Protecting
Western Australia's
big blue backyard

SAVE OUR
MARINE LIFE

Collaboration

SAVE OUR MARINE LIFE
WWW.SAVEOURMARINELIFE.ORG.AU

The *Save our Marine Life* Collaboration of global, national and state-based environment organisations is built around a common vision to conserve Australia's unique marine life through working with local communities, governments, industry stakeholders and Traditional Owners to secure a network of large no-take reserves in Australia's marine environment.

Save our Marine Life collaborators

The Pew Environment Group is the conservation arm of the Pew Charitable Trusts. The mission of the Pew Environment Group is to strengthen environmental policy through targeted initiatives aimed at producing concrete and measurable conservation gains in both terrestrial and marine systems worldwide. Pew works through partnerships to secure policy reforms and on-ground outcomes that curb global warming, protect ocean life and preserve wilderness. Pew has joined with The Nature Conservancy to establish the Wild Australia program, a joint three-year program that seeks to conserve large natural areas in Australia, both on land and sea.

The Nature Conservancy (TNC) is a leading conservation organisation working around the world to protect ecologically important lands and waters for nature and people. TNC has been working in Australia for 10 years. Working with partners, TNC's Australia program has impacted more than 48 million hectares through conservation action planning and has supported the protection and management of more than 3.6 million hectares.

For over 40 years the Australian Conservation Foundation (ACF) has been a strong voice for the environment, promoting solutions through research, consultation, education and partnerships. ACF works with the community, business and government to protect, restore and sustain Australia's environment.

Since 1967 the Conservation Council of Western Australia (CCWA) has been the state's peak non-government environment organisation. CCWA informs the public and governments on key environmental issues and participates in government and community processes that seek to restore and protect the natural environment.

The Wilderness Society (TWS) is a national, community-based environmental advocacy organisation formed in 1976 whose mission is protecting, promoting and restoring wilderness and natural processes across Australia's lands and seas for the survival and ongoing evolution of life on Earth.

WWF-Australia is part of the WWF International Network, the world's largest and most experienced independent conservation organisation. Its mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity; ensuring that the use of renewable natural resources is sustainable; and promoting the reduction of pollution and wasteful consumption. With active projects in Australia and the Oceania region, WWF works to conserve Australia's plants and animals, by ending land clearing, addressing climate change, and preserving and protecting our fresh water, marine and land environments.

The Australian Marine Conservation Society is a not-for-profit charity, dedicated to creating marine national parks, making fisheries sustainable and protecting and recovering ocean wildlife. It is an independent scientifically based charity that has been defending Australia's oceans for over 40 years. The Society was formed in 1965 to legally contest and successfully defeat an application to mine coral on the Great Barrier Reef. This victory was followed by Australia's largest sea-based campaign which culminated in the formation of the Great Barrier Reef Marine Park World Heritage Area.

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SAVE OUR MARINE LIFE
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CONSERVATION COUNCIL OF WESTERN AUSTRALIA INC.
AUSTRALIAN CONSERVATION FOUNDATION
The Nature Conservancy — Protecting nature. Preserving life.™
WWF
THE WILDERNESS SOCIETY
Australian Marine Conservation Society
THE PEW CHARITABLE TRUSTS

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EXECUTIVE SUMMARY

Protecting Western Australia's big blue backyard is the first report by ***Save our Marine Life***, a new collaboration of global, national and state-based environment organisations that is built around a common vision to conserve Australia's unique marine life through working with local communities, governments, industry stakeholders and Traditional Owners to secure a Comprehensive, Adequate and Representative (CAR) network of large no-take reserves in Australia's marine environment.

A *Comprehensive* conservation reserve network is one in which all major bioregions have reserves within them. *Adequate* refers to the number, size, configuration and level of protection of the reserves within a bioregion. The reserves also need to be *Representative* of the ecosystems within the bioregions.

The Conservation Council of Western Australia, the Australian Conservation Foundation, The Wilderness Society, WWF-Australia, the Australian Marine Conservation Society, The Nature Conservancy and the Pew Environment Group have established the ***Save our Marine Life*** Collaboration.

The area of focus for the Collaboration's first report, *Protecting Western Australia's big blue backyard,* is the southern half of Western Australia's immense coastline, from Kalbarri to Eucla. This is the Western Australian component of the South-west Marine Region currently being considered for protection by the Australian Government under its National Representative System of Marine Protected Areas.

The marine environment from Kalbarri to Eucla is globally significant for its unique and threatened species, underwater features and ecosystems including:

– globally high levels of unique marine species (70–90 per cent found nowhere else on Earth) as a result of geological isolation, an unusual major southerly current bringing temperate and tropical species together, and a history free of major environmental disturbance in geological time

– a series of hotspots for marine life including the Houtman-Abrolhos Islands, the Perth Canyon, Geographe Bay, Cape Mentelle, the Naturaliste Plateau, the Diamantina Fracture Zone, the Albany Canyons and the Recherche Archipelago

– critical habitat for a range of significant species including the world's largest animal, the endangered blue whale. Perth Canyon is one of only two blue whale feeding grounds known in Australia. It is a key to the survival and recovery of blue whales

– one of the world's largest sharks, the threatened white shark; and the world's largest marine turtle, the endangered leatherback turtle

– a greater southerly range for major tropical coral reefs than anywhere else in the Indian Ocean

– an unusual collection of fish life and habitats as a result of low nutrients, clear water due to limited river runoff, and waters warmer than are normally found so far south

– geologically and ecologically significant subsea features including the deepest point in Australia's oceans, an island under the sea—a large submerged fragment of continental shelf—Australia's highest underwater mountain range, and Australia's largest marine canyon.

A highly unusual and globally significant current is the life force of this region. At 5500 kilometres in length, the Leeuwin Current is the world's longest continuous coastal current, and its journey along the Western Australian coast connects and supports the key elements of the protection blueprint outlined in this report.

With less than five per cent of the region's marine environment explored, the region is in the midst of an exciting new phase of scientific discovery, with vast numbers of new species being found with each research voyage.

The region's unusual ecological characteristics make it both vulnerable to climate change and important as a potential source of refugia for species. These include tropical corals and associated marine life with ranges that may shift south in the face of climate change that warms their existing habitats to the north.

Of all Australian states, Western Australia is particularly dependent on its vast marine environment. The marine life of the Kalbarri to Eucla region has underpinned the State's social, cultural and economic development and will continue to be relied upon into the future. Marine-based recreation, tourism and trade are significant economic drivers. Australia's most lucrative fishery, the western rock lobster fishery, is found in this region, and the oil and gas industry appears to be on the cusp of a significant expansion.

With 90 per cent of the world's large predatory fish already gone, no nation can be complacent about its use of living marine resources. Commercial and recreational fishing in this region is placing enormous pressure on popular fish species.

Monitoring in many no-take areas around the world has shown fish abundance is higher in no-take reserves than in areas that continue to be fished. Research by the Australian Institute of Marine Science and James Cook University confirmed this for the Great Barrier Reef Marine Park in 2008. The coral trout, for example, has been found to be twice as abundant in some of the no-take zones as it is in fished areas.

Despite the critical importance of the region to Western Australia and the nation, its unique and relatively intact nature, and the increasing impacts and threats from use, levels of protection are inadequate. Less than one per cent of the region is secured in any type of marine protected area. This is in contrast to the protection afforded the eastern seaboard of Australia and Australia's global commitment to manage and conserve the huge marine environment in its care.

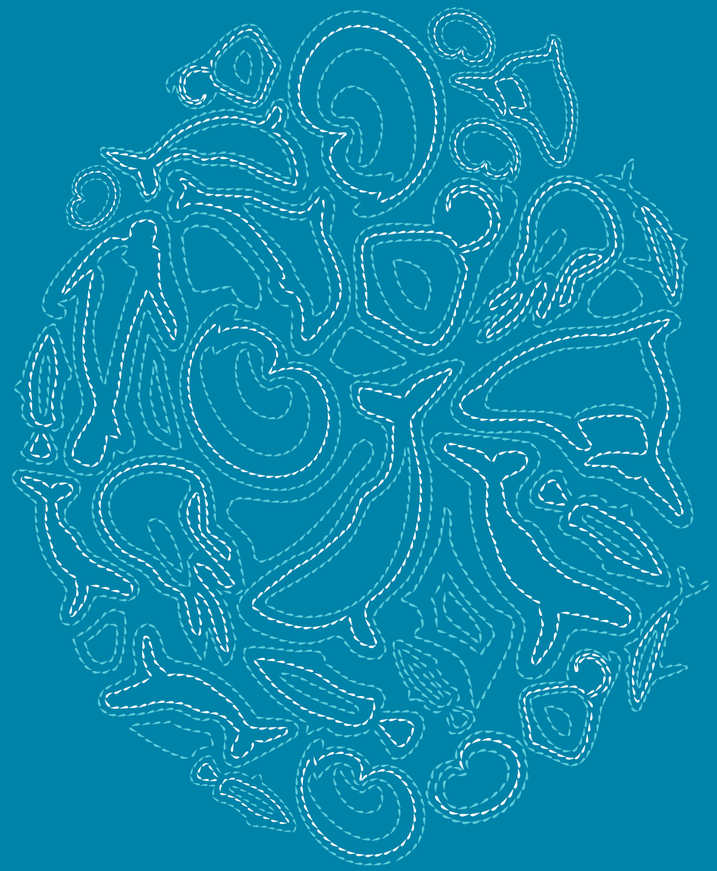
Australia values highly its international leadership position in the conservation of marine life and habitats. This is demonstrated by our commitment to the Convention on Biological Diversity and other important international conventions. In order to maintain that standing, Australia's challenge is to implement the expert international recommendation that all nations establish networks of no-take areas covering at least 20–30 per cent of each marine habitat. As little as four per cent of Australia's marine environment is afforded no-take protection.

Recent polling shows that Western Australians view marine protection as highly important. Of those polled, 73 per cent saw marine protection as very important, 75 per cent felt there was not enough marine protection in WA, and almost 50 per cent called for protection to cover at least 30 per cent of the marine environment.

Protecting Western Australia's big blue backyard concludes that a CAR network of large no-take marine reserves is needed now to secure the future of marine life, industries and people in the Kalbarri to Eucla region. Non-extractive uses of these areas such as diving, scientific exploration, ecotourism, education, shipping and sailing will continue and benefit from improved marine health.

The prime responsibility to act sits with the Australian Government, which is responsible for managing almost all of Australia's marine environment including that off the coast of Western Australia.

Protecting Western Australia's big blue backyard puts the case for the Australian Government to exercise leadership, maintain its international reputation in marine conservation and protect Australia's unique marine life by creating a CAR network of large no-take marine reserves. Western Australia's big blue backyard is where it can start.



Western Australia's big blue backyard: unique and unprotected

RISING TO THE CHALLENGE

Australia's marine environment is one of the most important on Earth. As a nation, we are responsible for almost 16 million square kilometres of the world's oceans—twice the area of our land.

Australia has the largest area of coral reefs in the world as well as the largest single coral reef, the Great Barrier Reef. Our 4000 fish species represent 20 per cent of the Earth's total. Six of the world's seven marine turtles are found here, along with 45 of the 78 known species of whales, dolphins and porpoises. No other nation has 30 of the globe's 58 species of seagrass.

Despite its global, national and regional values of significance, and our international commitment to sound marine management, less than four per cent of Australia's marine environment is highly protected from extractive uses including fishing and mining. Moreover, the no-take protection is mostly in one place—on the Great Barrier Reef. This is well below today's international standards that have been set by the recent establishment of large no-take areas in the Hawaiian Islands, Mariana Trench and Kiribati.

Many of the special qualities of Australia's marine environment reside in the marine waters off Western Australia.

Australia's marine environment spans five climate zones, Western Australia's crosses three. Of the 12,000 islands in Australian waters, 3747 are found in Western Australia's state waters alone.

Australia's marine waters have a vast depth range but the deepest waters, the largest marine canyon, the highest undersea mountain range and largest subsea plateau are off the south-west corner of Western Australia between Kalbarri and Eucla.

Three oceans come together in Australia's marine environment, two of these, the Indian and the Southern, merge in that same south-west corner of the continent.

The Kalbarri to Eucla region has important tropical coral reefs, and internationally significant seagrass meadows and sheltered inshore lagoons. Multi-coloured 'old-growth' sponge gardens, rocky reefs and a unique mix of tropical and temperate species are found here.

Threatened whales, sharks, turtles, seals and seabirds make the Kalbarri to Eucla region their home. The region also contains Australia's most lucrative fishery, the western rock lobster fishery, as well as the Perth Canyon's critical feeding area for the Earth's largest animal, the endangered blue whale. It is one of only two known blue whale feeding areas in Australia.

The region is a big part of Australia's southern waters where a world-record 70–90 per cent of fish, seaweeds, molluscs and other marine life are endemic, found nowhere else on Earth. Moreover, significant finds of species new to science continue to be made.

The Kalbarri to Eucla region is internationally significant and critically important to Australia. It is also of vital importance to the future of Western Australians, with their way of life reliant on the good health of the region's marine environment.

