GOVERNMENT OF WESTERN AUSTRALIA

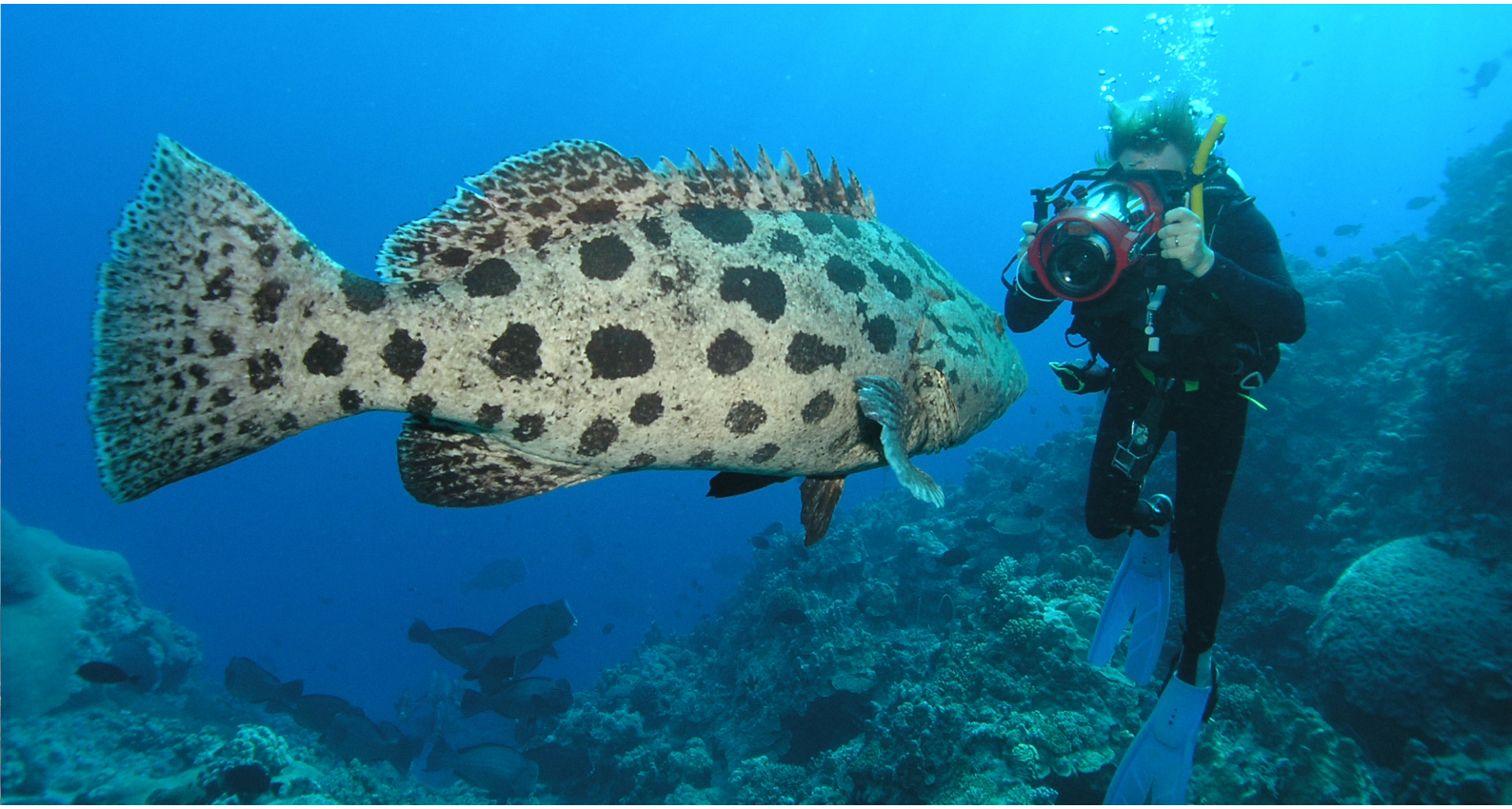
Department of **Parks and Wildlife**

Department of **Fisheries**

Kimberley Education Manuals

Series 2

Kimberley Marine Environment Years 4-6



Includes:

- curriculum-linked lesson plans
- project ideas and
- background information for Kimberley teachers.

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Shorebird Adaptation Card Game (p26-31), all images by Nigel Jackett, Broome Bird Observatory
Albatross with plastic in its stomach (p8), Keep Australia Beautiful Council WA
Potato cod (front cover), image by Eric Matson

Kimberley Science and Conservation Strategy

Six new marine parks are being established under the *Kimberley Science and Conservation Strategy,* the State Government's $103.6 million project to conserve the region's natural and cultural values. This action more than triples the total area of the State's marine parks and reserves from approximately 1.5 million hectares in 2008 to more than 5 million hectares once all new parks are complete. Jointly managed with traditional owners, Lalang-garram / Camden Sound and Eighty Mile Beach marine parks have already been created. Planning for four more marine parks under the strategy is underway to protect the natural and cultural values of the region, with proposed parks at Yawuru Nagulagun / Roebuck Bay in Broome, Lalang-garram / Horizontal Falls, North Lalang-garram, and the North Kimberley. The strategy further funds a number of marine research projects, providing new insights into the flora and fauna of this very remote coastal region, which will shape the management of these new marine parks.

To read more about other projects conserving the unique Kimberley environment, conducted under the strategy, visit www.dpaw.wa.gov.au/management/kimberley-strategy.

Top *Turtle Reef* ***Above left*** *Turtle on Turtle Reef. Photos - Kimberley Media* ***Above right*** *Water sampling*

Key messages

This resource series aims to introduce the topic of our local marine environment to Kimberley classrooms. Like most Western Australians, Kimberley people are passionate about the outdoors. With amazing beaches, hidden bays, coastal cliffs and coral reefs, it's not hard to see why. For those who don't live on the coast, many of these lessons can be adapted to suit freshwater places. Instead of using the beach as an example, you could talk about a local river, estuary or waterhole. The Kimberley marine environment is remarkably untouched, although as more and more people start to visit the spectacularly remote Kimberley coastline care must be taken to ensure threats such as pollution, overfishing and increased development are managed appropriately. These lessons focus on the variety of marine habitats found in the Kimberley, focusing on individual species and threats. An emphasis is placed on individual and community actions that contribute to ensuring our amazing Kimberley marine environment is preserved into the future.

