, rock lobsters, sea urchins and feather stars are common. Sea urchins can form large 'barren' areas in the far east of the state.

Deep-water reefs (beyond 20 m depth) are too dark to support much plant life. Instead they are covered in numerous plant-like invertebrates such as sponges, corals, bryozoans, sea-whips and ascidians, which in turn shelter a multitude of smaller invertebrates. Subtidal reefs support a diverse fish fauna, ranging from wrasse, Sweep, Old Wives and leatherjackets to Port Jackson Sharks.

The easy access to most of these reefs from shore or small boat makes them extremely popular with recreational divers. Reefs to 18 m depth are accessible to all certified divers and many are accessible to snorkellers. Caves and deeper reefs are accessible only to those with advanced training and experience. Dive schools emphasise the importance of conserving the animals and plants, and discourage interference with natural communities.

The main challenge in managing Victoria's subtidal reefs is to ensure that any harvesting of resources is ecologically sustainable. Over-harvesting of reef fish, octopus, lobster, abalone, and urchins have removed these animals from many reefs in other parts of the world. The abundance of abalone, lobster, and wrasse within Victoria have declined over the last 100 years.

Along the open coast, the Bunurong Sanctuary Zone protects the full range of reef species in the area.

### Seagrass Beds

Seagrasses meadows cover the seafloor in many of our bays and inlets and also occur in sheltered patches along the open coast. Seagrasses are true flowering plants (angiosperms), rather than seaweeds (macroalgae). Their ancestors made the move from the land to the sea early in the development of flowering plants. Some present-day seagrasses are ancient, being known from fossils up to 26 million years old. Their distributions have sometimes become fragmented with the movement of the tectonic plates. Many associated animals and plants have evolved to live exclusively in seagrass beds.

Although there are only seven seagrass species in Victoria, the extensive seagrass beds support a diverse marine community and contribute greatly to biological production in coastal areas.

## Natural Ecosystems

The four major species are eelgrasses (*Zostera* and *Heterozostera*), Sea Nymph (*Amphibolis* sp.), and Fibre-ball Weed (*Posidonia* sp.). Eelgrasses grow along the entire Victorian coastline and are common in bays, inlets and estuaries. *Zostera* forms beds on intertidal mudflats, covering very large areas in Western Port, while *Heterozostera* is more commonly subtidal on both mud and sand. Sea Nymph is found on sandy bottoms in slightly more exposed conditions, typically surrounding rocky reefs. Fibre-ball Weed forms large meadows in Corner Inlet and Nooramunga. Seagrass beds typically grow in sheltered waters on silt or sand. The beds bind together unstable sediments and provide substrate, habitat, and food sources for many other organisms. Numerous small seaweeds and lace corals (bryozoans) grow on the stems and leaves, some growing only on particular seagrasses. Abundant smaller invertebrates shelter in the leafy canopy or in the sediment amongst the roots. The most diverse of these groups are marine worms (polychaetes), small crustaceans (amphipods, cumaceans and harpacticoids), snails and bivalves (molluscs). Shrimps, crabs and seastars inhabit the seafloor.

Few organisms eat living seagrasses, instead feeding on seagrass detritus, epiphytic seaweeds or the smaller animals. Fish are abundant, including gobies, sea-horses and sea-dragons. Seagrass beds act as nursery grounds for many fish such as King George Whiting, Greenback Flounder and Mullet.

A significant decline in seagrass beds in recent decades has occurred throughout the world. In Victoria the most affected areas are Western Port Bay and Corner Inlet. No single cause has been identified. Some of the decline may be due to natural changes in populations, but other factors appear to be sediment and nutrients from urban and agricultural run off, dredging, and small boat activity.

The large seagrass meadows in Corner Inlet and Nooramunga are within Marine and Coastal Parks. Small open-coast seagrass beds are within reserves at Wilsons Promontory and on the Bunurong coast.

## Beaches and Soft Substrates

Beaches and soft substrates form a distinctive group of marine habitats with their own suites of organisms. The sands in west and central Victoria are derived from the shells and skeletons of living organisms, while the yellow quartzose sands in the east were eroded from Devonian granite. Intertidal mud and sand flats are best developed in Port Phillip Bay, Western Port and Corner Inlet, where they cover large areas at low tide. The tides play a major role in structuring and nurturing these habitats. Subtidal sandy substrates occur along much of the open coast, as well as in Port Phillip Bay, Anderson Inlet and Shallow Inlet, but muddy subtidal substrates are restricted to sheltered embayments and deeper waters offshore. The soft substrates in deeper, subtidal waters support some of the most diverse marine communities; a few square metres of sand can contain over 570 species of macro-invertebrates.