But less than one per cent of the marine waters from Kalbarri to Eucla is protected, a level that is the worst off any state in Australia. Most of this area is under Australian Government control.

Protecting Western Australia's big blue backyard demonstrates the importance of the Kalbarri to Eucla region—and the current and future threats to its superlative values—by following the route of the unique Leeuwin Current as it flows through the region on its 5500-kilometre journey from Indonesia to Tasmania. The Leeuwin Current has a profound influence on local climate, marine life and people and is the main reason for the region's global significance.

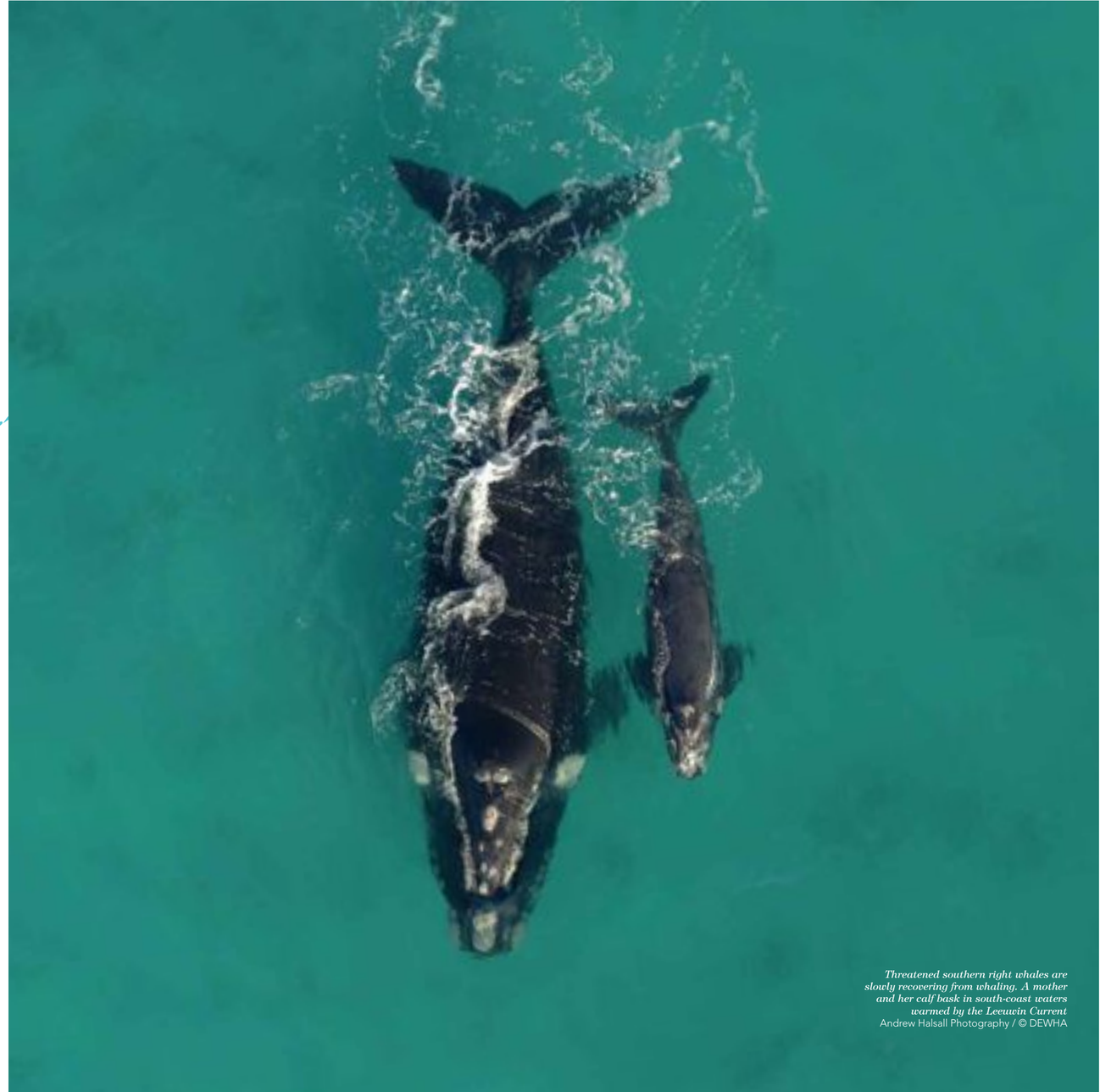
This report from the ***Save our Marine Life*** Collaboration visits a number of hotspots for marine life as it follows the Leeuwin Current's journey. These include the Houtman-Abrolhos Islands, the Perth Canyon, Geographe Bay, Cape Mentelle, the Naturaliste Plateau, the Diamantina Fracture Zone, the Albany Canyons and the Recherche Archipelago.

Each of these areas is of great significance and worthy of protection in its own right. But together, and combined with other important marine values, make the case for protection of the region's marine environment even stronger.

In *Protecting Western Australia's big blue backyard* the ***Save our Marine Life*** Collaboration is urging the Australian Government to secure with certainty the important marine values of the Kalbarri to Eucla region. It can do this by establishing a Comprehensive, Adequate and Representative (CAR) network of large no-take marine reserves. A *Comprehensive* network is one in which all major bioregions have reserves within them. *Adequate* refers to the number, size, configuration and level of protection of the reserves within a bioregion. The reserves also need to be *Representative* of the ecosystems within the bioregions.

This report outlines the many environmental, social and economic benefits that will flow from a CAR network of large no-take marine reserves in Western Australia's big blue backyard.

Australia's marine environment is one of the most important on Earth



Threatened southern right whales are slowly recovering from whaling. A mother and her calf bask in south-coast waters warmed by the Leeuwin Current
Andrew Halsall Photography / © DEWHA

The endangered leatherback turtle, the world's largest marine turtle, drifts with the Leeuwin Current feeding on jellyfish

The continuing good health of the marine waters from Kalbarri to Eucla is integral to the lives of Western Australians

PROTECTING WESTERN AUSTRALIA'S THREATENED MARINE LIFESTYLE

Lifestyle, culture and economy come together in Western Australia's big blue backyard. Consider these images of life in the West:

– piling the kids and spouse in a fully loaded wagon and heading to the beach—a typical summer holiday for the family

– rock lobsters for Christmas dinner, prawns on the barbie out back and deep-fried scallops from the fish and chip shop—all locally caught

– lying on the Cottesloe Beach turning rotisserie-like for an even tan, surfing the break at Margaret River, sailing along one of the windiest coasts in the world at Geraldton—are just part of the lifestyle

– feet up in the tinnie waiting for a fish to bite, leaning over the charter boat's handrail watching for humpback whales off Fremantle, diving among a school of western blue groper—people and marine life strongly connect in Western Australia

– miners from Kalgoorlie and farmers near Norseman cleansing themselves of dust and dung at Esperance Beach, stuck in a bicycle traffic jam on 'Rotto', driving through forests and wineries followed by a sunset walk along an empty south-coast beach—great holiday snaps

– setting commercial lobster pots off the Houtman-Abrolhos Islands, hauling anchor at Fremantle Port to send a load of alumina around the world, exploring the prospects for oil—each connects industry and the marine environment.

The connection between Western Australians and their marine environment is arguably stronger than anywhere else in the nation.

Eighty-five per cent of Australians live within 50 kilometres of the coast, which is a very high figure internationally. But in Western Australia nearly 90 per cent of its two million people live in just eight of the population centres found along the 2500 kilometres of coast between Kalbarri and Eucla. These centres are Geraldton, Perth, Fremantle, Bunbury, Busselton, Mandurah, Albany and Esperance.

In a state that has a population growing faster than any other in Australia, increasing by nearly 1000 people each week, it is the Kalbarri to Eucla region that will continue to be the focus of the Western Australian marine lifestyle.

The marine environment from Kalbarri to Eucla—one million square kilometres in area—is remarkable and its marine life globally unique courtesy of the Leeuwin Current.

As well as its special natural values, each year the region's marine environment delivers significant social and economic benefits. Commercial fisheries annually harvest around 25,000 tonnes of seafood, including the catch of the western rock lobster fishery, Australia's most lucrative fishery. The region also has a significant share of the state's $3 billion tourism industry and the $45 million whale-watching industry, while the Port of Fremantle handles $15 billion of trade.

The future of Western Australia is inextricably linked to the health of the marine environment from Kalbarri to Eucla. Despite this, the region's marine environment faces considerable threats and lacks any marine protected areas. The social and economic benefits it provides are increasingly at risk, and the Western Australian marine lifestyle is under threat.

This has not gone unnoticed by Western Australians who have begun to recognise the signs that all is not well in their big blue backyard.

There is a high level of community awareness in Western Australia about commercial and recreational overfishing of the big reef fish species known as the 'Vulnerable 5'. Western Australians have also observed the decline of water quality, marine life and habitats in the Swan River, Cockburn Sound and the Peel Harvey Inlet. Algal blooms, fish kills, the loss of seagrass nursery areas for fish, and even respiratory ailments for young people, are some of the results.

With strong links existing between the life in estuaries, inshore and offshore waters, these coastal impacts could become a region-wide problem as the population grows, coastal housing spreads and the petroleum and shipping industries expand. This will put further pressure on the relationship that Western Australians have with their big blue backyard.

Then there is the factor of climate change. Rising global temperatures could alter the influence of ocean currents like the Leeuwin Current, with major implications for marine life as well as Western Australia's fisheries. Climate change could also increase the acidity of marine waters to a level that dissolves the shells of many marine animals. A predicted rise in sea level of close to one metre this century would flood the region's beaches and rock pools that are so much a part of local seaside life.

The continuing good health of the marine waters from Kalbarri to Eucla is integral to the lives of Western Australians. Recent polling by the Pew Environment Group showed that Western Australians view marine protection as highly important and want their big blue backyard protected, both from current threats and impacts and those looming on the horizon.

Of those polled, 73 per cent said that marine protection was very important to them. According to 75 per cent of respondents, there was not enough marine protection, and almost 50 per cent called for protection to cover at least 30 per cent of the marine environment.

The Conservation Council of Western Australia, the Australian Conservation Foundation, The Wilderness Society, WWF-Australia, the Australian Marine Conservation Society, The Nature Conservancy and the Pew Environment Group are bringing community, science and good public policy together to assist the Australian Government in establishing a CAR network of large no-take marine reserves to protect the marine life in Western Australia's big blue backyard.

Western Australia's big blue backyard

Shark Bay
HMAS Sydney II
Kalbarri
Houtman-Abrolhos Islands
Geraldton
Dongara
Rottnest Shelf
Jurien
Cervantes
Lancelin
Swan River
Perth Canyon
Perth
Rottnest Island
Garden Island
Mandurah
Bunbury
Geographe Bay
Busselton
Cape Naturaliste
Yallingup
Cape Mentelle
Margaret River
Augusta
Cape Leeuwin
Naturaliste Plateau
Walpole
Denmark
Albany
Esperance
Albany Canyons
Recherche Archipelago
Eucla
Diamantina Fracture Zone
Indian Ocean
Southern Ocean

WHAT'S MISSING FROM THE MAP OF MARINE PROTECTION IN AUSTRALIA?

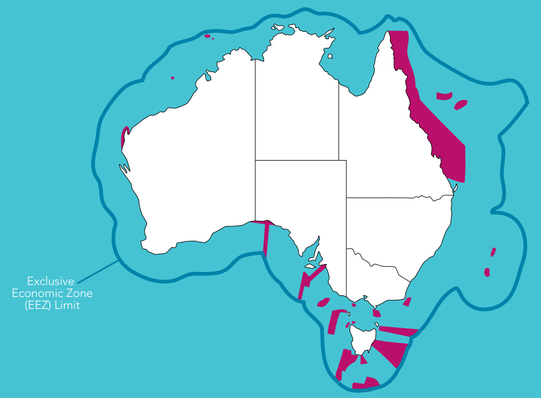
The marine environment of Australia's Exclusive Economic Zone (EEZ) is unique but just four per cent of it has been given sufficient protection from extractive activities.

The map below shows the location of marine protection in our EEZ. The shaded areas (nine per cent of EEZ) include marine protected areas that prohibit extractive activities and others where these are allowed to continue.

Most of Australia's marine protection is on the Great Barrier Reef and around Tasmania and the sub-Antarctica Heard, McDonald and Macquarie islands.

Compared with other states, the waters off Western Australia are clearly the least protected, with not even one per cent covered by no-take protection. And within that area, the waters between Kalbarri and Eucla have next to no protection of any kind despite being home to so many globally unique and threatened species.

A CAR network of large no-take marine reserves as proposed here in *Protecting Western Australia's big blue backyard* will contribute significantly to meeting Australia's international obligations to establish comprehensive, adequate and representative marine protection.



Key

Exclusive Economic Zone

Eddies

Leeuwin Current

Scale

0 100 200 300 400 500 600 700 800 Km

0 100 200 300 400 500 Mi

Source of bathymetric image: Geoscience Australia

MAINTAINING AUSTRALIA'S INTERNATIONAL REPUTATION IN MARINE PROTECTION

When the Australian Government signed the United Nations Convention on the Law of the Sea, which came into force in 1994, Australia was given the right to use the Exclusive Economic Zone (out to 200 nautical miles) for social and economic benefits. With that right came the formal responsibility for the huge area of the world's marine environment entrusted to our care.