The key questions we are examining through these activities at all year levels are:

- **What are marine habitats?**
- **How have animals adapted to different Kimberley marine habitats?**
- **How do marine parks protect our marine plants and animals?**
- **How can we fish for the future?**
- **What can we do to protect our Kimberley marine plants and animals, and their habitats?**

Introducing marine themes to your classroom

The following passage can be used to introduce the topic of the Kimberley marine environment to your class. You may also like to organise an incursion with the Fisheries or Parks and Wildlife education teams, or work towards participating in a community clean up or setting up a marine display at a community event once you have completed all the lessons (see p15-16).

Have you ever swum at the beach, stopped to watch the whales, or caught a big fish? Built a sandcastle, played beach cricket or volleyball, camped by the beach or a waterhole, or gone out on a boat? If you have, you are probably already familiar with the Kimberley marine environment.

When we talk about marine, we are talking about our beaches and oceans. If you don't live near the sea, don't worry, as we'll be talking about rivers and waterholes, too. Every wet season, rivers take thousands of litres of water out into our ocean around the Kimberley, so the lives of our freshwater and saltwater animals are connected. Some animals, such as barramundi and crocodiles, like to spend time in both places.

Not all parts of our marine environment are the same. We have sandy beaches where turtles nest, dense mangrove forests where mud crabs hide, seagrass beds that are home to dugongs, vast mudflats where shorebirds rest, estuaries where the river meets the sea, open ocean where whales play, and even coral reefs full of brightly coloured fish. Many of these habitats are protected as marine parks. Marine parks are like national parks for the ocean and coastline. They preserve these remarkable landscapes and ensure that all of our marine wildlife has a home for the future.

Our Kimberley marine environment really is an amazing place. We hope you enjoy learning about all the special plants and animals that call it home. Compared to the rest of the world, the Kimberley has some of the most well looked after ocean in the world. It's right up there with Antarctica in terms of how little impact people have had on it, and that's the way we'd like to keep it.

As more and more people start visiting and living in the Kimberley, looking after our marine environment becomes more complicated. We want to make sure there are enough fish for everyone, and their habitats are looked after as best we can. Following fishing rules and keeping our beaches and oceans clean is the best way to look after our marine wildlife. If we all work together to care for our marine environment, it's easy to make sure our animals' homes are looked after, and we will always have fish for the future.

Montgomery Reef in the Lalang-garram / Camden Sound Marine Park.

Series 2, Kimberley Marine Environment Years 4-6

This is the second of two teacher guides in the second series of Parks and Wildlife's Kimberley educational manuals. Further series cover Kimberley biodiversity, cane toads, fire and introduced species. Each series comprises two teacher guides, offering sets of six curriculum-linked lesson plans for Years 1-3 and 4-6 in addition to background information and useful resources for educators. Printable worksheets and presentations to use in the classroom are available on the accompanying USB.

Contents

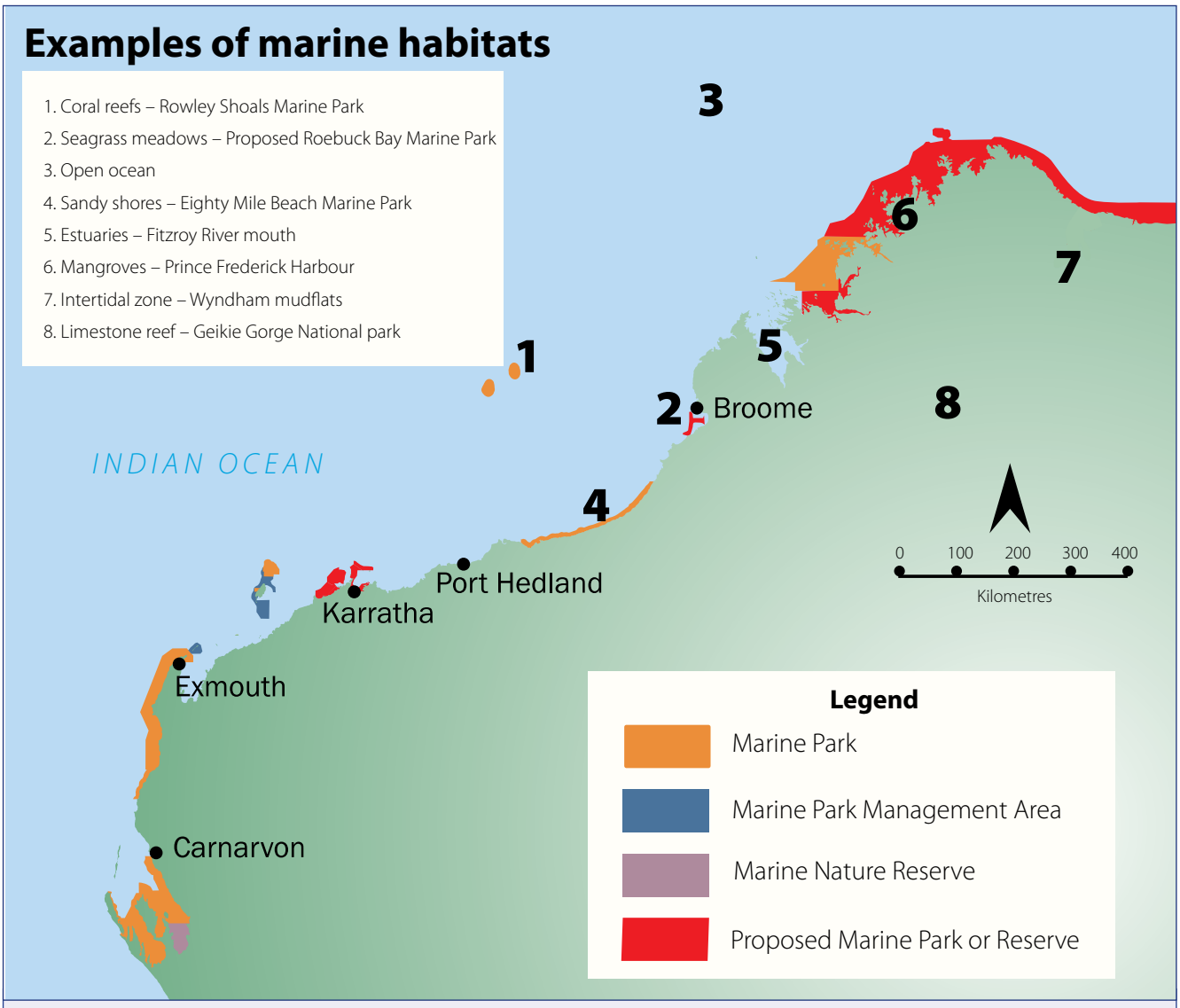
Background information for teachers

The basics: marine habitats

Encompassing almost a third of the Western Australian coastline, the Kimberley features gulfs, headlands, cliff-lined shores, archipelagos, coral reefs, mangrove forests, tidal flats and the longest uninterrupted beach in Western Australia. Huge tides and a monsoonal climate make for ever-changing water conditions, for example reefs 10m deep underwater at high tide may be exposed for hours at low tide, and marine flora and fauna have had to adapt to the influx of freshwater and sediment from swollen wet season rivers.