Microscopic diatoms are the only plants to thrive on a beach. Small sea-fleas, pill-bugs, pipis and beach worms predominate in the splash zone, while bacteria, protozoa and nematode worms exist in the spaces between the sand grains. Silver Gulls are the most common of the larger animals, but other birds such as Sooty Oystercatchers and Pacific Gulls are also common. Algae washed up onto the beach provide the diet for a number of other animals, including beetles, sandhoppers, kelp flies and small crustaceans.

Animals such as Soldier Crabs, gastropod snails, marine worms and pipis inhabit intertidal sand flats, while mud flats support molluscs such as tellins, lantern shells and the Mud Ark, and crustaceans such as the Semaphore Crab and Ghost Yabby. Many fish move in over intertidal flats during high tides, particularly the Smooth Toadfish, stingarees, King George Whiting and Greenback Flounder. Victorian mud flats are also home to a wader bird community of international significance. Amongst the most numerous are the Eastern Curlew, Curlew Sandpiper, Red-necked Stint and Bar-tailed Godwit. Anglers collect intertidal invertebrates for bait, particularly pipis, large polychaetes and yabbies.

## Natural Ecosystems

Soft subtidal sediments commonly support seapens, ascidians, hydroids, bryozoans and large, diverse sponge gardens. The animals within the sediment are dominated by marine worms and crustaceans. Subordinate groups are bivalves, brittle stars, holothurians, sea-urchins, gastropods, nematodes and nemerteans. Scallops inhabit fine sandy bottoms in Port Phillip Bay and in eastern Bass Strait. Fish include flatheads, whiting, flounder and sharks. Many introduced species have become established in subtidal soft sediments, where they are among the most abundant species.

The major pressures on beaches and soft substrates come from harvesting, the alteration of natural sedimentation regimes by coastal developments, bait collection, inappropriately placed structures, bottom trawling and dredging, boat traffic, trawling, and the introduction of exotic organisms.

## Pelagic

A distinct marine community inhabits the water column above the seafloor. Unlike the air above land, the very medium of the marine environment supports a multitude of life. Surface waters teem with tiny plants (phytoplankton) and animals (zooplankton); some are the young larval stages of benthic animals or fish, others spend their entire lives in the plankton. The photosynthetic phytoplankton are very important to the ecology of the ocean, forming the basis of the marine food web. In addition to the tiny plankton, the sea abounds with larger swimming animals, from shrimps and jellyfish to whales. Many of these animals migrate large distances. Whales arrive in Victoria from deep in the Southern Ocean. Eels migrate from Victoria's rivers all the way to Torres Strait to spawn. Vertical migration is also common in the ocean, with animals ascending and descending during the day to feed or shelter.

Water is obviously a part of every marine environment, but pelagic communities are more complex in the deeper water off the open coast. Jellyfish, including comb jellies and salps, feed on phytoplankton and zooplankton carried in the currents. Jellyfish species include the By-The-Wind-Sailor and the Bluebottle. Molluscs include the Arrow Squid and the Paper Nautilus. Many species of fish inhabit Victorian waters; the most notable are Silver Trevally, Barracouta, Jack Mackerel, Pilchards and Anchovies.

Unlike reef animals whose colour usually matches that of their habitat for camouflage, most fish that live near the surface display counter-shading: a gradation of colour that camouflages them against the shadowy water when seen from above, and from the sunlit surface when seen from below.

A number of cetaceans travel through Victorian coastal waters. The most spectacular of all are the Southern Right Whales, which regularly calve off the coast of Warrnambool.

Others sighted include the Pilot, Killer, False Killer and Humpback Whales. Two dolphins regularly appear, the Bottlenose Dolphin and Common Dolphin. Fur-seals, sea-lions and true seals are often seen swimming in open waters, taking advantage of the abundance of small fish, squid and octopus. Some seals also take krill, seabirds, penguins, and even young seals. The Little Penguin, the star attraction of the Phillip Island 'penguin parade', also feeds on Pilchards and Anchovies in these waters.