This responsibility, Australia's commitments under the international Convention on Biological Diversity and our participation in IUCN's program promoting the establishment of a global representative system of marine protected areas, saw Australian governments agree on a plan of action in 1998 for the National Representative System of Marine Protected Areas (NRSMPA). Since that time the NRSMPA has been in development across Australia. All types of marine protected areas within it now cover more than nine per cent of Australia's marine environment. Just over four per cent is covered by no-take protection.

Looking after a marine environment as large as Western Australia's big blue backyard is an enormous responsibility, but Australia is well-placed to do so. We have a stable government system, a history of international leadership in marine protection, the necessary scientific expertise and a community that is seeking action.

By establishing a CAR network of large no-take marine reserves, the Australian Government would put in place the critical foundation necessary to secure the health of the region's unique and important species and ecosystems, and Western Australia's social and economic future.

In time, the next step will be to ensure that all industries using Australian waters are truly sustainable, operating within the constraints of the marine ecosystems that support them. The starting point is to lay the cornerstone of marine protection: large no-take marine reserves.

Creating effective and credible marine protected areas is a big challenge. The marine environment is immense, complex and interconnected. Marine reserves cannot be effective unless they are of a size and protection level that matches the ecosystems and the geographical ranges of species they seek to protect.

This was recognised by the US Government which established two of the world's three largest no-take marine protected areas in US waters.

In 2006 the US Government created the Papahānaumokuākea Marine National Monument in the north-western Hawaiian Islands covering 365,000 square kilometres. This was followed with marine national monument protection given to 500,000 square kilometres in the Mariana Trench, the northern Mariana Islands, the Rose Atoll and a chain of Central Pacific islands in early 2009.

Prior to the declaration of these large, ecologically valuable and diverse marine protected areas, the largest marine reserve was in the marine waters of the tiny Pacific nation of Kiribati, with no-take protection covering 410,000 square kilometres.

Australia is seen as a leader in protection of the marine environment, largely due to protection of the Great Barrier Reef, as well as Heard, McDonald and Macquarie islands in our sub-Antarctic waters. The 2003 rezoning of the Great Barrier Reef Marine Park, with its expansion of the no-take green zones to cover one third of the marine park, received international acclaim.

However, this reputation should not be taken for granted. A recent analysis by WWF-Australia revealed that the marine environment in the South-east Marine Region was not adequately protected by the Commonwealth network of marine reserves established there in late 2007.

Creating a CAR network of large no-take marine reserves in Western Australia's big blue backyard is vital to maintaining our international reputation in marine protection.

Western Australia has always been larger than life, politically, economically, socially and environmentally. Its marine environment is no different. Big values need big protection.

THE MANY BENEFITS OF MARINE PROTECTION

We can protect the big values of Western Australia's big blue backyard by establishing a CAR network of large no-take marine reserves between Kalbarri and Eucla. These will protect the habitats and feeding, breeding, nursery and resting areas of the region's marine life.

Allowing marine life to survive and thrive in the Kalbarri to Eucla region will help commercial and recreational fishers keep putting fish on the table, so we will still see 'gone fishing' signs in windows. Jobs in Western Australia will continue to grow in the marine-based industries of the future, including whale watching and the dive and ecotourism sectors, at the same time as many of the great natural values elsewhere in the world's oceans disappear.

By reducing or eliminating threats, marine protection can give marine life greater resistance to climate change. More abundant marine life and undisturbed sea floor sediments can also help fight that change by storing carbon.

The creation of a CAR network of large no-take marine reserves is the most effective way to protect the threatened whales, sharks, tuna and other fish, seals and seabirds of the region. Ranging across large areas, each relies on very specific places at different times in their life cycle in order to feed, take shelter, find mates, breed and grow.

The movement of water, nutrients and marine life creates strong connections between estuaries, inshore and offshore waters and from the sea floor to the surface. Many animals living on the bottom rely on the nutrients that rain down from the surface, while fish that grow up in estuaries often spend their adult lives in open waters. Large no-take marine reserves can help protect these and many other ecological connections and natural life cycles across the region.

Large no-take marine reserves will also protect the vital role of the biggest connector of all in the region, the Leeuwin Current. In large reserves the marine life will increase in abundance and the Leeuwin Current will carry that benefit along the region. But if we allow the region's marine life to decline, then the Current will have fewer larvae, fish, coral polyps and other marine life to transport, causing the region to suffer.

The creation of a CAR network of large no-take marine reserves will also send a message that we as a nation highly value our marine life. This will encourage improved marine management and better catchment management, reducing the threats to those marine reserves that have links to inshore waters and estuaries.

Large no-take marine reserves are **not** 'no-go' areas. Non-extractive uses such as diving, scientific research, ecotourism and education will continue, benefiting from improved marine health. Shipping and sailing will continue as before.

The Australian Government can now bestow these benefits to Western Australia's big blue backyard by establishing a CAR network of large no-take marine reserves that will again see our nation at the forefront of international efforts to protect the world's oceans.

Weedy seadragons are endemic to southern Australia's cooler waters where they are threatened by harvesting for the aquarium trade and accidental catch in fishing nets

The Houtman-Abrolhos Islands are the most southerly major tropical coral reefs in the Indian Ocean, thanks to the Leeuwin Current's delivery of warm water and tropical species

What's so special about Western Australia's big blue backyard?

CURRENT AFFAIRS

Ocean waters are never still. The rise and fall of waves, the ebb and flood of tides, the ups and downs of canyon waters, the spirals in eddies and the streaming of currents—ocean water is always on the move and marine life goes with the flow.

In the world of ocean currents there is nothing quite like the Leeuwin Current. It is the only major current in the world that flows south along the eastern side of an ocean basin—all others flow north.

By heading south, the Leeuwin Current has created a marine and coastal environment in Western Australia that is very different to that provided by the cool and northerly currents off the west coasts of Africa and South America. The Leeuwin Current makes Western Australia's marine environment a very special place in the world.

Currents like the Leeuwin transport marine life around the oceans of the world. They form in response to the effects of solar heating, wind, gravity and the Earth's rotation, and are influenced by variations in atmospheric pressure, water temperature, salinity and sea floor shape.

Coastal climates are affected by ocean currents—warm currents, such as the Leeuwin Current, lead to increased evaporation and higher rainfall along nearby coasts, while evaporation and rainfall are lower on coasts bordered by cold currents.

Fisheries can be enhanced by ocean currents. Equator-bound, west-coast currents such as the Benguela off Africa and the Humboldt off South America bring upwellings of cool, nutrient-rich water to the surface. This drives marine plant production and attracts enormous amounts of surface-dwelling fish that are targeted by some of the world's major fisheries. In contrast, with no major northerly flowing surface currents and nutrient-poor marine waters, Australia ranks fiftieth in world fisheries production even though we have the third-largest marine area in our care.

There are six main currents in the Kalbarri to Eucla region—the Leeuwin Current, the Leeuwin Undercurrent, the Western Australian Current, the Flinders Current and the seasonal and inshore Capes and Creswell currents. They flow in different directions and with varying strengths, but each has its own special influence on the region's marine environment and marine life. By far the most important of these is the Leeuwin Current.

The Leeuwin Current is like the southbound lanes of a freeway and marine life is like the traffic. The lower deck is the Leeuwin Undercurrent, while breakaway eddies are the exits and on-ramps. During summer the northbound traffic of the Capes Current is driven by south-east winds off capes Leeuwin and Naturaliste. Once around Cape Leeuwin, the Leeuwin freeway is eastbound, while the cooler Flinders Current carries westbound traffic.

The Leeuwin Current makes Western Australia's marine environment a very special place in the world

TAKING THE TROPICS SOUTH

The Leeuwin Current begins its long and important journey in the tropical waters surrounding the Indonesian islands. The warm waters around the islands are less dense and lower in salinity than the cooler waters of southern Australia. The result is a sea level around the islands that is 50 centimetres higher than in the south. In response, the Leeuwin Current does what water normally does—it flows 'downhill'.

The strength of the Leeuwin Current in the Indian Ocean is variable from year to year and season to season—it is at its strongest in autumn and winter. The current's variations in strength are related to major ocean processes in the Pacific Ocean, which are linked to the Indian Ocean through Torres Strait and the waters across northern Australia.

During what are called El Niño events, differences in atmospheric pressure push sea level higher on the eastern side of the Pacific and reduce sea level around the Indonesian islands. At these times the sea level gradient along the west coast is reduced and the Leeuwin Current is weaker.

With La Niña events, sea level is relatively higher on the western side of the Pacific and also around the Indonesian islands. When this occurs the sea level gradient is steeper and the Leeuwin Current stronger.

From Indonesia the Leeuwin Current carries warm and clear tropical water down the west coast of Western Australia, around Cape Leeuwin, along the state's south coast, across the Great Australian Bight, finally ending on the western shores of Tasmania. At 5500 kilometres, it is the world's longest continuous coastal current.

Tropical fish larvae and coral polyps, whales, tuna and other marine life are either taken or go along for the ride. The world's largest marine turtle, the endangered leatherback turtle, drifts with the current while surface-feeding on jellyfish. It can also swim away from the current and dive to depths of 1200 metres on the continental slope.

As water temperatures rise with climate change, the Leeuwin Current could bring more tropical coral species into the region and carry them even further south. This is the conclusion of a scientific study of fossil evidence by the ARC Centre of Excellence for Coral Reef Studies. According to the analysis, tropical coral species could move south to avoid coral bleaching and coral diseases associated with warmer water in the tropics. There are suitable areas of shallow and clear water off the west coast of Western Australia where these climate refugees could re-establish themselves as southern waters also warm with climate change. The Centre of Excellence believes these areas need to be protected and well managed to provide a sanctuary for these travelling coral species.

CREATING A UNIQUE MARINE REGION

As it rounds Shark Bay the Leeuwin Current enters the Kalbarri to Eucla region. About 200 kilometres to the west are the recently discovered wrecks of *HMAS Sydney II* and the German cruiser, the *Kormoran*, both sunk in battle with one another in 1941.

On passing Kalbarri, the Leeuwin Current is less than 100 kilometres wide, barely 300 metres deep and travelling at about two kilometres per hour. From here its journey will have a profound effect on the region's marine life, climate and people.

The Leeuwin Current's warm waters moderate winter temperatures and encourage higher annual rainfalls than would normally occur here. It brings tropical species south where they are shaken and stirred with subtropical and temperate species in a remarkable cocktail of marine life. Blue whales and southern right whales from cooler waters share the region's ocean with tropical short-finned pilot whales, and striped and spinner dolphins.

The Leeuwin Current's influence, the region's isolation and a history free of major environmental disturbance over geological time have created a marine environment unlike any other. Marine plants and animals have evolved here in their own ways, making the best of a unique west coast environment. Most of them are not found anywhere else in the world, making this region globally unique.

The Current's southerly movement prevents upwellings of nutrients from the sea floor. This suppresses blooms of phytoplankton (tiny plants) and zooplankton (tiny animals). In turn, this limits the abundance of surface-dwelling fish that target the plankton for food.

With only a few small river discharges, nutrient levels are very low and the warm waters crystal clear. Seaweeds and seagrasses thrive in depths much greater than usual—extensive seagrass beds on the west coast are found in water at least 30 metres deep. These are critical feeding and nursery areas for marine species targeted by commercial and recreational fishers.

The low level of nutrients in surface waters and the water column also means that marine species living on or near the sea floor are more numerous and most are invertebrates, not fish. As a result, the region's commercial fisheries largely target bottom-dwelling crustaceans and molluscs: western rock lobster, deep sea crabs, prawns, abalone and scallops.

Upward and downward spirals of water break off the Leeuwin Current at the Abrolhos Islands, Jurien Bay, Rottnest Island and Cape Naturaliste and assist the region's upwellings. These eddies can also carry marine life off the continental shelf, out into the Indian Ocean and possibly back again, fuelling food supplies for open-ocean species.

Where localised upwellings of nutrients do occur, usually at the heads of submerged canyons etched in the edge of the continental shelf, they become oases for larger marine life. Between these oases, marine animals and plants have adapted to an environment low in nutrients but with deep light penetration.

The nutrients raised by the upwellings are a mixture of materials from marine animals and plants that have died and sunk to the seabed, and plants, nitrogen, phosphorous and silica flowing from rivers.

Nutrients are just what phytoplankton and zooplankton need for growth, and small surface-dwelling fish such as pilchards, herring, sprat, anchovies, red bait and jack mackerel gather in vast numbers to feast on them. In turn they are eaten by southern bluefin tuna and spanish mackerel. These large and mobile predators survive on limited food resources while travelling between upwellings.

There is still much scientists do not know about the Leeuwin Current or the impact climate change might have on its nature and strength. However, there is no doubt that the Leeuwin Current has brought together a unique and internationally significant mix of marine life in Western Australia's big blue backyard.