Examples of marine habitats

1. Coral reefs – Rowley Shoals Marine Park
2. Seagrass meadows – Proposed Roebuck Bay Marine Park
3. Open ocean
4. Sandy shores – Eighty Mile Beach Marine Park
5. Estuaries – Fitzroy River mouth
6. Mangroves – Prince Frederick Harbour
7. Intertidal zone – Wyndham mudflats
8. Limestone reef – Geikie Gorge National park



Coral reefs

Corals reefs are living structures made up of colonies of tiny tubular animals called polyps. Only the surface of a coral reef is living coral; underneath are the skeletal remains of reef-building or hard corals. Corals are animals, not plants, and they belong to the class of organisms called Anthozoans. Coral polyps secrete a limestone skeletal case in which they live. This external skeleton supports and protects the soft body of the animal. Corals without this hard structure are called 'soft corals'. Coral colonies have distinctive structures and forms. Their common names, for example staghorn, branching and plate, often describe their shape. The atolls of the Rowley Shoals, sitting on the edge of the Australian continental shelf northwest of Broome, are pristine examples of WA's coral reefs.

Seagrass meadows

Around 60 species of seagrass exist worldwide. Australia is home to more than 30 species and Western Australia has the largest and most diverse seagrass meadows in the world. Western Australia's dry climate and clear, nutrient-poor waters allow seagrasses to thrive.

Seagrasses are true flowering plants that can live underwater. Not to be confused with seaweeds (algae), seagrasses have leaves, roots, flowers, seeds and underground horizontal stems called rhizomes. They can range from the size of a fingernail to plants with leaves up to 7m long. Many individual plants live together to form extensive seagrass beds or 'meadows'.

Animals such as dugongs and sea turtles feed directly on the plants themselves. Many other creatures, such as bacteria, worms and crabs, feed on the decomposing leaf litter (called detritus) that releases nutrients when it decomposes. Seagrass meadows provide shelter for marine animals. They offer protection from predators and provide breeding habitats and nursery areas for many fish and crustaceans, including whiting, tailor, flathead, prawns and crabs, and homes and food for dugongs and green turtles. The seagrass meadows of Roebuck Bay can be examined close up at low tide, and are regularly monitored by volunteers involved in Seagrass-Watch, the world's largest seagrass assessment and monitoring program.

Limestone reefs

Limestone reefs are formed slowly from the remains of marine organisms such as coral and shells. Limestone easily erodes to create formations such as rockpools, caves and ledges. Macroalgae (seaweed) and seagrasses grow on and around the reef surfaces exposed to sunlight, while a colourful array of invertebrates such as sponges and sea squirts inhabit the shady parts. Many of the Kimberley's iconic geological features, such as the stunning walls of Geikie Gorge, Tunnel Creek and Windjana Gorge in the central Kimberley, were once limestone reefs. Over time, as sea levels changed and watercourses developed, these historic reefs have been carved out to form the landscape we know today. If you look carefully when visiting these places, you can find fossilised remains from a time when these places were at the bottom of the ocean.

Intertidal zone

The intertidal zone lies between the high tide and low tide marks; intertidal zones may be rocky, limestone or granite reefs, sandy or mudflats. It is an area that is constantly changing as the water moves in and out with the tides. This area is colonised by a diverse mix of tough plants and animals that can survive the changes in exposure to water, sunlight and wind that characterise this habitat. With famously high tides, the Kimberley is an excellent place to study the intertidal zone and the creatures that inhabit it, but make sure you're on the lookout for crocodiles if you're near the water's edge.

Mangroves

In 2010, there were 15.6 million hectares of mangroves worldwide. The total mangrove area in Australia is over 1 million hectares. Mangroves grow along sheltered shores and are more plentiful in the warm tropical regions in the north of Australia. In Western Australia, mangroves are most common in the Kimberley and Pilbara regions. In many parts of the world, large tracts of mangroves have been cleared for development, decimating this key marine habitat.

Mangroves are land plants that can live in salt water. They have adapted to live in the intertidal environment, where the mud is regularly flooded, low in oxygen and high in salt. They have developed various mechanisms to cope with the problem of excess salt, including filtering it out through their roots, excreting it through special salt glands in the leaves, and depositing the salt in older leaves and bark which then drop from the tree.

Mangroves protect the coastline by creating a buffer from storms and reducing erosion. They slow down currents and encourage an accumulation of mud and sediment that harbours an abundance of invertebrate life.

Mangroves are also an important nursery area for many marine animals, such as barramundi. Many species of fish spend at least part of their life in mangrove communities. It's not hard to find mangroves in the Kimberley; just about any coastal creek and much of our coastline hosts a healthy mangrove population. They can even be found on Town Beach in Broome.

Open ocean

Over 70 per cent of the Earth's surface is ocean but little is known about life in the open ocean. It is the largest aquatic habitat, allowing marine organisms to move from one habitat or area to another. Microscopic plants and animals called plankton, which drift with ocean currents, inhabit the surface layers of open waters. The open ocean of the Kimberley is still largely unexplored, although the results of a series of surveys in recent years have started to build our understanding of this rarely studied environment.

Sandy shores

Although it may appear to be a barren landscape, the seabed is teeming with tiny animals that burrow into the soft sand. These organisms filter food particles from the water column or obtain them from sediments. Some larger animals (such as crabs) survive here by burrowing into the sediment to hide during the day and emerging at night to feed. Eighty Mile Beach, south of Broome, is the longest uninterrupted sandy beach in Western Australia, at 220km long.

Estuaries

Estuaries are the meeting place of saltwater and freshwater. The sheltered waters, abundance of food, and lack of large predatory fish provide a vital habitat for many fish species, for some or all of their life cycle. Some fish such as barramundi are migratory species that pass through an estuary on their way to the sea. Others enter for a short period to feed when conditions are favourable. Some species live permanently in the estuary system and are able to tolerate the changing salinities.

Estuaries that are permanently open or seasonally opened for long periods by heavy wet season rains tend to have a higher diversity of fish. This is because a large variety of marine fish can swim easily into the estuary.