The major challenges in managing our pelagic habitats concern fish harvesting and pollution. Commercial fishing practices need to be carefully managed to minimise the accidental capture of non-target species, or bycatch. Slow growing species with low fertility are particularly vulnerable. Inshore waters can become eutrophic from pollution, as decaying algal blooms deprive bottom waters of oxygen.

## Human-Created Ecosystems

### Living Areas

When Europeans first arrived in Victoria, some of the ecosystems had already been altered by Aborigines, especially through the use of fire. But since then, every ecosystem in the Victoria has been affected by the consequences of European settlement. Almost two-thirds of the State has been largely cleared of native vegetation, and many of our rivers and streams have been vastly altered. At one extreme — the high-density cities and towns — most of the natural ecological communities have been eliminated.

Earlier in Victoria's colonial history there were concerted efforts to make cities and towns more like the familiar places of Europe. By planting exotic trees, the settlers tried to create landscapes reminiscent of their homelands. Many of these places, such as the north-eastern township of Bright, retain a sense of beauty and history, but they also highlight the difference, diversity and uniqueness of our native landscapes. In the past we have brought, both consciously and inadvertently, many alien species to Victoria. In vastly modified environments many of these exotic species have survived, usually displacing all but the widespread and opportunistic native species, such as the Brush-tailed Possum and the Sweet Pittosporum.

Introduced species are dominant in our living areas, but native flora and fauna, although altered and depleted, survive in some areas and can even increase with proper management. In inner suburban Melbourne, for example, roosting fruit bats, nesting Peregrine Falcons, a colony of penguins, and patches of native grasslands are a few examples of populations that have been able to survive or recolonise. Many once-degraded urban areas are being restored to recreate parts of our biological heritage. Here, the return of the Sacred Kingfisher and Platypus have been celebrated by locals as symbols of restoration.

Urbanisation has also produced artificial habitats for certain species, or enabled fragments of habitat to be preserved. For example, the Cheetham Saltworks and Melbourne Water's Werribee sewage treatment plant, now extremely important for international migratory birds; abandoned mine shafts, which may be occupied by bats; and roadsides, railway reservations, buffer zones around industrial sites and quarries, which can sometimes provide habitat for rare grassland species.

The parts of human-created environments that are significant for biodiversity may be at risk from the increased fragmentation of remnants, inappropriate management, and urbanisation. The risks are being identified and minimised as our understanding of this complex environment increases. In these environments active restoration can make an invaluable contribution to biodiversity conservation. For example, the installation of 'fish ladders' at Dights Falls on the Yarra River has enabled native fish to recolonise the catchment above the falls for the first time in many years.

### Agricultural Areas

Fields of wheat as far as the eye could see, and cattle and sheep grazing in fertile paddocks under a hot sun, with a few scattered trees for shade, once evoked an idyllic image of rural Victoria. But our modern agricultural lands are far more diverse, and many farms still retain substantial valuable native vegetation, even though many are intensively cultivated or grazed. The productivity of these agricultural lands depends very much on the quality of the environment within and around agricultural systems; for example, clean water is essential for the growth of crops and watering of stock, and invertebrates and other animals perform many useful functions in nutrient recycling and soil stability. In some agricultural areas the remnants of the natural landscape are reduced to roadsides and streamsides and other relatively small areas of public land. These areas are increasingly having their conservation values restored or enhanced, particularly by landowners working with their neighbours.

## Human-Created Ecosystems

Although some species have been lost, others have adapted to these radically changed environments. Occasionally, rare fauna such as Blue-bonnets, Grey-crowned Babblers, Eltham Copper Butterflies and Legless Lizards survive where their critical habitat components have been maintained. These areas are also valuable habitat for sedentary species and for migratory or nomadic species such as some honeyeaters. In some parts of the extensively cropped cereal areas, stubble may provide habitat for a range of quail species, and farm dams can provide habitat for many waterbirds, particularly if the surrounds are vegetated. In south-western Victoria, some landholders manage their properties to attract Brolgas to their wetlands. In many areas the daily and seasonal cycles can be heard in the landscape: Magpies and Kookaburras in the morning, ravens and cockatoos during the day, and Willie Wagtails and Masked Lapwings often calling long into the night. Biodiversity in these landscapes needs active management. Some populations of native fauna may become out of balance, so that there is a need to protect the long-term viability of the population and ameliorate damage these animals may cause.