BUILDING A CONNECTION BETWEEN PEOPLE AND THE REGION'S MARINE WORLD

It is more than 40,000 years since the ancestors of the Noongar and Yamatji people arrived in the Kalbarri to Eucla region, staying to build a long, continuous and intimate social, cultural and spiritual connection with their Sea Country.

Passed down through the generations in Indigenous communities are stories of how the region's land and seascapes were created. One tells of the carving of Perth's Swan River by Waakal, the Rainbow Serpent.

Shell middens at former coastal camp sites show that the Noongar and Yamatji people used marine resources extensively over millennia. The beaching of a whale would have been cause for spontaneous feasting and celebration, while fish traps in estuaries such as the Peel Harvey Inlet at Mandurah provided a more regular marine-based food supply.

Today, the connection of Indigenous Australians with their Sea Country in the Kalbarri to Eucla region remains strong.

Europeans came across the ocean much later to find safer trade routes, new knowledge and resources, to chase marine life and to transport goods.

The waters of the region were on the Dutch East India Company's spice-trade route to Batavia (now Jakarta, Indonesia) established in 1610. Dutch mariners had the region largely to themselves until the 18th century when a rivalry developed with the French and the English over claims to the 'Great Southern Land'. The Kalbarri to Eucla region was caught up in the contest until the English won by establishing Albany in 1826 and the Swan River Colony (now Perth) in 1829.

In the early days of exploration and trade, Europeans made contact with Indigenous people living along the coast, especially where the survivors of shipwrecks reached land. Little is known of these early interactions. However, the push by European settlers away from the limits of small coastal ports to establish pastoral, agricultural and mining interests, led to the unjust treatment, death and displacement of many of the region's Indigenous people.

After Major Edmund Lockyer founded a military base at Albany in 1826 he rescued Indigenous women who had been kidnapped by sealers for sexual slavery. He sent the kidnappers east for trial and the local Minang people held a corroboree in his honour. Nevertheless, injustice continued, including the kidnap of Indigenous men for forced labour in the pearling and shore-based whaling industries.

The early European explorers were more interested in discovering and claiming the land than the sea. But when sealing and whaling began—a whaling ship came out with the First Fleet in 1788—the exploitation of marine resources began in earnest. By the 1830s many shore-based whaling stations operated along the region's south coast, and 300 whaling vessels were working off the west coast in 1840.

Stormy weather and rough seas made whaling a dangerous business. Wrecks were frequent. The *North America* and *Samuel Wright* were both wrecked in Koombana Bay in 1840, while in 1844 the US-based *Cervantes* was wrecked off what is now the town of Cervantes near Jurien. Salvage of the wrecks was usually carried out by locals and they gradually took over the whaling industry from the Americans.

For a time whaling and sealing were important to the region's economy, but by the mid-1800s whale numbers had declined and the expanding production and trade of wool, wheat, sandalwood, meat and minerals were the mainstays of the economy. Geraldton and Albany became large, bustling ports to meet the demand. Albany maintained its premier port status until rocks at the mouth of the Swan River were blasted away to build the new port of Fremantle in 1897. Shipping was critical to overseas and domestic trade as land-based routes were rough or non-existent.

Until the 20th century, fishing was usually carried out with other marine-based activities—cargo transport, whaling and sealing—or simply as a means to vary the local diet. The commercial fishing industry grew slowly and fish canneries were established in the early 1900s, including a rock lobster cannery on West Wallabi Island in the Houtman-Abrolhos Islands. The introduction of trawling gear, refrigeration and motorised steel boats allowed fishers to go further offshore, to stay away from port longer and to sell their products across Australia and overseas.

Through the development of its international trade, the Kalbarri to Eucla region and its marine environment are now well connected with the rest of the world.

By the 1830s many shore-based whaling stations operated along the region's south coast, and 300 whaling vessels were working off the west coast in 1840

Perth's iconic Cottesloe Beach is part of Western Australia's marine lifestyle but is under threat from predicted sea level rises caused by climate change
© Nico Kenderessy

Surfing is growing in popularity because Western Australia is blessed with many fine surf breaks, including this world-famous one at Margaret River
© jamiescottimages.com

Strong winds, currents and reefs along the Western Australian coast have caused many shipwrecks that are now a major focus for dive ecotourism
© Jürgen Freund

WESTERN AUSTRALIANS CONNECTING WITH THEIR MARINE ENVIRONMENT

The population of the Kalbarri to Eucla region is growing, continuing the strong connection between people and Western Australia's big blue backyard. Perth and the commuter suburbs and coastal towns directly to its north and south are the scene of most of this population growth.

The ports of Geraldton, Fremantle, Bunbury, Albany and Esperance have expanded to meet trade demand from a strong mining and agricultural sector, as well as major industrial development in the Kwinana and Bunbury areas.

Surfing, diving and ecotourism have grown in popularity in recent decades and along with other tourism and recreational activities have become essential to the economies of coastal communities such as Esperance and Busselton.

World-famous surf breaks are found at Margaret River and Yallingup on the south-west coast, while those at Dongara and Point Moore near Geraldton are becoming increasingly popular. Being one of the windiest coasts in the world, the west coast is internationally recognised as ideal for windsurfing.

Increasing leisure time, mobility and affluence are fuelling tourism growth, as well as the community's increasing awareness of the region's natural marine values. These include the Houtman-Abrolhos Islands, whales and dolphins, coral and rocky reefs, seals and seabirds.

Whale watching is a booming industry, seal watching is becoming very popular on the south coast near Esperance, and Bunbury and Rockingham are focal points for dolphin watching. The charter boat sector has grown in response to this as well as the growth in recreational fishing.

Private boat ownership has doubled to 100,000 in the past decade, and there is growth in and further pressure for marina developments. Although jobs in commercial fishing have dropped, around 30 Commonwealth and state-managed commercial fisheries operate in the region.

One of the Royal Australian Navy's most important defence facilities is the Stirling Base on Garden Island near Perth.

Marine-based production of oil and gas is limited to the operation of a small oil field at Cliff Head about 20 kilometres south of Dongara, but several gas discoveries in the same basin are yet to be exploited. The search for oil and gas goes on and the area of exploration is expanding. It now includes waters near the Houtman-Abrolhos Islands, the Perth Canyon and Esperance.

Increasing leisure time, mobility and affluence are fuelling tourism growth, as well as the community's increasing awareness of the region's natural marine values

CRUSTACEANS AND MOLLUSCS RULE

High-value crustaceans are king of the fisheries in Western Australia. According to the most recent status reports for Western Australia's fisheries, the catches of western rock lobster, blue swimmer crabs, deep sea crabs and prawns were worth $335 million in 2007.

Molluscs are next in dollar-value importance, with the pearl oyster industry in the state's north providing another $122 million. The annual harvest of Roe's, greenlip and brownlip abalone was valued at $12 million. Sharks, goldband and pink snapper, spanish mackerel, baldchin groper, pilchards, Australian salmon and other fish contributed more than $40 million to the Western Australian economy.

State-managed commercial fisheries on the west coast of the Kalbarri to Eucla region are dominated by the western rock lobster. Line fishing for West Australian dhufish and pink snapper is also significant but the fish stocks are in decline. Commercial fishing for these and other species has now been banned within the Perth metropolitan area as a first response to help reduce pressure on them.

Roe's abalone grazes the inshore reefs in shallow waters and is prised from the rocks by local abalone divers. Crab fishers set pots for deep sea crabs—king, champagne and crystal—on the upper continental slope.

Smaller state-managed fisheries target bait, pilchards, squid, blue swimmer crabs, saucer scallops and estuary fish. Concerns have been expressed about the impact that saucer scallop trawling has on sponges and corals and the accidental catch of sea snakes, turtles and sharks.

On the south coast the most valuable fishery is for greenlip and brownlip abalone, which are collected from algae-covered reefs. These reefs provide few habitats for rock lobsters and crabs compared with west coast reefs and, as a result, the south coast crustacean fishery is tiny in comparison to that on the west coast.

The harvest of fish is relatively more important on the south coast than the west coast due to cooler waters, the presence of temperate species and the affects of canyon upwellings along the continental slope. The shark and finfish fishery is second in value to the abalone fishery, and the pilchard fishery third. Small fisheries also exist for Australian salmon, herring and estuarine species.

Of the Commonwealth-managed fisheries in the region, longline fishing in the Indian Ocean targets skipjack, albacore, yellowfin and bigeye tuna, striped marlin and swordfish. Trawl nets are dragged across the fragile sea floor communities of the west coast's continental slope seeking bugs, ruby snapper and orange roughy. Pilchards, orange roughy, deepwater flathead and bight redfish are the main species taken in Commonwealth fisheries on the south coast.

When assessing commercial fisheries operating within Commonwealth waters for its profile of the South-west Marine Region, the federal environment department found that in the Kalbarri to Eucla region there are targeted species that are 'overfished' in two fisheries, 'fully fished' in three fisheries and 'uncertain' in two fisheries. Four fisheries had not been assessed.

The number of recreational fishers is growing in the region, and they now have more fishing time available because of retirement, semi-retirement or the fly-in/fly-out shift arrangements for workers in the mining boom.

Recreational fishers target similar species to commercial fishers on the west and east coasts. Each year anglers use lobster pots to catch 500,000 western rock lobsters. For some species, such as West Australian dhufish, baldchin groper and the breaksea cod, anglers catch more than commercial fishers. In Cockburn Sound anglers take 80 per cent of the total fish catch. In estuaries their harvests are from 30–70 per cent of the commercial catch, for blue swimmer crabs it is 60 per cent, while for Roe's abalone it can be up to one third.

Most of the recreational fishing activity in the Kalbarri to Eucla region is focused on the west coast. However, recreational fishing is increasing on the south coast, despite the area's stormy seas, as the population grows, leisure time increases, boats get bigger and stocks decline on the west coast.

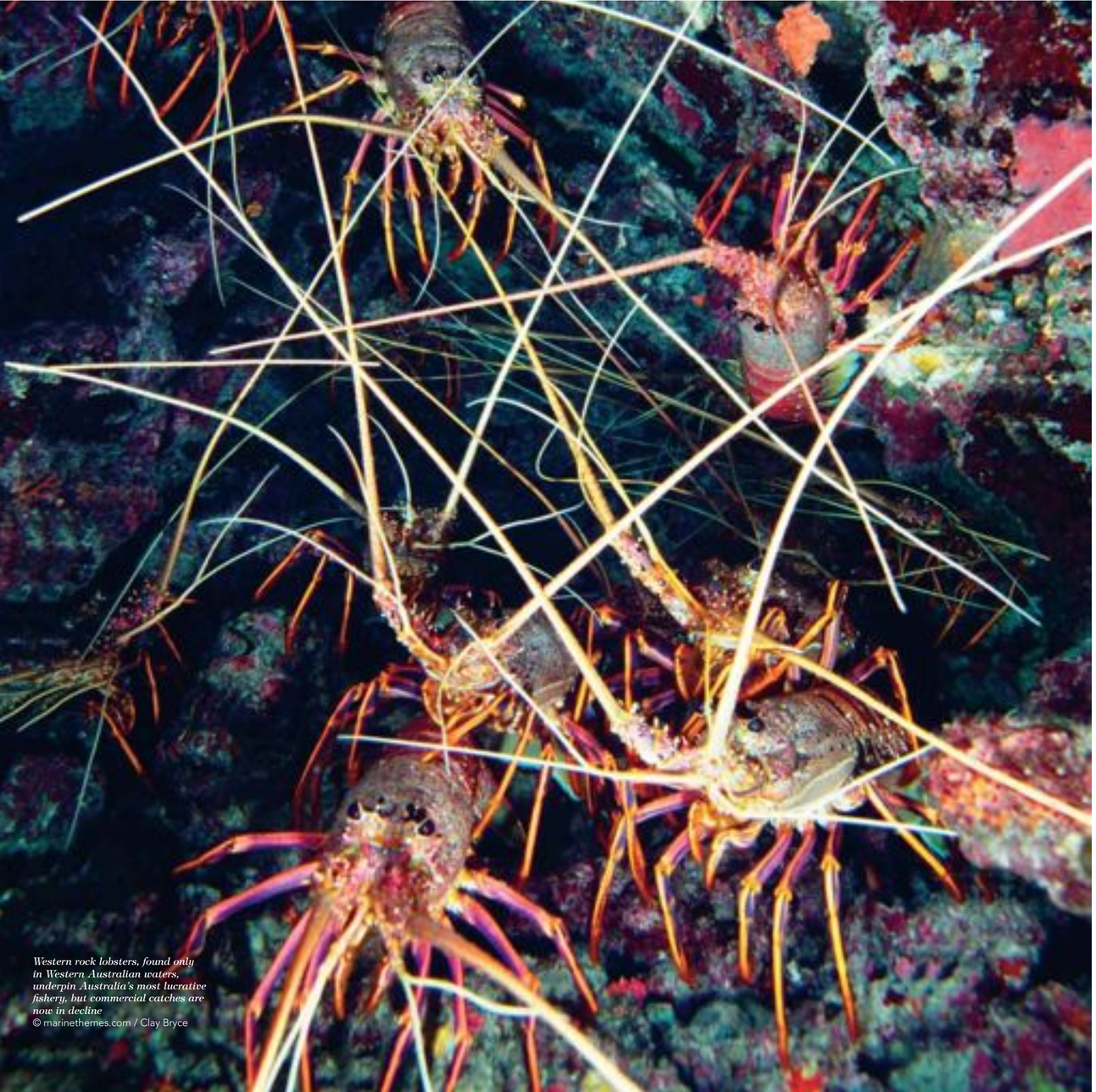
Like its commercial counterpart, recreational fishing can remove significant quantities of fish from the marine environment. This must be factored in to management and protection measures if there are to be fish for anglers in the future.