Environmental changes can place significant pressure on estuarine fish. Across Western Australia, estuaries are at risk of loss of vegetation, increased salinity arising from catchment clearing, acid sulphate soils, and increased pesticide, herbicide and fertiliser runoff. These all badly affect estuary health and fish abundance.

The lower reaches of most major Kimberley river systems, such as the Ord, Pentecost and Fitzroy are estuarine in nature, with seasonal variations in the output of freshwater and even daily changes in salinity and water level due to the tidal influx and efflux of seawater.

A history of the Kimberley marine environment

Three hundred and fifty million years ago, during the Devonian period, much of what is now the Kimberley mainland was underwater. A tropical sea filled the Canning and Bonaparte basins, and a barrier reef stretched more than 1000km around the coastline, the remains of which are visible as the Ningbing Range north of Kununurra, the cave systems of Mimbi Caves and Tunnel Creek, Geikie and Windjana gorges, right through to the rugged limestone hills running parallel to the King Leopold Ranges in the west Kimberley. Fossil sponges, fish, corals, snails, bivalves and stromatolites have been found in the ancient limestone reef system, including Western Australia's fossil emblem, the Gogo fish (*Mcnamaraspis kaprios*).

The Gogo fish, fossil emblem of Western Australia.

The Kimberley coastline as we know it today, with its rugged bluffs, sculpted gorges and numerous archipelagos, was formed approximately 17,000 years ago at the end of the last ice age as the ocean flooded into the system of hills and river valleys as part of a global rise in sea levels. This kind of drowned river valley is called a ria coast. The Kimberley ria coastline is globally unique in the extensiveness and variety of landforms exhibited in a tropical environment with such extreme tidal patterns.

Aboriginal people have a connection with Kimberley waters that dates back at least 40,000 years. There are hundreds of archaeologically significant marine sites (such as shell middens and fish traps) scattered all along the coastline, and the ocean remains prominent in oral traditions and spiritual activities. Today, traditional owners and Indigenous ranger groups work in partnership with Parks and Wildlife and Fisheries to manage the Kimberley marine environment and conserve these culturally significant places and species for future generations.

Northern Australia was visited regularly by fishermen and traders from neighbouring countries long before Europeans visited the continent. Of the more recent visitors, the Makassans, from the island of Sulawesi in what is now Indonesia, visited seasonally from the mid seventeenth century up until the early twentieth century. Arriving before the onset of the wet season, with equipment to set up semi-permanent camps including smokehouses, the Makassans stayed throughout the wet season collecting and smoking trepang, a kind of sea cucumber, which was a highly prized trade item throughout Asia. Evidence of buildings, metal cauldrons and other archaeological items has been discovered right across the top end, including at sites near Kalumburu and Yampi Sound.

Following the discovery of the world's largest pearl oyster shell in Roebuck Bay in 1861, pearlers from around the globe arrived in the Kimberley *en masse* seeking their fortunes. Today's pearlers continue to operate along the Northwest coastline between Broome and Darwin, and pearling remains a major contributor to the Kimberley economy, behind mining, tourism, retail and agriculture. The onset of the pearling wave roughly coincided with the Halls Creek gold rush, increased 'opening up' of the Kimberley's interior for pastoralism, and the arrival of missionaries to the region, all of which contributed to the displacement of the Kimberley's Aboriginal population from their traditional lands and lifestyles.

Conservation values

The Kimberley marine environment is listed among only 3.7 per cent of the world's oceans which have had a very low impact from human activities, alongside the Arctic and Antarctic polar regions. As both commercial and recreational human usage increases across the region, the need for carefully considered management strategies becomes more important.

Lalang-garram / Camden Sound Marine Park, south of the Bonaparte Archipelago, protects the largest humpback whale nursery in the southern hemisphere, with more than 1000 humpbacks using the sound each year to

breed, calve and nurse their young. The Kimberley also has important populations of manta rays, dugongs and all six species of threatened marine turtle found in Australia. Roebuck Bay lays claim to having the largest known population of snubfin dolphins, only recently known to scientists and found only in Australia.

The Kimberley's fringing coral reefs may be more extensive and diverse than those of Ningaloo Marine Park, but scientists are only just discovering them. Montgomery Reef, in Lalang-garram / Camden Sound Marine Park, is a particularly outstanding, biologically diverse coral reef covering around 30,000ha.

The Kimberley contains two of only a dozen areas in the world with huge intertidal flats rich in shorebirds. The Proposed Yawru Nagulagun / Roebuck Bay and recently established Eighty Mile Beach marine parks are summer refuges to hundreds of thousands of internationally protected migratory waders that fly from as far afield as Siberia.

Some of the largest mangrove patches in Australia, considered among the most pristine mangrove forests in the world, fringe the Kimberley coast, with a total area of 140,000ha. Stands comprise up to 18 tree species and their fauna is rich and distinctive.

There are more than 2500 islands off the Kimberley coast, spectacularly beautiful places with plunging sea cliffs, tropical vegetation and secluded beaches. Most importantly, these islands are reservoirs of wildlife and ecological communities, many of which have disappeared or are under threat on similar areas of the mainland. This is because the islands have mostly been spared from recent disturbances such as feral cats, cattle and inappropriate fire regimes. The number of islands and their isolation has resulted in tremendous natural diversity. Just as in the Galapagos Islands, the Kimberley islands are a drawcard for the study of evolution. Unlike other parts of Western Australia, at present few islands in the Kimberley are reserved for conservation due to their remoteness.

Conservation challenges and sustainability

A combination of the historic inaccessibility of the Kimberley marine environment and the high costs associated with conducting research in the region, along with relatively low commercial and recreational use of the area, has meant that until recently the ecological value of the region had not been fully quantified. Comprehensive marine and biological surveys of Kimberley islands, conducted in 2006-13, have provided new insights that will shape future management strategies to preserve this unique environment while balancing the interests of commercial and recreational users.

Increased use and accessibility must be carefully balanced to prevent possible pollution, overfishing and the destruction of cultural and historic sites. The importance of living in a sustainable manner and adhering to rules that help us to manage marine populations of fauna is a vital part of modern society.

Albatross with plastic in its stomach.

Marine debris

One of the greatest threats to the world's oceans is marine debris, that is, rubbish found in the ocean. The bulk of marine debris is non-biodegradable plastic, which spreads by travelling on ocean currents. The majority of this rubbish originates from land-based sources, such as beach users, stormwater drains, sewage outlets and windblown litter from adjacent urban areas and landfill sites. A small proportion of marine debris originates from recreational and commercial fishing vessels, tourist vessels and marine related industries, such as mining and shipping. Marine debris is hazardous to ships, swimmers, divers, beach users and marine life, and can remain in the marine environment for many years. In its original form, marine debris affects marine life directly through entanglement, ingestion and smothering the sea floor. As it breaks up into smaller pieces, plastic is mistaken for food by different organisms to the extent that it can affect entire ocean food chains.