This is evident in some agricultural landscapes but also in reserves that are being restored after a history of pastoralism. The recognition of significant catchment management problems, such as salination and algal blooms, has brought a new awareness of the need for a balance between resource development and biodiversity conservation. Native vegetation that remains in these landscapes is also increasingly valued for its aesthetic and cultural values. But some types of native vegetation, such as native grasslands, could be an economic advantage in whole-farm management, and old trees on farms provide habitat for a range of species, including some that are beneficial for pest control. The community efforts over recent years in Landcare, Land for Wildlife and similar programs have produced significant gains for our biodiversity.

# Acknowledgements

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**Fine art credits:** \*J. & E. Gould \*\*Michele Kohout \*\*\*Robert Ingpen. **Contents\*** Azure Kingfisher *Alcedo azurea*. **Introduction\*\*** Tufted Buttercup *Ranunculus gunnianus*. **The Past\*** Eastern Hare Wallaby *Lagorchestes leporides*. **The Future\*** Brush-tailed Rock-wallaby *Petrogale penicillata*. **The Alps\*** Common Wombat *Vombatus ursinus*. **Grasslands\*** Brown Falcon *Falco berigora*. **Heathlands\*** Dusky Antechinus *Antechinus swainsonii*. **The Mallee\*** Mallee Ringneck *Barnadius zonarius*. **Dry Forests and Woodlands\*\*** Leopard Orchid *Diuris maculata*. **Wet Forests and Rainforests\*** Greater Glider *Petauroides volans*. **Inland Waters and Wetlands\*\*** Murray Cod *Maccullochella peelii peelii*. **The Coast\*** Australasian Gannet *Morus serrator*. **Intertidal Rocky Shores\*\*** Neptune's Necklace *Hormosira banksii*. **Subtidal Rocky Reefs\*\*** Red Alga *Plocamium dilatatum*. **Seagrass Beds\*\*** Sea Nymph *Amphibolis antarctica*. **Beaches and Soft Substrates\*\*\*** Sand Crab *Portunus pelagicus*. **Pelagic** (Artist unknown). Port Jackson Shark *Heterodontus portusjacksonii*. **Living Areas\*** Grey-headed Flying-fox *Pteropus poliocephalus*. **Agricultural Areas\*** Little Raven *Corvus mellori*.

**Photo Credits:** **Front cover.** Wet Forest, Tarra–Bulga National Park: **Ted Mead/ANT**. Towards Wonnangatta – Moroka, Victorian Alps: **J P & E S Baker/ANT**. Discovery Bay Coastal Park: **Otto Rogge**. Eucalypt bark: **Roxanne Oakley**. Porcupine Grass *Triodia irritans*: **David Parkes**. Bearded Dragon *Amphibolurus barbatus*: **Otto Rogge**. Silky Mouse *Pseudomys apodemoides*: **McCann/NRE**. Coral Snake *Simoselaps australis*: **McCann/NRE**. Red-necked Avocet *Recurvirostra novaehollandiae*: **McCann/NRE**. Eastern Banjo Frog *Limnodynastes dumerilii*: **McCann/NRE**. Common Nardoo *Marsilea drummondii*: **McCann/NRE**. Ischnochiton *Ischnochiton australis*: **Rudie Kuiter**. White-browed Wood-swallow *Artamus superciliosus*: **McCann/NRE**. Drooping Mistletoe *Anyema pendula*: **McCann/NRE**. Three-nerved Wattle *Acacia trineura*: **McCann/NRE**.

**Inside front and back covers:** Dragonfly *Hemianax papuensis*: **David Meagher**

**The Alps:** Main - View from Mount Hotham to the peaks of the Wonnangatta–Moroka wilderness, Victorian Alps Bioregion: **J P & E S Baker/ANT**. Side bar - White Sallee *Eucalyptus pauciflora*: **David Parkes**. Others - Ovens Wattle *Acacia pravissima*: **McCann/NRE**. Rosy Baeckea *Baeckea ramosissima*: **McCann/NRE**. Alpine Water Skink *Sphenomorphus kosciuskoi*: **McCann/NRE**. Mountain Gentian *Chionogentias cunninghamii*: **McCann/NRE**. Flame Robin *Petroica phoenicea*: **McCann/NRE**