The Kalbarri to Eucla region's commercial fisheries are worth hundreds of millions of dollars each year. Recreational fishing is important in the lifestyle of many Western Australians. But the fish species that both of these fishing sectors rely upon are under serious fishing pressure. Establishing a CAR network of large no-take marine reserves is an effective way to ensure the future of the region's commercial and recreational fisheries.

Establishing a CAR network of large no-take marine reserves is an effective way to ensure the future of the region's commercial and recreational fisheries

This school of rough bullseyes swirling among plate coral off the coast of Cape Naturaliste is able to find food and shelter in sea floor communities

Wedge-tailed shearwaters living on the Houtman-Abrolhos Islands find food by diving into schools of small surface fish such as these anchovies



Western rock lobsters, found only in Western Australian waters, underpin Australia's most lucrative fishery, but commercial catches are now in decline

THE HOUTMAN HOTSPOT FOR MARINE LIFE

Lying in the Leeuwin Current's path, bathed in its warm tropical waters, are the globally significant Houtman-Abrolhos Islands.

It was Dutch sea captain Frederik de Houtman who so modestly named the Houtman-Abrolhos Islands in 1619. This glittering archipelago of 122 islands lies 70 kilometres off the Geraldton coast.

Ten years after Houtman's visit, the islands became the scene of human tragedy with the wreck of the Dutch East India Company's treasure-laden ship the *Batavia*. It is a dark and infamous story, one of mutiny, murder and mayhem among the survivors as they waited nine months for rescue.

The wreck of the *Batavia* is also well known for what it revealed about the early exploration and use of Australia's oceans by the Dutch, well before the arrival of French and English explorers. After the wreck's discovery in the 1960s, Australian history had to be rewritten.

The *Batavia's* hapless survivors, who would have made extensive use of marine life on and around the islands, could never have known of its global significance.

As warm waters flow among the Houtman-Abrolhos Islands, the larvae, eggs and polyps of tropical species settle on the fringing coral reefs. Thanks to the Leeuwin Current, which keeps the waters warmer than they would otherwise be, this is the most southerly location for tropical reef-building coral in the entire Indian Ocean.

The tropical marine life brought to the islands, reefs and lagoons mixes with subtropical and temperate algae, fish and invertebrates. There are more than 400 species of fish and at least 184 species of coral, 492 of mollusc, 110 of sponge, 172 of echinoderm such as seastars and sea cucumbers, and 234 of benthic algae (which include seaweeds).

With an abundance of small surface-dwelling fish in the surrounding shallow waters forming tantalising 'bait balls', the islands are internationally important breeding colonies for seabirds including the sooty tern and bridled tern. Nowadays more than one million pairs of wedge-tailed shearwaters and 68,000 pairs of the threatened lesser noddy live and breed here—the only known Australian breeding site for this species.

But the significance of these remarkable bird colonies was not always recognised. On islands like Rat Island, the guano formed by the build up of the birds' droppings was mined from the 1890s for use as fertiliser on Western Australian farms. Before mining began an estimated 1.5 million brown noddy and sooty terns lived on the islands. By the time mining ended in the 1940s, and after egg collectors, rats and cats had taken their toll, the brown noddies and sooty terns were gone.

Fortunately, the sooty terns have returned to the Houtman-Abrolhos Islands and are now extending their range south. Along with bridled terns, roseate terns and brown noddies, they have settled on Lancelin Island, the most southerly point for any of their colonies. The extension to their range could be connected to a southerly shift by their food fish as the region's waters warm with climate change. No-take marine reserves can provide vital protection for the food species needed by these birds.

The Houtman-Abrolhos Islands are a hotspot for marine life and this has made them an increasingly popular destination for ecotourists, recreational fishers and divers—20 of Australia's 132 dive wrecks are found here. Unfortunately, greater pressure on fish stocks, and damage to delicate corals from fishing gear and anchors, are some of the results of this growing interest.

THE LEEUWIN, LARVAE AND LOBSTERS

Before leaving the Houtman-Abrolhos Islands, the Leeuwin Current plays a pivotal role in the life cycle of the western rock lobster, which is only found off Western Australia. The region's western rock lobster fishery is Australia's most lucrative fishery.

When lobster larvae emerge from their mother's eggs, they spend ten months drifting as plankton offshore. Those that avoid being eaten by small fish turn into puerulus, which is the life stage when they begin to look like lobsters. Westerly winds help the puerulus drift inshore where they settle on shallow reefs and among seagrass meadows nurtured by the clear warm waters of the Leeuwin Current.

When the Leeuwin Current is strong, water temperatures are higher and a greater number of puerulus are able to survive. More settle, grow up as rock lobsters and then move en masse to deeper water four years later. The current also carries rock lobster larvae from the Houtman-Abrolhos Islands to southern waters where they make up half of the puerulus settlement each year.

The life of a western rock lobster is critical to many other lives in the region's marine waters. As it grows, so too does the size of its predators. Lobster larvae are food for small pelagic fish. At the puerulus stage it is eaten by wrasse or trumpeter, and as an adult a rock lobster is on the menu for seals, baldchin groper, West Australian dhufish, octopuses and wobbegongs. The lobster is a voracious predator in its own right, feeding on snails, crabs and urchins.

For the past two years there have been very low numbers of puerulus settling in the shallows along the region's west coast. There are concerns this could mean many fewer lobsters reach adulthood, further worsening recent poor catches.

The variable strengths of the Leeuwin Current also lead to ups and downs in the commercial catches for other species such as prawns, scallops, Australian salmon, herring, pink snapper, whitebait and tailor. The links between the Leeuwin Current and these commercially significant species are yet to be fully understood.

Scientists from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) recently suggested that climate change could weaken the Leeuwin Current and lead to cooler water temperatures in the region. This could, however, be offset by the rising water temperatures generally associated with climate change. With water temperatures influencing the distribution and productivity of many marine species, any long-term increases or decreases within the region could have significant implications for the region's marine life.

LIFE ON THE SHELF

Beyond the Houtman-Abrolhos Islands, the Leeuwin Current passes by inshore lagoons, rippled sands, coral reefs, seagrass meadows and beds of kelp on the Rottnest Shelf.

Stretching from Kalbarri to Cape Leeuwin, the Rottnest Shelf's shallow and sheltered waters—only 50 metres at their deepest—are protected by submerged limestone ridges and reefs and influenced by the Leeuwin Current. They are now recognised as a globally unique subtropical ecosystem.

Here the low-nutrient waters are clear, light penetrates further and seagrass and kelp can grow at greater depths than usual. West Australian dhufish, pink snapper, breaksea cod, baldchin groper and the western blue groper use these areas to feed, breed and grow. Western blue groper can live in these waters for up to 70 years.

Regular visitors to the inshore lagoons of the Shelf include herring, garfish, tailor and Australian salmon. They feed on small surface-dwelling fish and squid and in turn provide food for mulloway, snapper, samson fish, spanish mackerel and dusky whaler sharks. Species such as pink snapper live the early part of their lives in coastal bays and later move to the shelf edge and over the shelf break. There, wave energy and water circulation is higher and food is more abundant.

The creation of large no-take marine reserves would protect the strong connections between life on and off the Rottnest Shelf.

TROUBLE FOR THE BIG REEF FISH

Overfishing by commercial and recreational fishers in the Kalbarri to Eucla region is placing enormous pressure on popular fish species.

The West Australian dhufish, pink snapper, baldchin groper, breaksea cod and red snapper (also known as bight redfish) have been dubbed Western Australia's 'Vulnerable 5'. Their populations have plummeted and are now at risk. Other species with the potential to be added to this 'at-risk' list include queen snapper, western blue groper and red emperor.

Their large size makes these reef fish easy targets for fishers, while their slow growth and late maturing give their populations no time to recover. The drop in numbers of the 'Vulnerable 5' species has been greatest in the Perth area. Fishers from Perth are now travelling further north and south to find them.

With improved fish-finding technology and gear, an increasing human population and booming boat ownership, few areas of the region are now out of the reach of fishers. There are fewer places for fish to hide.

The number of eggs produced by one 98-centimetre female dhufish is equivalent to that produced by 11 females of 60 centimetres in length. Big, fat and old females also produce stronger larvae than younger females, dramatically increasing their reproductive success. It is therefore critical to the future of the species that the larger females are left to spawn. Unfortunately, the dhufish summer spawning time occurs when recreational fisher numbers are at their highest.

Although catch and release fishing is on the increase, most big reef fish are unlikely to survive this practice. The fish, like divers, suffer the bends during rapid changes in pressure as they are pulled to the surface.

The establishment of a CAR network of large no-take marine reserves can help the 'Vulnerable 5' survive.

DOWN THE CONTINENTAL SLOPE

Washed off the Rottnest Shelf are the broken blades of seagrass and seaweed and the remains of dead animals. This is food for life on the continental slope that begins at a depth of about 200 metres.

Bryozoans (colonies of small animals called zooids), ascidians (sea squirts), sponges and algae attach themselves to the sea floor of the continental slope and provide shelter and food for molluscs, crystal crabs and sea spiders which are eaten by blue grenadiers, dogfish and cucumber fish. Species diversity is high with 480 fish species identified for the area, of which 31 are found nowhere else on Earth.

In the deeper waters above the slope a six-metre megamouth shark might be seen moving towards the surface to filter feed on shrimp and jellyfish. These sharks are extremely rare, with only six specimens ever collected. One of these was found beached at Mandurah, south of Fremantle, in August 1988.

A visitor to the continental slope might also find a toothless Gray's beaked whale sucking up deep sea fish and squid, and possibly seastars and urchins. Little is known about the world's 21 species of deep-diving beaked whales, but we do know that half of those species are found in the Kalbarri to Eucla region.

Down below, on the sea floor of the continental slope, sponges filter food from the water and also provide shelter for crustaceans, fish and seastars, as well as homes for zoanthids and food for cowries. Scientists believe that sponges could be the oldest living animal on Earth, with one specimen thought to be older than 2300 years of age. Sponges in Western Australia are the 'old-growth forests' of the sea.

Large sponges have become rare on Australia's continental shelf and slope. In some areas they are completely absent due to trawling. Harrison's dogfish and other small deepwater sharks that live and are caught on the continental slope have also been seriously affected because they are long-lived and produce few young. Sea floor communities and bottom-dwelling fish need the protection from bottom trawling that large no-take marine reserves provide.

The continental slope ends at the abyssal plain. This huge and mysterious plain covers much of the region's sea floor. What weird and wonderful creatures have adapted to life in the dark, at depths of more than 5000 metres and with an immense weight of water upon them? Scientific discoveries elsewhere provide clues, indicating that they could include giant sea spiders, deep sea anglerfish, viperfish, prickly dogfish, frilled sharks, tripod fish or giant isopods (related to shrimps and crabs).

Unless we act to protect the continental slope and abyssal plain, we may never find out what mysteries lie deep below the waves.

The endemic West Australian dhufish is one of a number of big reef fish species under threat from overfishing by commercial and recreational fishers

Overfished sharks, such as this dusky whaler shark, require large no-take marine reserves to ensure their survival

Large no-take marine reserves will protect sea floor habitats and marine life in the water column and increase the abundance of fish

Carnac and Garden islands near Perth are the most northerly colonies for little penguins that rely on a healthy marine environment for their food of small surface fish

The escape of the virus led to fish-kills that were perhaps the worst ever caused by humans, breaking the link in the food chain and affecting other animals, including little penguins and seals

DIVING DEEP INTO THE GRAND PERTH CANYON

The Perth Canyon marks the end of the line for some of the tropical sponges, corals and crabs the Leeuwin Current has supported beyond their normal range. It is Australia's largest marine canyon and was cut deeply into the edge of the Rottnest Shelf by the ancient course of the Swan River. Deeper than the US Grand Canyon, it meanders for 100 kilometres down to a depth of 4000 metres where it meets the abyssal plain.

In summer, south-easterly winds drive the Capes Current north, creating upwellings in the Perth Canyon and off Cape Naturaliste and Cape Leeuwin. Huge balls of krill and swarms of squid rise with cold water and nutrients until they are stopped by the warm Leeuwin Current about 300 metres below the surface. Southern bluefin tuna, and sperm, fin, beaked, minke, humpback, southern right, blue and pygmy blue whales all dive into this deep blue food feast.

The Perth Canyon is of interest to Australia's marine-based oil and gas industry, presenting potential risks to marine species and ecosystems.