Erosion and climate

Inshore reefs are adversely affected by the influx of soil each wet season, an issue exacerbated by inappropriate fire regimes and the management of livestock, which contribute towards erosion in catchment areas and subsequently increase the amount of sediment in the river systems. Future changes in storm patterns attributed to climate change may further compound the issue. While Kimberley coral species are highly adapted to cope with regular exposure to sunlight and high air temperature at low tide, they are still susceptible to coral bleaching caused by a rise in sea temperature.

Industry

Historically, industries such as pearling, aquaculture, marine tourism and mining have only been conducted on a small scale, and as such site selection and planning for these activities has been done on a case by case basis. As industries grow and diversify, broader scale management strategies and zoning based on both projected growth and the results of marine research are required to balance industry, recreational, cultural and conservation values.

Increased marine industry may lead to new conservation challenges in the region, such as the increased likelihood of the introduction of marine pests and the need to monitor developing aquaculture.

Customary activities

Customary fishing and hunting by traditional owners is legislated independently from recreational fishing, but like recreational fishing, it is a requirement that all customary activities are undertaken sustainably. Traditional communities recognise the importance of maintaining local species and practices into the future as per their custom. Overfishing and the inhumane treatment of any species, including turtles and dugongs, are both prohibited under customary activity legislation. Projects such as the 2005-08 Northern Australian Indigenous Land and Sea Management Alliance's Dugong and Marine Turtle Project have seen traditional owners and Indigenous ranger groups from across the top end working together to survey and monitor these key species with the aim of developing their own species management plans. These plans, unique to each community, outline their own limits to hunting and/or sanctuary zones for use by their own community members.

What can we do to minimise impacts?

The Department of Parks and Wildlife and Department of Fisheries work together with traditional owners, industry, community groups and recreational users to look after the Kimberley marine environment. Key tools in managing the marine environment include fishing regulations and marine conservation areas, including marine parks. Community groups and individuals play a role as well, as on the ground users are often the first to notice something changing in their area and can suggest protection measures that would best suit their community.

Fishing rules

Western Australia's fisheries management strategy has one primary goal: fish for the future. This means ensuring our fisheries are ecologically sustainable. This is done through managing and licensing commercial and recreational fishing activities and protecting the aquatic environment and ecosystems on which fish depend.

Recreational fisheries are threatened by population growth, coastal development and improved fishing technology. A high participation rate, due to the low cost of equipment and the ability of fishers to access previously remote areas, is placing pressure on many fish stocks. Industrial activities and other human-induced environmental changes have caused damage to many fish habitats around the globe.

In Western Australia, recreational fishing is managed by the Department of Fisheries, and management is based on the biology and ecology of fish stocks and knowledge of patterns of past fishing effort. Typical recreational fishing management strategies include bag limits, size limits for certain species, and licences for fishing from boats, using nets, or catching certain shellfish such as abalone or western rock lobster (often incorrectly referred to as 'crayfish'). A number of species found in Kimberley waters, such as sawfish and humphead Maori wrasse, are totally protected under the Western Australian *Fish Resources Management Act 1994*, meaning they cannot be taken by recreational or commercial fishers. These initiatives are most effective when combined with community education programs and campaigns.

Marine parks

Marine parks are created to protect the natural features and intrinsic value of a particular area, while allowing a level of recreational and commercial use that does not compromise its conservation. In 2015, the Kimberley had three gazetted marine parks; Rowley Shoals, 300km northwest of Broome, Eighty Mile Beach, 100km south of Broome, and Lalang-garram / Camden Sound, 150km north of Derby. Additional parks are proposed under the *Kimberley Science and Conservation Strategy* for Yawuru Nagulagun / Roebuck Bay, Lalang-garram / Horizontal Falls, North Lalang-garram, and the North Kimberley coast from Camden Sound to the Northern Territory border.

Marine parks have four management zone options – sanctuary, general use, recreation and special purpose. These options can be described as follows:

- **Sanctuary zones** are 'look but don't take' zones, where surface water sports, snorkelling and scuba diving are permitted.
- **General use zones** are areas where activities such as sustainable commercial fishing, aquaculture, pearling, and petroleum exploration and production are permissible, provided they do not compromise conservation values.
- **Recreation zones** are areas where the priority use is recreation. These zones allow most types of recreational fishing, water sports and non-extractive tourism such as whale-watching, however commercial fishing is prohibited.
- **Special purpose zones** are areas that are created to give scientists baseline data about this and surrounding areas. Only certain activities are permitted in these areas, the details of which are unique to each park. Examples of special purpose zone restrictions may include a speed limit on boats to protect marine mammals, or an area allowing shore-based fishing alongside a sanctuary zone.

Proposed Lalang-garram / Horizontal Falls Marine Park.

Community actions

Community groups play a vital role in protecting the marine environment. By educating the broader community about issues affecting their local area, communities are able to enact positive change through long-term campaigns. Many community groups conduct or take part in citizen science projects, allowing researchers to gather valuable scientific data that they would not otherwise have access to due to geographic, financial or time constraints. All groups listed below welcome individual and school group volunteers.

The following groups contribute to conserving Western Australia's marine environment:

- **Tangaroa Blue** www.tangaroablue.org

Tangaroa Blue is a not-for-profit organisation working to improve the health of our marine environment. They coordinate marine debris research, working with communities and individual volunteers to collect litter found on their beaches, and record and report their findings back to the central organisation. This information is used to identify the main sources of marine litter, subsequently stakeholders can be engaged to identify strategies to stop this rubbish entering our rivers and oceans in the first place.

- **Recfishwest** recfishwest.org.au

Recfishwest is a community organisation representing Western Australia's recreational fishers. Their vision is to ensure sustainable recreational fishing resources, which means many of their projects focus on ensuring fish stocks are maintained through a variety of conservation projects. Community grants are offered to groups wanting to protect their local recreational fishing opportunities through litter reduction, maintaining healthy rivers and oceans, and reducing chemical run-off.

- **Keep Australia Beautiful** www.kabc.wa.gov.au

Keep Australia Beautiful works to prevent and reduce litter through community education and engagement, legislation and enforcement. Keep Australia Beautiful's *Clean Marine* campaign targets recreational fishers and boaters to reduce the amount of marine litter. Resources available include signage, posters, brochures, stickers and portable ashtrays. Additional campaigns promote action through community clean ups and the *Adopt-a-spot* program, with gloves, bags and other resources available free of charge through an order form on their website.