**Grasslands:** Main - Remnant grasslands near Wyperfeld, Murray Mallee Bioregion: **Otto Rogge**. Side bar - Eucalypt bark: **Roxanne Oakley**. Others - Broughton-pea *Swainsona procumbens*: **McCann/NRE**. Hoary Sunray *Leucochrysum albicans*: **McCann/NRE**. Eastern Barred Bandicoot *Perameles gunnii*: **McCann/NRE**. Dwarf Greenhood *Pterostylis nana*: **McCann/NRE**. Australian Kestrel *Falco cenchroides*: **McCann/NRE**

**Heathlands:** Main - Heathlands overlooking Five Mile Beach, Wilsons Promontory Bioregion: **David Tatnall**. Side bar - Mealy Honey-myrtle *Melaleuca squamea*: **McCann/NRE**. Others - Blue Tinsel-lily *Calectasia intermedia*: **McCann/NRE**. Red-eye Cicada *Psaltoda moerens*: **McCann/NRE**. Brush Heath *Brachyloma ericoides*: **McCann/NRE**. Heath Rat *Pseudomys shortridgei*: **McCann/NRE**. Common Correa *Correa reflexa*: **McCann/NRE**

**Mallee:** Main - Big Desert Wilderness, Lowan Mallee Bioregion: **David Parkes**. Side bar - Eutaxia *Eutaxia microphylla*: **McCann/NRE**. Others - Western Pigmy-possum *Cercatetus concinnus*: **McCann/NRE**. Three-nerved Wattle *Acacia trineura*: **McCann/NRE**. Scarlet Mint-bush *Prostanthera aspalathoides*: **McCann/NRE**. Bearded Dragon *Amphibolurus barbatus*: **Otto Rogge**.

**Dry Forests & Woodlands:** Main - Ironbark forest, Goldfields Bioregion: **David Tatnall**. Side bar - Southern Freetail Bat *Mormopterus* sp. (eastern form): **McCann/NRE**. Others - Salmon Sun-orchid *Thelymitra rubra*: **McCann/NRE**. Sugar Glider *Petaurus breviceps*: **McCann/NRE**. Short-beaked Echidna *Tachyglossus aculeatus*: **McCann/NRE**. Drooping Mistletoe *Anyema pendula*: **McCann/NRE**. White-browed Wood-swallow *Artamus superciliosus*: **McCann/NRE**.

**Wet Forests & Rainforests:** Main - Wet sclerophyll forest, Tarra–Bulga National Park, Highlands (Southern Fall) Bioregion: **Ted Mead/ANT**. Side bar - Ming's Fingers *Dicranoloma menziesii*: **David Meagher**. Others - Soft Tree-fern *Dicksonia antarctica*: **Roxanne Oakley**. Otways Black Snail *Victaphanta compacta*: **McCann/NRE**. Spot-tailed Quoll *Dasyurus maculatus*: **McCann/NRE**. Lilly-pilly *Acmena smithii*: **McCann/NRE**. Macleay's Swallowtail *Graphium macleayanus*: **Otto Rogge**.

**Inland Waters & Wetlands:** Main - Sunrise, Lake Mournpall, Murray Mallee Bioregion: **Roxanne Oakley**. Side bar - Freshwater Crayfish *Euastacus yarraensis*: **McCann/NRE**. Others - Common Nardoo *Marsilea drummondii*: **McCann/NRE**. Eastern Banjo Frog *Limnodynastes dumerilii*: **McCann/NRE**. Swamp Paperbark *Melaleuca ericifolia*: **McCann/NRE**. Red-necked Avocet *Recurvirostra novaehollandiae*: **McCann/NRE**.

**The Coast:** Main - Sunset over the eastern crescent of Discovery Bay, Warrnambool Plain Bioregion: **Otto Rogge**. Side bar - Rock lichen *Caloplaca* sp.: **David Meagher**. Others - Great Sun-orchid *Thelymitra aristata*: **McCann/NRE**. Coast Banksia *Banksia integrifolia*: **McCann/NRE**. Diamond Python *Morelia spilota* ssp. *spilota*: **McCann/NRE**. Heath Milkwort *Comesperma ericinum*: **McCann/NRE**. Pied Oystercatcher *Haematopus ostralegus*: **McCann/NRE**.