Seismic testing for oil and gas prospects can add to marine noise pollution, and waste water, oil spills and blowouts can cause chemical pollution. Other factors can include the ongoing disturbance of marine life by oil rigs, pipelines, floating facilities, tankers, ships and helicopters. Unique and rare species, of which there are many in Western Australia's big blue backyard, are the most at risk due to their limited numbers and range.

Nothing else as big as the blue whale has ever lived on the Earth. At close to 30 metres it is as long as a large passenger jet and can weigh up to 180 tonnes. Blue whales once ruled the oceans but their populations are now less than one per cent of what they were before commercial whaling began. Sadly, unlike a number of the other great whales that were the target of whaling, their numbers are not recovering. More needs to be done to bring them back from the brink.

Every year blue whales come to Western Australia's big blue backyard to feed. The Perth Canyon is one of only two blue whale feeding grounds known in Australia. It is a key to the survival and recovery of this critically endangered animal.

But these ocean giants are under increasing pressure from a number of sources. Blue whales are highly sensitive to noise. The waters off Perth are noisier than ever before due to shipping, oil and gas exploration and defense training. The Perth Canyon is within the Western Australian Exercise Area where training activities include gunnery and military flying, bombing practice from aircraft, firing from ships, deepwater exercises and submarine diving.

Increasing noise pollution or ship strikes could cause blue whales to avoid this critical feeding area, affecting the species' recovery.

Strategically placed and large no-take marine reserves can help ensure the survival of endangered blue whales by providing a safe place for them to feed and by minimising other threats in and around their critical habitats.

PERTH'S PLAYGROUND, PENGUINS AND 'PORSCHE'

Rottnest Island is also in the path of the Leeuwin Current and is home to tropical fish, molluscs and hard corals in a significant marine-life mixture with temperate species. Each year close to 500,000 people visit 'Rotto', Perth's island playground.

Carnac and Garden islands near Perth are the most northerly colonies for the little penguin. With 1200 birds, Penguin Island, 40 kilometres south of Perth is the region's largest colony for this species. Little penguins can travel up to 200 kilometres from the islands in search of food, but when breeding often take much shorter trips of around 20 kilometres to find whitebait to feed to their chicks. Healthy stocks of small surface-dwelling fish are crucial to their survival. There are concerns the state's beach bait fishery could harm this food supply.

Further offshore there are large migratory fish also in search of small fish near the surface. The southern blue fin tuna is a powerful fish built for speed – it can swim in bursts at 70 kilometres per hour – and travel over long distances. It has been dubbed the 'porsche' of the ocean.

Each year schools of southern bluefin tuna leave their spawning grounds in waters near Indonesia and head south along the west coast of Australia. It is in the south-west corner of the Kalbarri to Eucla region where they must choose either to swim west towards Africa or east to the Pacific Ocean.

During their annual migration southern bluefin tuna rely on upwellings along the region's south and west coasts. The small fish that the tuna feed on are a critical link in the marine food chain between plankton and larger animals such as sharks, little penguins, shearwaters, seals and whales.

Although fast and powerful, the southern bluefin tuna has been unable to escape commercial fishers and is critically endangered. Even though their numbers are less than 15 per cent of what they were in 1960, they continue to be commercially fished in Australian waters off South Australia and New South Wales during their migration.

Ironically, the pilchards they chase are caught and fed to harvested tuna being fattened for export in cages off South Australia's Port Lincoln. There have been proposals for similar cages in the Kalbarri to Eucla region.

The feeding of virus-infected meal to caged tuna is the probable cause of enormous pilchard kills that occurred in the 1990s across southern Australia. These fish-kills were perhaps the worst ever caused by humans, breaking the link in the food chain and affecting other animals including little penguins and seals. The virus still persists in pilchard populations, and their numbers are only now beginning to recover, although they remain a target of commercial fishers.

THE POLLUTION CONNECTION BETWEEN LAND AND SEA

The health of our marine environment is affected by what happens on land. The connections between catchment health, marine health and community health are clearly demonstrated by disturbing stories from Cockburn Sound and the Peel Harvey Inlet.

Cockburn Sound off Fremantle has for many years been a very important area for commercial fishing and angling, as well as swimming, boating and other recreational activities.

From the 1950s the Cockburn Sound catchment and coastline experienced major industrial and urban development with refineries, port development, chemical plants, horticulture and housing.

The amount of pollutants such as nutrients, herbicides, hydrocarbons, fertilisers and sewage finding their way into Cockburn Sound has increased fourfold in the past 50 years, carried there by surface runoff and groundwater flows. The ability of the Sound to flush naturally was reduced by 40 per cent with the construction of the causeway between the mainland and Garden Island.

Since the 1950s, the seagrass meadows of Cockburn Sound have declined by 80–90 per cent. These critical feeding and nursery areas for marine life have been lost to pollution and shell-sand mining. The loss could be permanent because seagrasses recolonise very slowly. The blue swimmer crab fishery, which is reliant on healthy seagrass habitat, has collapsed. Cockburn Sound is now closed to the recreational and commercial fishing of the crabs.

The future continues to look grim for Cockburn Sound. The human population of its catchment is expected to triple over the next 20 years, the ports are to be further developed and a desalination plant is now extracting water and marine life from the Sound and returning hyper-saline brine.

South from Cockburn Sound, the Peel Harvey Inlet at Mandurah became badly polluted by agricultural and urban runoff—massive algal blooms were the result. As well as impacting on fisheries and tourism, a community health study revealed that the rate of respiratory illnesses had doubled, and children from 11 to 15 years of age were most at risk.

In the late 1990s a canal costing $50 million was dug to flush the Peel Harvey Inlet. But algal blooms still occur and dead zones exist in some places. Newly flooded areas have attracted mosquitoes and increased the incidence of the Ross River virus.

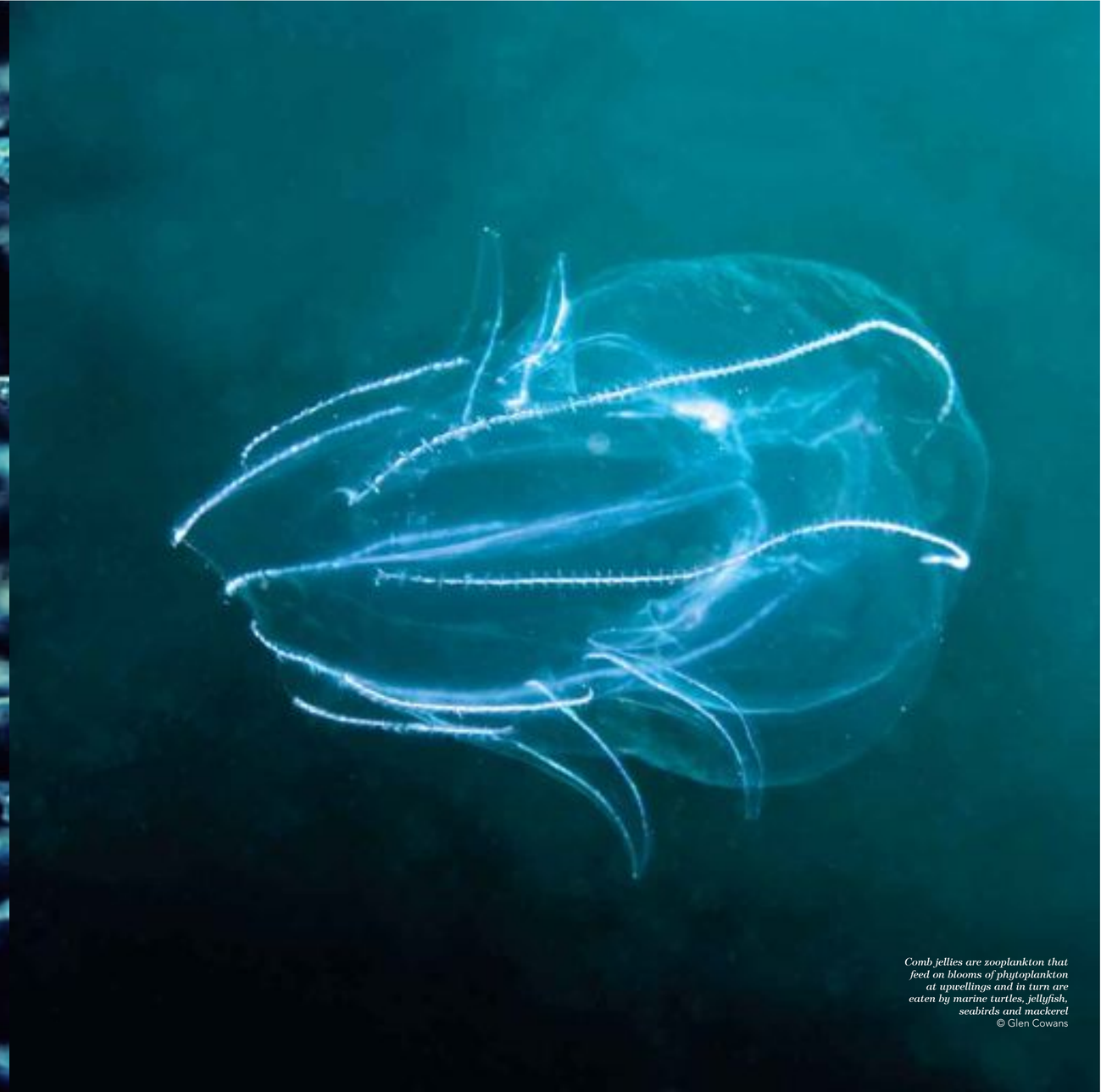
Many estuaries along the west coast have been impacted by urban and industrial development, resulting in marked declines in fish catches as habitats have disappeared. Fortunately the estuaries along the south coast are less affected because population growth and coastal development is limited to a number of relatively small centres. However, the problems on the west coast should not be ignored by state and local authorities when planning the management and protection of the connected catchments, estuaries and offshore waters along the south coast.

Many estuaries along the west coast have been impacted by urban and industrial development, resulting in marked declines in fish catches as habitats have disappeared

Light penetrates more deeply in the region's clear waters, allowing extensive and globally significant seagrass meadows to grow at depths greater than usual
© Glen Cowans

The critically endangered blue whale is the largest animal to have ever lived and one of its key feeding areas is the Perth Canyon

Large balls of krill are swept towards the surface in the Perth Canyon, making it a feeding oasis for endangered blue whales and tuna
© Rudie Kuiter / Oceanwidelmages.com



Comb jellies are zooplankton that feed on blooms of phytoplankton at upwellings and in turn are eaten by marine turtles, jellyfish, seabirds and mackerel
© Glen Cowans

Protection of the island colonies and feeding grounds of the Australian sea lion is critical for its survival in the region
© Gary Bell / OceanwideImages.com

Gorgonian fans are soft corals found in the inshore waters of the region which are highly vulnerable to bottom trawling and anchor damage.
© Glen Cowans

Internationally threatened white sharks are sometimes caught in fishing nets as they migrate along the west coast

SHELTERING SEAGRASSES, SHARKS AND SEALS

South of Mandurah, the Leeuwin Current flows by the rich and extensive inshore lagoons and seagrass meadows of Geographe Bay. For the endangered loggerhead turtle, these sheltered waters are an important feeding area.

Humpback whales rest here in winter and spring as they return from Antarctica on their way home to the Kimberley to mate and give birth. The migrations of the humpback and southern right whale support a growing whale-watching industry in Western Australia. It is now worth more than $45 million annually, with 150,000 whale watchers each year catching a treasured glimpse into the world of the whales.

Geographe Bay is sheltered from south-westerly swells by Cape Naturaliste, as well as the limestone ridges and reefs of this southern section of the Rottnest Shelf. The inshore lagoons here are similar to those on the Shelf's northern section.

The seagrass meadows in Geographe Bay include tropical and temperate species that account for about 80 per cent of the area's production of marine plants. These are a source of food for many marine animals. Shoals of squid, anchovies, silver sprat, pilchards, garfish and herring use the lagoons as nursery areas and fall prey to Australian salmon, snapper, West Australian dhufish, samson fish and dusky whaler sharks. Blue swimmer crabs are a popular target for local recreational fishers and for their benefit Geographe Bay is now closed to commercial fishing of the species.

Juvenile dusky whaler sharks live in the seagrass meadows before heading out to the shelf edge as adults. Dusky whaler sharks are targeted by commercial and recreational fishers and are overfished in the region, along with school shark, whiskery shark and sandbar or thickskin shark. This reflects the world trend where 90 per cent of the populations of large predatory fish have been removed from the oceans—all in the past 50 years.

There is still much to learn about the importance of sharks in the Kalbarri to Eucla region, although its marine waters are considered of global significance for the threatened white shark. Ironically it is the high number of white sharks caught in fishing nets or on lines in the region that has led scientists to this conclusion. The sharks are sometimes caught during their northerly migration along the west coast in spring and their return south in summer.

Scientists recently announced the discovery of 46 new shark species in Western Australia's marine waters, of which 24 are thought to live nowhere else on Earth. These included the dwarf spotted wobbegong and floral banded wobbegong. Of only 10 species of wobbegong worldwide, seven live in the region.