The Derby Bush Rangers *received a Recfishwest grant to install fishing line recovery bins at the Derby Jetty and to create signs encouraging fishers to put their rubbish in the bin at popular local fishing spots such as Willare Bridge, May River and the Cuttings.*

The following groups contribute to conserving the Kimberley marine environment:

- **Roebuck Bay Working Group** www.roebuckbay.org.au

The Roebuck Bay Working Group is a partnership between land and sea managers, traditional owners and community members seeking to protect, restore and maintain the natural and cultural value of Roebuck Bay. Projects include community awareness campaigns, citizen science monitoring projects and contributions towards management plans concerning Roebuck Bay. Volunteers are invited to participate in turtle monitoring, mud sampling, bird catching and tagging, seagrass monitoring and community clean ups.

- **Environs Kimberley** www.environskimberley.org.au

Environs Kimberley is a community-based environmental organisation seeking to protect the natural environment of the Kimberley. Environs Kimberley partner with a broad range of stakeholders to deliver research, practical conservation and restoration projects, and community education. Environs Kimberley partner with the Department of Parks and Wildlife and Nyamba Buru Yawuru to monitor the health of Roebuck Bay's seagrass. Seagrass is used internationally as an indicator of marine health, it provides food for wildlife such as dugongs and turtles, and habitat for smaller fish and crustaceans. A healthy seagrass bed stabilises the sea floor and absorbs nutrients from run-off, keeping the water clean. Volunteers are enlisted to collect seagrass information from three sites around Broome, which are each surveyed every four months.

- **Yawuru Rangers – Cable Beach Turtle Monitoring, Roebuck Bay Mud Sampling**
  yawuru.rangers@dpaw.wa.gov.au

The Department of Parks and Wildlife's Yawuru joint management team coordinate an annual turtle monitoring program on Cable Beach from November to February. Volunteers nominate to walk a section of the beach early in the morning looking for signs of turtle activity such as tracks, nests and turtles themselves. Information gathered by the volunteers is used to develop management strategies for conserving the turtle population.

The Yawuru Rangers partner with the Broome Bird Observatory and community volunteers to conduct monthly benthos (mud) sampling on the mud flats of Roebuck Bay. Cores of mud are collected from the mudflats at low tide and examined for invertebrates such as small crustaceans, snails and bivalves. These invertebrates form the bulk of the diet for migratory shorebirds that visit Roebuck Bay each year. Learning about changes in abundance of these invertebrates can help researchers identify links between external factors and the overall health of the bay.

Bush Rangers *instructors take part in a mud sampling workshop.*

- **Broome Bird Observatory** broomebirdobservatory.com

Broome Bird Observatory is a research and education facility situated on Roebuck Bay, dedicated to the conservation of migratory shorebirds. Established by Birdlife Australia, Australia's peak scientific and recreational bird organisation, researchers and volunteers monitor the tens of thousands of birds that visit Roebuck Bay each year. Activities include bird catching and banding, observational surveys and mud sampling, in addition to tours and information sessions.

Individuals

There are simple actions that individuals can take to contribute towards conserving our marine environment. By leading a sustainable lifestyle and minimising waste production and energy usage, people can make a significant contribution to protecting our marine flora and fauna.

The following actions can directly improve the survival rates of marine wildlife:

- Fish sustainably, only take what you will eat and pay attention to catch and size limits.
- Follow any signs showing where you can and can't fish, boat, camp and drive.
- Take all rubbish with you or put it in a bin, even if it wasn't your rubbish. Keep spare rubbish bags in the car for impromptu clean ups.
- Keep your distance and respect all wildlife. When watching nesting turtles observe from behind, use a red torch, and don't block their path to or from the water.
- Don't drive on beaches between November and February; this is turtle nesting time. If you drive on beaches at other times of year stay out of the dunes and watch out for wildlife.
- Think about chemicals you may be sending into rainwater drains (e.g. detergent from car washing or fertilisers from the garden). These end up in our oceans and rivers. Use slow-release fertiliser dug into the soil and covered with mulch, and wash cars, boats and bikes on the grass.

Additional resources for the classroom

Picture books

- ***Dhyum the Dugong***, Mariana Fuentes 2012. Available online: http://www.coralcoe.org.au/wp-content/uploads/2016/05/dhyum-the-dugong.pdf
- ***Myrtle's battle against climate change,*** Mariana Fuentes 2010 (caution: scary themes). Available online: http://www.coralcoe.org.au/wp-content/uploads/2016/05/fuentes_educational-book_myrtle.pdf
- ***Dolphin Baby!*** Nicola Davies, 2012, Candlewick.
- ***Seadragon Sea***, Margaret Spurling, 2005, Working Title Press.
- ***Underwater Workout***, Clare Hibbert, 2008, Evans Brothers Limited.
- ***On the Beach*** (Usborne Lift-the-flap), Alastair Smith & Laura Howell 2004, Usborne Publishing.
- ***Claws, eyes, flippers***, Dub Leffler, 2012, Magabala Books.

Fiction for older readers

- ***Blueback: a fable for all ages***, Tim Winton, 2008 Pan Macmillan.

Non-fiction books

- ***Living Nature: Fish***, Oxford Scientific Films, 2003, Chrysalis Children's Books.
- ***Australian Sea Life***, Steve Parish, 1998, Steve Parish Publishing.
- ***Discover and learn about Australian Coasts and Oceans***, Pat Slater & Steve Parish, 2002, Steve Parish Publishing.
- ***Ocean watch***: ***The young person's guide to protecting the planet***, Martyn Bramwell, Planet Ark, 2001, Dorling Kindersly.
- ***Australia's Changing Environments: Marine Environments,*** Anna Sheppard, 2006, Heinemann Library.