**Intertidal Rocky Shores:** Main - Apollo Bay, Open Coast Bioregion: **Roxanne Oakley**. Side bar - Ischnochiton *Ischnochiton australis*: **Rudie Kuiter**. Others - Waratah Anemone *Actinia tenebrosa*: **William Boyle**. Sea Lettuce *Ulva australis*: **Mary Malloy**. Seastar *Plectaster decanus*: **William Boyle**. Cleft-fronted Shore Crab *Plagusia chabrus*: **Rudie Kuiter**. Neptune's Necklace *Hormosira banksii*: **McCann/NRE**. Amphipod *Cyproidea* sp.: **Museum of Victoria/Michael Marmach**

**Subtidal Rocky Reefs:** Main - Rocky Reef off the south-eastern coast, Open Coast Bioregion: **William Boyle**. Side bar - Senator Wrasse *Pictilabrus laticlavus*: **William Boyle**. Others - Leather Kelp *Ecklonia radiata*: **William Boyle**. Pale Octopus *Octopus pallidus*: **William Boyle**. Western Blue Devil *Paraplesiops meleagris*: **William Boyle**. White's Seahorse *Hippocampus whitei*: **William Boyle**. Jewel Anemone *Corynactis australis*: **Mary Malloy**. Red Velvet Fish *Gnathanacanthus goetzeei*: **William Boyle**.

**Seagrass Beds:** Main - Seagrass bed, Open Coast Bioregion: **Ken Hoppen**. Side bar - Sponge (Porifera sp.) on seagrass *Heterozostera tasmanica*: **Mary Malloy**. Others - Southern Calamari *Sepioteuthis australis*: **Mary Malloy**. Isopod *Paridotea collingei*: **Museum of Victoria/Michael Marmach** unidentified crab: **Mary Malloy**. Banjo Ray *Trygonorrhina fasciata*: **William Boyle**. Rough Leatherjacket *Scobinichthys granulatus*: **Mary Malloy**.

**Beaches & Soft Substrates:** Main - Shallow sandy bottom, Inlets, Bays and Estuaries Bioregion: **Mary Malloy**. Side bar - Stargazer *Kathetostoma laeve*: **Mary Malloy**. Others - Western Stingaree *Urolophus mucosus*: **Mary Malloy**. Isopod *Heteroserolis tuberculata*: **Museum of Victoria - Michael Marmach**. Octopus *Octopus berrima*: **Mary Malloy**. Greenback Flounder *Rhombosolea tapirina*: **Mary Malloy**. Volute *Amoria undulata*: **Mary Malloy**.

**Pelagic:** Main - Comb Jelly *Leucothea* sp., Open Coast Bioregion: **William Boyle**. Side bar - Krill *Nyctiphanes australis*: **Rudie Kuiter**. Others - Great White Shark *Carcharodon carcharias*: **William Boyle**. Jack Mackerel *Trachurus declivis*: **Rudie Kuiter**. Australian Fur-seals *Arctocephalus pusillus*: **William Boyle**. Southern Calamari *Sepioteuthis australis*: **Mary Malloy**. Paper Nautilus *Argonauta nodosa*: **Rudie Kuiter**.

**Living Areas:** Main - Urban revegetation project, Victorian Volcanic Plain Bioregion: **David Tatnall**. Side bar - Crimson Rosella *Platycercus elegans*: **McCann/NRE**. Others - Common Brushtail Possum *Trichosurus vulpecula*: **McCann/NRE**. Pacific Black Duck *Anas superciliosa*: **McCann/NRE**. Crimson Bottlebrush *Callistemon citrinus*: **McCann/NRE**. Gould's Wattled Bat *Chalinolobus gouldii*: **McCann/NRE**. Hairpin Banksia *Banksia spinulosa*: **McCann/NRE**. Silver-eye *Zosterops lateralis*: **McCann/NRE**.

**Agricultural Areas:** Main - Dairy farm with rich winter pastures, Gippsland Plain Bioregion: **P & M Walton/ANT**. Side bar - Bread Wheat *Triticum aestivum*: **Roxanne Oakley**. Others - Eastern Grey Kangaroo *Macropus giganteus*: **McCann/NRE**. Unidentified dragonfly: **McCann/NRE**. Scarlet Bottlebrush *Callistemon rugulosus*: **McCann/NRE**. Prickly Moses *Acacia verticillata*: **McCann/NRE**. Growling Grass Frog *Litoria raniformis*: **McCann/NRE**. Common Wombat *Vombatus ursinus*: **McCann/NRE**. Laughing Kookaburra *Dacelo novaeguineae*: **McCann/NRE**.