Scientists recently announced the discovery of 46 new shark species in Western Australia's marine waters, of which 24 are thought to live nowhere else on Earth

On from Geographe Bay the Leeuwin Current begins its turn around the south-west corner of Australia at Cape Leeuwin. Both the Current and the Cape share the name of a Dutch East India Company ship that accidentally arrived in the south-west corner in 1622. It stayed to map the coastline and for some time after the area was known as the 'Land of the Leeuwin'.

The explorer Matthew Flinders named the Cape in 1801 but it was not until 1980 that the Leeuwin Current was named by two CSIRO scientists, George Creswell and Terry Golding. They were the first to determine that it was one continuous coastal current, replacing the view that it was three separate ones.

Eddies and summer upwellings off Cape Mentelle mix water and nutrients and generate blooms of phytoplankton on the shelf. Krill, then small pelagic fish, orange roughy and whales gather to feed and make this one of the most significant hotspots for marine life in the region. This appears to be the westerly limit for orange roughy.

Near Dunsborough the Leeuwin Current passes a rock outcrop that has been colonised by about 40 New Zealand fur seals. During the sealing days fur seals were all but wiped out along the region's west and south coasts. This small colony is a sign of a recovering but fragile population.

Threats to the fur seals still include entanglement in marine debris and fishing nets, oil spills and competition with fishers for fish. In 1991 more than 60 fur seals had to be cleaned of oil that spilled from the wreck of the *Sanko Harvest* off the Recherche Archipelago to the east of Esperance.

FRACTURES, RIFTS AND PLATEAUS

To the west and south of Cape Leeuwin, and beyond the influence of the Leeuwin Current, deep and rugged sea floors and mysterious marine life worthy of a Jules Verne novel await scientific discovery.

The remarkable scientific voyages of France's Captain Nicolas Baudin, and the exploratory efforts of an old Australian Navy warship are honoured in the deepest waters of Western Australia's big blue backyard.

From 1800-01 Nicolas Baudin and Jacques Hamelin travelled through the region on their great voyage of scientific discovery during the Age of Enlightenment. By the time their ships the *Naturaliste* and *Geographe* returned to France they were loaded with 200,000 specimens, including 30 live animals. These animals caused such a stir in Paris that Napoleon Bonaparte's wife, Josephine, had a private zoo built for emus, kangaroos, swans and other birds.

The Baudin voyage resulted in more than 200 French names being given to landmarks along the region's coast including Cape Leschenault, Breton Bay, Lancelin Island and Jurien Bay.

The Leeuwin Current flows between the capes of the south-west corner of Western Australia and some of the most imposing and significant sea floor features in the world which are likely to host globally important marine life.

At 2000-5000 metres in depth, the Naturaliste Plateau is the deepest marine plateau off the Australian continent and covers 90,000 square kilometres. It is a piece of the continent's crust that was uplifted millions of years ago and then subjected to volcanic eruptions. Some scientists believe it could be a continent in its own right. Today it is relatively flat, rectangular in shape, incised with canyons and with cliffs of 1000 metres in height.

In the past only about two-thirds of the Naturaliste Plateau was in Australia's care, but in 2008 the United Nations extended our responsibility to the remaining third of the feature, which stretches west into the Indian Ocean.

Off the coast between Cape Leeuwin and Albany is the deepest part of both the Indian Ocean and Australia's marine environment. It was discovered in 1960 by a team aboard a retired Australian Navy frigate that hosted the surrender of Japanese forces at Nauru and Ocean Island in September 1945. The frigate was later recommissioned as an oceanographic survey vessel.

A deep trench of 7390 metres was discovered. It could be deeper still but the equipment used was incapable of measuring a greater depth. The trench, also known as a fracture zone or rift valley, was formed as Australia separated from Antarctica more than 50 million years ago.

The frigate was *HMAS Diamantina* and the 100,000 square kilometres of rugged sea floor is now called the Diamantina Fracture Zone, Australia's highest yet completely submerged mountain range.

Little is known of the marine life in the Diamantina Fracture Zone or the Naturaliste Plateau. However, scientists believe it is likely to be diverse and contain many endemic species given its long and uninterrupted geological isolation. Large and complex sea floors like these provide plenty of habitats for marine life, and the mixing of major ocean currents increases food supplies.

The Naturaliste Plateau is also the only place in Australia's marine environment influenced by the cool and nutrient-rich waters of the Subtropical Convergence Zone, a major oceanic zone where warm and cool waters collide.

Most importantly, the Diamantina Fracture Zone and the Naturaliste Plateau have been free of human disturbance and the declaration of a CAR network of large no-take marine reserves will help secure their unique evolutionary potential.

SEEK AND WE SHALL FIND

Following the grand tradition of maritime exploration set by Baudin, Flinders and Darwin, in 2005 scientists from CSIRO embarked on their own voyage of discovery in the region.

The *Southern Surveyor,* CSIRO's research vessel, sailed along the path of the Leeuwin Current between Shark Bay and the Great Australian Bight, stopping at 12 locations for scientists to collect samples and photos (see opposite) of sea floor marine life. The region's continental slope, shelf and shelf break were sampled at various depths from 100 to 1000 metres off places such as Kalbarri, the Houtman-Abrolhos Islands, Perth Canyon, Bunbury, Cape Mentelle and Albany.

At each location the scientists discovered species new to science, and many more that had not been previously recorded in Western Australian or even Australian waters.

Off Albany there were 224 species collected, 29 of which were new to science, 39 previously had not been seen in Australia and 77 not in Western Australia. The sea floor off the Houtman-Abrolhos Islands yielded 185 species, with 22 new to science, 31 to Australian waters and 47 to Western Australian waters.

Brought to the surface was a remarkable array of sponges, bryozoans, corals, brittle stars, snails, shrimps, prawns, sea cucumbers, molluscs, sea pens, sea whips, bristle worms, decapods, crabs, hydroids, sea urchins, worms, ascidians and sea spiders.

Rocks from the shelf and shelf break were in many places covered in colourful sponges, bryozoans, corals, ascidians and hydroids, while the soft sediments of the slope were riddled with the feeding pits and burrows of worms, crabs and other burrowing species.

There were so many sponge species collected that scientists at the Western Australian Museum are still working on their identification and description almost four years on.

Less than five per cent of Australia's marine environment has been explored. Too often we have had to rely on the records of centuries-old explorations or chance encounters with creatures rarely seen or new to science caught in fishing nets or washed onto beaches.

Australia's marine world remains largely unknown, and due to a range of threatening processes we may be losing species that we will never know existed. Voyages of scientific discovery like that of the *Southern Surveyor* are going to places new to science, extending our knowledge and the effectiveness of marine protection efforts in the future. A precautionary approach which protects these areas is particularly important.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2


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1
New Australian snakestar species (*Asteromorpha koehleri*) in 100 metres on outer shelf off Point D'Entrecasteaux

2
Polychaete worm (*Amphinomidae* sp2) in 400 metres on slope off Lancelin Island

3
Dumpling squid (*Sepiolina* sp.) in 500 metres on slope off Cape Mentelle

4
Possibly new basket star (*Astroboa* sp.) in 180 metres on shelf break near Houtman-Abrolhos Islands

5
New Australian crab species (*Quadrella reticulate*) in 100 metres on outer shelf off Kalbarri


4


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6
Tam o'Shanter sea urchin (*Phormosoma* sp.) on fine mud in 700 metres off Albany

7
New species of hump-backed shrimp (*Lebbeus* n. sp.) in 400 metres on slope off Bald Island

8
Ghost shark (Family Chimaeridae) in 400 metres on slope off Point D'Entrecasteaux

9
Lush sponge garden with ascidians and bryozoans in 200 metres on slope off Albany

10
Redfish and morwong in 160 metres and above sponges, octocorals, bryozoans, hydroids and colonial ascidians off Bald Island

Images from
CSIRO Wealth from Oceans Flagship

Sponges could be the oldest living animals on Earth. This orange-coloured one is home for a colony of zoanthids which are bottom-dwelling plankton feeders

Blue throated ascidians or sea squirts are filter feeders that form colonies in sea floor communities, providing food and shelter for other marine species

Deep-diving sperm whales were harvested in Australian waters until 1978 when the Albany whaling station – the last in Australia – was closed

COOLER AND STORMIER WATERS WITH GRANITE REEFS

The turbulent mixing of water at Cape Leeuwin saps the Leeuwin Current of some of its energy as it turns to head east along the south coast. From here it leaves behind the limestone coast and flows into the stormier waters of the south coast and a very different marine environment.

Along the region's south coast there is little protection from fierce southerly swells and inshore lagoons are absent. The Leeuwin Current is also in competition with the cooler Flinders Current from the east carrying the larvae and fish eggs of cool-water species.

The south coast's cliffs and reefs are carved from hard granite, a rock that erodes very slowly, even on coastlines like this where the energy of the waves can be felt at a depth of 100 metres. With little erosion, the reefs here have far fewer microhabitats than the west coast's myriad of caves and crevices etched in soft limestone. As a result, there are lower numbers of bottom-dwelling species such as crabs and rock lobsters.

Kelp beds and sponge communities cover the south coast's reefs which are generally in deeper water than those of the west coast. The clear waters allow light to penetrate deeply and kelp to grow at depths of up to 120 metres.

Leafy and weedy seadragons gently hover among the swaying kelp blades. These beautiful and fragile creatures are only found in Australia's southern waters and are threatened by harvesting for the aquarium trade and as accidental catch in fishing nets.

In these cooler south-coast waters the composition of marine species changes. Western rock lobster are replaced by the southern rock lobster, and the West Australian dhufish and baldchin groper give way to mulloway, harlequin cod and bight redfish. Greenlip abalone, not found on the west coast, occurs here in relatively large numbers.

Compared with the limestone coast of the west, there is a greater proportion of bottom-dwelling finfish relative to crustaceans. Surface-dwelling fish numbers are higher on the south coast's continental slope.

The creation of large no-take marine reserves can ensure the protection of the various habitats found along the west and south coasts, in offshore and nearshore waters and on the sea floor.

In supporting an end to whaling, Western Australians made a major contribution to the cause of protecting the world's marine life taking refuge in their waters

CANYON COUNTRY, WHALES AND ORANGE ROUGHY

Near Albany the Leeuwin Current encounters what the locals call the Albany Hills, even though there is nothing small about the Albany Canyons. Here 32 canyons spread along 700 kilometres of the continental slope from Albany to the east of Esperance. Offshore eddies and upwellings spur plankton production and feeding frenzies by small and large surface-dwelling fish.

Deep sea orange roughy gather in the Albany Canyons to spawn, possibly along with blue grenadier and gemfish. Until 2005, commercial fishers were allowed to target the orange roughy, but by 2007 only bycatch was permitted, set at five per cent of previous allowable catches. Here and throughout Australia the stocks of orange roughy have been overfished and their deep sea habitats severely damaged by bottom trawling. The species is now listed as 'of conservation concern' under federal environmental law.

Every summer the southern right whales of Western Australia go to the sub-Antarctic to feed. In winter they return to calve in the Leeuwin Current's warm waters between the Albany Canyons and the coast. The sheltered Princess Royal Harbour at Albany is a favoured location for these rare whales, much to the delight of whale watchers and whale tour operators.

Only a few hundred southern right whales live along the Australian coast. They are still recovering from the days of commercial whaling when 26,000 were killed in Australian and New Zealand waters before whaling was banned.

Sperm whales are also known from the canyons of this area where they might swoop down the slope in pursuit of a giant squid. In 1978 two giant squid were found in the stomach of a sperm whale caught in the final days of the Cheynes Beach Whaling Company station at Albany. Sperm whales had become the target of the station after whaling for humpbacks was banned in 1963.

On 20 November 1978, the company caught a sperm whale that was to be the last whale to be killed in Australian waters. The next day the station, the last in Australia, closed. In April of 1979 the Australian Government banned commercial whaling in Australian waters.

In supporting an end to whaling, Western Australians made a major contribution to the cause of protecting the world's marine life taking refuge in their waters. Since then Australia has become a global champion for whales. And the ban on whaling is now reaping huge rewards back home with the rapidly growing whale-watching industry fuelling jobs and tourism in Western Australia and beyond. Protecting marine life can provide long-term economic benefits and is further reason to establish a CAR network of large no-take marine reserves in the Kalbarri to Eucla region.

105 ISLANDS AND A PIRATE

The Leeuwin Current has lost some of its heat and strength by the time it reaches Esperance, but at 20°C in summer it is still warmer than the surrounding waters.

It is now on its way to the Great Australian Bight, but the islands that were home to Australia's only pirate, Black Jack Anderson, are in its path. In the early 19th century Black Jack lived on Middle Island in the Recherche Archipelago and attacked passing ships.

The warm water and marine life transported by the Leeuwin Current, and the shelter provided by the many islands and reefs of the Recherche Archipelago, support a wonderful mix of temperate and subtropical species. To the south of the islands, eddies and upwellings attract life to the surface waters of the upper continental slope and its canyons.