Resources for teachers

- ***Marine WATERs*** – see 'Websites' on next page.
- ***Exploring Western Australia's Marine Parks*: *Teachers' Guide*,** Department of Parks and Wildlife 2013. Available online: https://www.dpaw.wa.gov.au/images/documents/education/20130084-ExploreWAMarineParkUpPrimWB.pdf
- ***Marine Parks: Kids activity book***, Department of Parks and Wildlife 2014. Hardcopies of activity book and accompanying bookmarks and posters available from Parks and Wildlife's education team (see contacts p15). Available online: www.dpaw.wa.gov.au/images/documents/education/20140609_Marine_Parks_Kids_Actitivity_book_WEB.pdf
- ***Seagrass-Watch Activity Book***, Junior and Senior editions and educators handbook, Seagrass-Watch. Available online: www.seagrasswatch.org/education.html
- ***Dugong and Marine Turtle Teaching Resource and Information Pack***, Northern Australian Indigenous Land and Sea Management Alliance, 2006. Available online: www.nailsma.org.au/sites/default/files/publications/Dugong-and-Marine-Turtle-Teaching-Resource-and-Information-Package.pdf

Posters and brochures

- ***Marine wildlife of WA's north-west: Identification guide***. Department of Parks and Wildlife. Available online: www.dpaw.wa.gov.au/management/marine/marine-wildlife
- ***Marine turtles of the Kimberley coast.*** Department of Parks and Wildlife. Hardcopies available in Resource Pack. Additional copies available from Parks and Wildlife education staff (see contacts p15).
- ***Recreational fishing guide 2016*: *simpler rules for better fishing.*** Department of Fisheries. Available online: www.fish.wa.gov.au/Documents/recreational_fishing/rec_fishing_guide/rules_guide_statewide.pdf
- ***Recreational fishing in Western Australia: Fish identification guide.*** Department of Fisheries. Available online: www.fish.wa.gov.au/Documents/occasional_publications/fop103.pdf
- ***The Kimberley Coast, The Last Sanctuary: Nine iconic places.*** Available online: awsassets.wwf.org.au/downloads/mo028_the_kimberley_coast_nine_iconic_places_16aug12_1.pdf
- ***Dugong and Marine Turtle Handbook***. Northern Australian Indigenous Land and Sea Management Alliance, 2006. Available online: http://www.nailsma.org.au/hub/resources/publication/dugong-and-marine-turtle-knowledge-handbook-2006
- ***Code of Conduct for Recreational Fishing in the Kimberley***. Department of Fisheries, 2013. Available online: www.fish.wa.gov.au/Documents/recreational_fishing/additional_fishing_information/kimberley_recreational_fishing_code_of_conduct.pdf

Dugong.

Websites

- **Marine Parks WA,** Department of Parks and Wildlife's marine parks website for kids. Learn about marine parks and the animals that live in them with information and interactive games. Teacher resources are also available under 'Downloads'.
  https://www.dpaw.wa.gov.au/management/marine/marine-parks-wa
- **Marine WATERs,** teacher education resources from the Department of Fisheries. Create a free account and login to access curriculum linked lesson plans, worksheets, presentations and classroom resources.
  marinewaters.fish.wa.gov.au
- **Seagrass-Watch,** resources relating to seagrass monitoring projects, data collection and background information.
  www.seagrasswatch.org/home.html
- **Tangaroa Blue,** information for organising marine clean ups and collecting marine debris data.
  www.tangaroablue.org
- **Roebuck Bay Working Group,** interactive presentations about Roebuck Bay's shorebirds and seagrass ecosystems.
  www.roebuckbay.org.au/learning-activities

Videos

Three minutes of footage showcasing the Kimberley marine environment above and below the water.
museum.wa.gov.au/kimberley/videos/day-18-kimberley-montage-kimberley-2012

An explanation of how marine researchers work in the Kimberley.
museum.wa.gov.au/kimberley/videos/story-1-kimberley-2013

The turtle nesting experience at Eighty Mile Beach, Department of Parks and Wildlife, 2014.
www.youtube.com/watch?v=vXmCrloj3dg

Incursions, excursions and clean ups

Parks and Wildlife and Fisheries incursions and excursions

Parks and Wildlife and Fisheries education officers have a frequently updated program of incursions and excursions available to suit all year groups. Many of these activities can also be adapted for school holiday programs, youth groups and clubs. For the latest program, contact:

Fisheries Northern Education	(08) 9193 8600
Parks and Wildlife Education	(08) 9168 4200

Marine studies excursions

Marine monitoring activities suitable for undertaking on excursions are listed in Exploring Western Australia's Marine Parks: Teachers' Guide.

Contact us on the numbers above if you need assistance with planning your excursion.

Clean ups

Conducting a clean up around your school or a local waterway or beach is a great way to start or finish your studies of the marine environment. Clean ups are one of the simplest practical measures students can take that directly assist with protecting marine wildlife. Data collected from clean ups is analysed by organisations such as Tangaroa Blue to identify the main sources of marine debris. Once they know where the litter is coming from, it is possible to work with stakeholders to reduce the amount of marine debris originating from these sources in the future.

The following organisations may assist with planning your clean up:

Tangaroa Blue – 'How to' manual, checklists and data sheets.

Keep Australia Beautiful – Register your clean up to receive gloves, bags and tongs. If you plan to make your clean up a regular event you may like to 'Adopt-a-spot'.

Volunteering

The following organisations may be able to accommodate school groups with sufficient notice. As many of these activities take place in the early morning you may wish to combine them with an overnight camp at Broome Camp School, Broome Bird Observatory or Eighty Mile Beach.

- **Seagrass monitoring, Broome.**

  See website for training sessions, monitoring dates and contact details: www.environskimberley.org.au/kimberley-conservation-campaigns-projects/conservation-campaigns.

- **Mud sampling, Broome Bird Observatory.**

  Contact yawuru.rangers@dpaw.wa.gov.au to register your interest. Sampling dates are listed here: www.roebuckbay.org.au/volunteer-activities/benthos-monitoring.

- **Birdwatching, catching and banding, Broome Bird Observatory.**

  Contact broome@birdlife.org.au. Dates are listed here: www.roebuckbay.org.au/volunteer-activities/shorebird-monitoring.

- **Turtle monitoring, Cable Beach and Eighty Mile Beach.**

  For Cable Beach, email yawuru.rangers@dpaw.wa.gov.au to register your interest. For Eighty Mile Beach, contact Parks and Wildlife on (08) 9195 5500.

King Cascades.