The archipelago is another significant hotspot for marine life in the region and contains the region's most extensive area of reef. At the last count there were at least 263 fish species, 347 mollusc species and 242 algae species. Almost 30 per cent of Western Australia's endemic fish are found here, and the archipelago provides important rookeries for protected shearwaters and terns and nesting areas for white-bellied sea-eagles.

The sheltered islands are a great place for travelling marine animals to rest or breed. Southern right whales calve here and there is a significant Australian sea lion breeding colony. These sea lions can only be found in Australia's southern waters living on scattered islands.

Scientists believe the separate sea lion colonies stagger their breeding seasons to ensure there is plenty of food to go around. Australian sea lion populations are only slowly recovering from the decimation of 19th century sealing. Now entanglement in fishing nets and competition with fishers for fish are their main threats.

Recently a team of scientists found 450 species of sponges, extensive beds of rhodoliths (coralline algae) and a wide range of soft corals in the Recherche Archipelago. The discovery of the rhodoliths was a first for the area and some have been dated at 720 years of age.

Rhodoliths are free-living algae that secrete a coralline skeleton, sometimes resemble golf balls and can grow up to five centimetres across. With sponges and soft corals they provide shelter, nursery and feeding areas for marine spiders, snails, worms and juvenile scallops. They are rare in Australia and highly vulnerable to bottom trawling.

When rhodoliths, sponges, bryozoans, barnacles, crabs and seastars die, the calcium carbonate in their bodies breaks down and forms carbonate sands that blanket the sea floor and help cycle nutrients. Most of the region's sea floor is covered by sand which is washed off the shelf, down the slope, into the canyons and then out on to the abyssal plain.

The shelf that extends to the east of the Recherche Archipelago and across the Great Australian Bight is now recognised as the world's largest area of cool-water carbonate sediments.

These sandy and muddy sediments provide soft habitats for burrowing animals like the giant crab, worms and microscopic animals that live below the surface of the sea floor. Little is known of these creatures, although it is thought there could be more than 100 million species worldwide—mostly microscopic animals. Many of these animals rely on oxygen trapped between the sand grains and food that sinks to the sea floor. In one study, more than 800 species were found in just 10 square metres.

Scientists suspect that the creatures living in the mud and sand of the sea floor could be highly vulnerable to disturbance. Drilling in a petroleum field near Portland in Victoria caused the numbers of some species to drop by nearly 90 per cent for several months. The oil and gas industry is likely to expand in the Kalbarri to Eucla region.

The sea floor communities on the continental shelf, shelf break and slope are the foundations of many food chains in the region's marine environment and critical to its good health. But they are also fragile and in need of strong protection.

THE LEEUWIN CURRENT'S LONG AND IMPORTANT JOURNEY

After the Recherche Archipelago the Leeuwin Current leaves the Kalbarri to Eucla region and continues east across the Great Australian Bight to its end on the west coast of Tasmania.

On its long and important journey through Western Australia's big blue backyard, the Leeuwin current connects and influences the marine life and people of the region. The current is integral to the global uniqueness of the Kalbarri to Eucla region's marine life.

The Leeuwin Current brings the region clear, warm and low-salinity water and mixes the eggs and larvae of tropical marine life with subtropical and temperate species. It passes the most southerly tropical coral reefs in the Indian Ocean, internationally significant inshore lagoons, the largest Australian canyon, the deepest point in Australia's oceans, the nation's highest underwater mountain range and the feeding area of the world's largest and one of the world's rarest animals.

It also witnesses many of the threats now facing the region's marine environment including overfishing, bycatch, coastal development and water pollution and is itself under threat from climate change.

People living along the Kalbarri to Eucla coast have developed a strong connection with and reliance on the region's marine environment. Their futures are inextricably linked.

The western wobbegong is unique to Western Australia. Seven of the world's ten wobbegong species are found in the waters off south-west Australia

Populations of New Zealand fur seals are slowly recovering after being all but wiped out in the region by 19th century sealing

A growing number of whale watchers see threatened humpback whales returning to their Kimberley home from sub-Antarctic feeding grounds

The multi-coloured soft corals and sponge communities that cover granite rocks off the south coast are important habitats for fish, crabs and shellfish
© Andrew Halsall Photography

The ecotourism sector is growing in the region and no-take marine protection can provide a further economic boost
© Andrew Halsall Photography

Bryozoans are colonies of tiny marine animals that attach themselves to the sea floor, providing shelter and food for bottom-dwelling marine life
© Glen Cowans

How to protect Western Australia's big blue backyard

PROTECTING WESTERN AUSTRALIA'S BIG BLUE BACKYARD

The marine life from Kalbarri to Eucla is astonishing in its breadth and distinctiveness and is unique on a global scale. But it remains unprotected. The delivery of a CAR network of large no-take marine reserves offers the best hope for maintaining viable populations of the region's marine species.

Leading scientists from around the world have strongly advocated the creation of such areas in their writings and public commentary. The prestigious American Academy for the Advancement of Science and the Australian Marine Sciences Association both support the establishment of no-take areas. In 2003 the World Parks Congress in Durban urged all nations to establish networks of no-take areas covering at least 20–30 per cent of each marine habitat by 2012. Most recently some of Australia's top scientists have added their support to the proposal to create the world's largest no-take area in the Coral Sea covering an area of one million square kilometres.

Monitoring in many no-take areas around the world has shown fish abundance is higher in no-take reserves than in areas that continue to be fished. The increase in the number and size of fish and other marine species within large no-take marine reserves, and their potential spillover across reserve boundaries, could create opportunities for recruitment outside the reserves.

The eggs, larvae, juveniles and adults of many species are carried along the region by the Leeuwin Current. This transport from marine reserves and the protection of nursery and spawning areas will give greater fish stock security for commercial and recreational fishers alike.

Protection will also allow overfished stocks of the 'Vulnerable 5' (West Australian dhufish, baldchin groper, breaksea cod, pink snapper and red snapper), orange roughy and sharks to rebuild. It will also support the recovery of blue whales, leatherback turtles and other threatened species, and enhance the food supply of Australian sea lions and New Zealand fur seals.

The dispersal of larvae, which is critical to the future of the western rock lobster, as well as nutrient cycling and pollutant breakdown, could be encouraged by large no-take marine reserves. The reserves will also provide opportunities for research into the carbon storage potential of protected sea floor communities, seagrass meadows and undisturbed sediments that could support the global fight against climate change.

Large no-take marine reserves protecting unique local marine life and features can strengthen the regional tourism brand and help protect local economies from contractions of tourism markets during financial crises.

They can also broaden the economic profile of a region and reduce the dependence of traditional marine-based industries such as fisheries now in decline due to rising costs and overexploitation of fish stocks. And the government declaration process for no-take marine reserves can also help put those fisheries on a more viable footing through the strategic application of structural adjustment schemes.

The growing whale watching, diving and ecotourism sectors in the region will be given a huge boost and will in turn support coastal economies adjusting to changes in fisheries management.

Large no-take marine reserves can also become long-term monitoring sites for scientists. These will enable scientists to better understand the marine environment, examine the effects of fishing and improve the way we use and manage it. By publicly communicating that improved understanding, the community will become increasingly aware of marine conservation needs.

In order to secure what is unique, important and threatened in Western Australia's big blue backyard the ***Save our Marine Life*** Collaboration of the Conservation Council of Western Australia, the Australian Conservation Foundation, The Wilderness Society, WWF-Australia, the Australian Marine Conservation Society, The Nature Conservancy and the Pew Environment Group has been formed. It is working with scientists, the Australian and Western Australian governments and those who work and play in the marine environment to ensure these significant benefits are realised through establishing a CAR network of large no-take marine reserves from Kalbarri to Eucla.

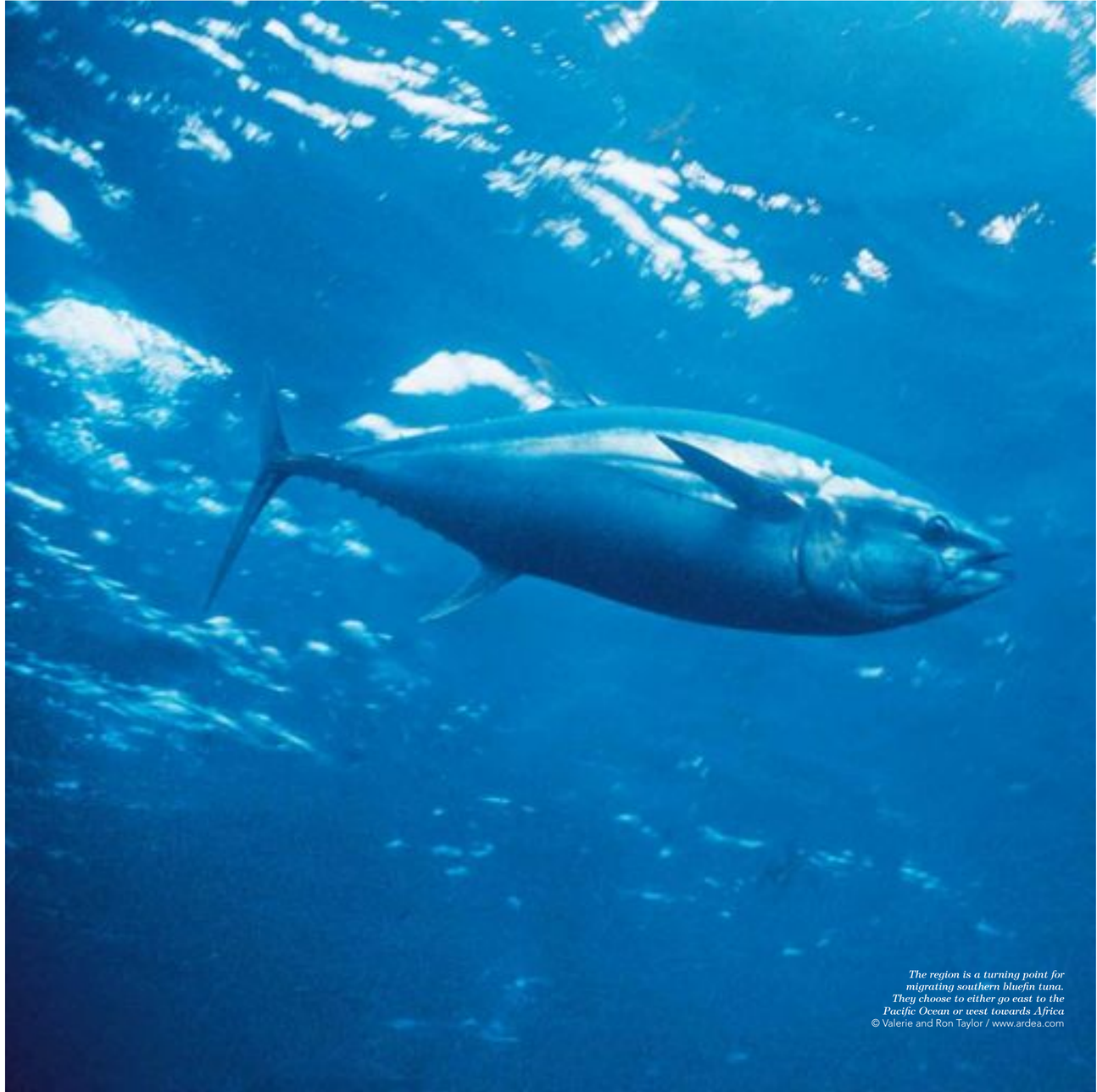
Such protection should be extended to habitats that are critical to the survival of marine species and their key feeding, breeding, nursery and resting areas. The ecological links between offshore and inshore, between sea floor and sea surface, and between the abyssal plain, slope and shelf should be maintained. It is insufficient to protect a species without protecting the water column and sea floor it relies upon.

The world has vested responsibility for the region's marine life and its habitats with the Australian people. Unlike many other areas of the globe, Australia still has the opportunity and the capacity to act in advance of the rising tide of human pressure on our oceans. But time is short as marine pollution, habitat damage and exploitation are increasingly taking their toll.

A 2008 global survey by the World Resources Institute identified 415 dead zones in the world's oceans, a tripling of the number found in the 1990s. Dead zones are places that are starved of oxygen because land-based sources of pollution have encouraged blooms of algae. The algae eventually die and are broken down by bacteria that consume oxygen.

Four of the dead zones identified by the survey are located off Sydney, Hobart, in the Gippsland Lakes and south of Perth. Six of 15 'areas of concern' identified for Australia were along the west coast of the Kalbarri to Eucla region, while another was on the south coast. The survey's findings clearly demonstrate the critical links between the health of catchments, coasts and marine waters, and the need for integrated protection and management.

The establishment of a CAR network of large no-take marine reserves from Kalbarri to Eucla will lay the foundation necessary to maintain the health of the region's precious marine life, and preserve the culture, heritage, traditions, economies and lifestyle of Western Australians and their big blue backyard.



The region is a turning point for migrating southern bluefin tuna. They choose to either go east to the Pacific Ocean or west towards Africa

The region's clear, light-filled waters encourage kelp to grow in greater depths than usual, providing food and shelter for local marine life
© Glen Cowans

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