Curriculum link overview Years 4–6

Year	Lesson 1 Who lives there?	Lesson 2 Shorebirds away	Lesson 3 Design your own marine park
	Science	Science	Geography
Year 4	Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) *Investigating the roles of living things in a habitat.* *Recognising that interactions between living things may be competitive or mutually beneficial.* Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)	Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) *Predicting the effects when living things in feeding relationships are removed or die out in an area.*	The importance of environments to animals and people, and different views on how they can be protected (ACHGK022) *Explaining how people's connections to the environment can also be aesthetic, emotional and spiritual.* *Recognising that there are different perspectives on what constitutes environmental sustainability and considering the role of people in protecting the environments that provide habitats for animals and discussing ways of doing this.* *Exploring strategies to protect particular environments that provide habitats for animals.*
Year 5	Living things have structural features and adaptations that help them survive in their environment (ACSSU043) *Describing and listing adaptations of living things suited for particular Australian environments.* *Exploring general adaptations for particular environments.*	Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) *Explaining how particular adaptations help survival; describing and listing adaptations of living things suited for particular Australian environments; exploring general adaptations for particular environments.*	The influence people have on the human characteristics of places and the management of spaces within them (ACHGK029) *Examining how the use of space within their local place is organised through zoning.* *Investigation of a current local planning issue, exploring why people have different views on the issue, and developing a class response to it.*
Year 6	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) *Researching organisms that live in extreme environments.*	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) *Considering the effects of physical conditions causing migration.*	The effects that people's connections with, and proximity to, places throughout the world have on shaping their awareness and opinion of those places (AHCGK036) *Identifying factors that influence people's awareness and opinions of places, for example, the media, significant known events, proximity to places, and personal relationships with places.* *Explaining various generalisations about people and places and researching their accuracy.*

Curriculum link overview Years 4–6

Year	Lesson 4 Fish fact files	Lesson 5 Turtle life cycle	Lesson 6 Save our turtles
	Science	**Science**	**Geography**
Year 4	Science knowledge helps people to understand the effect of their actions (ACSHE062) *Exploring how science has contributed to a discussion about an issue such as loss of habitat for living things or how human activity has changed the local environment.* Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) *Investigate the roles of living things in a habitat.*	Living things have life cycles (ACSSU072) *Describing the stages of life cycles of different living things.* *Recognising environmental factors that can affect life cycles.*	The importance of environments to animals and people, and different views on how they can be protected (ACHGK022) *Explaining how people's connections to the environment can also be aesthetic, emotional and spiritual.* *Recognising that there are different perspectives on what constitutes environmental sustainability and considering the role of people in protecting the environments that provide habitats for animals and discussing ways of doing this.* *Exploring strategies to protect particular environments that provide habitats for animals.*
Year 5	Living things have structural features and adaptations that help them survive in their environment (ACSSU043) *Describing and listing adaptations of living things suited for particular Australian environments.* *Exploring general adaptations for particular environments.*	Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) *Explaining how particular adaptations help survival.* *Describing and listing adaptations of living things suited for particular Australian environments; Exploring general adaptations for particular environments.*	The influence people have on the human characteristics of places and the management of spaces within them (ACHGK029) *Examining how the use of space within their local place is organised through zoning.* *Investigation of a current local planning issue, exploring why people have different views on the issue, and developing a class response to it.*
Year 6	Scientific knowledge is used to inform personal and community decisions (ACSHE220)	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) *Considering the effects of physical conditions causing migration.*	The effects that people's connections with, and proximity to, places throughout the world have on shaping their awareness and opinion of those places (AHCGK036) *Identifying factors that influence people's awareness and opinions of places, for example, the media, significant known events, proximity to places, and personal relationships with places.* *Explaining various generalisations about people and places and researching their accuracy.*

Lesson one: Who lives there?

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Parks and Wildlife**

Department of **Fisheries**

Students examine four different marine habitats and discuss each habitat's unique features and potential threats, before mapping different marine habitats found across the Kimberley.

Australian Curriculum - Science

Year 4	Year 5	Year 6
Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) *Investigating the roles of living things in a habitat.* *Recognising that interactions between living things may be competitive or mutually beneficial.* Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)	Living things have structural features and adaptations that help them survive in their environment (ACSSU043) *Describing and listing adaptations of living things suited for particular Australian environments.* *Exploring general adaptations for particular environments.*	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) *Researching organisms that live in extreme environments.*

Teacher notes:

Adaptation: evolutionary process whereby a population becomes better suited to its habitat or changing environment.

Organism: a living thing.

Coral reef: a reef composed mainly of coral and other organic matter of which parts have solidified into limestone. Fringing coral reefs appear at the shoreline of continents or islands.

Ecosystem: a complex set of relationships among the living resources, habitats and residents of an area.

Habitat: area or environment in which an organism normally lives or occurs.

Threat: a factor likely to cause damage to an organism or ecosystem.

An introduction to each of the habitats discussed in this lesson can be found in the background information for teachers on p4-6. For further information, view the original lesson plan on the Marine WATERs website: http://marinewaters.fish.wa.gov.au/wp-content/uploads/Lesson-Plan-Who-Lives-Where1.pdf

Resources: *Who Lives There?* PowerPoint (from Resource Pack or Marine WATERs). Class set of posters: *Coral Reef Communities, Living Limestone Reefs, The Mysteries of Mangroves, The Secrets of Seagrass* (from Resource Pack or Marine WATERs). Computers with internet access or marine environment reference books

For each student: *Who lives where?* worksheet, *Mapping Marine Habitats* worksheet, coloured pencils

Introduction: Who lives there?

Display the *Who Lives There?* PowerPoint presentation for your class. List each habitat on the board as you go, and give an example of where each is found in the Kimberley (see Background Information p4-6). Once you have viewed all of the slides, engage students in a discussion about each of the habitat types. Where in Western Australia do you think (or know) they are found? What organisms do you think inhabit these areas and why? Why do different animals and plants live in different environments? How are some animals better suited to one habitat or another? Have students been to any of these habitats before? What did they see and do there? What threats might exist to these environments? Write your notes on the board.

Activity: Who lives there?

Introduce or review the following vocabulary: **habitat organism inhabit threat ecosystem**

Divide students into four groups. Give each group at least one copy of the *Who lives where?* worksheet. Allocate each group a different habitat from the four habitat types listed at the top of the worksheet. Give each group the poster relating to their habitat.

Students use information from the posters and notes from the *Who lives there?* discussion to answer the questions on the worksheet. For any remaining questions, look up the answers online or in the reference books.

Reflection: Mapping habitats

Allow each of the four habitat groups to share what they have learnt with the class. Note down where each habitat is found in the Kimberley.

Give each student a copy of the *Mapping Marine Habitats* worksheet. Ask students to mark Port Hedland, Broome, One Arm Point, Derby, Kalumburu, Wyndham and Kununurra on the map. Add in your town or community, too. Using different coloured pencils, students create a legend and then shade in areas where each type of marine habitat is found. Alternatively, you may prefer to create one giant map as a class.

Bar-tailed godwit.

Who lives where?

Circle your group's habitat:

Coral reef communities **Mysterious mangroves** **Secrets of seagrass** **Living limestone reefs**

Where in the Kimberley can you find this habitat?

Give at least one example, make sure you can find it on a map.

What organisms inhabit your habitat?

What plants and animals live in your habitat?

Name one threat to your habitat. What causes this threat?

Is it natural or caused by people?

What benefits does your habitat have to the marine ecosystem?

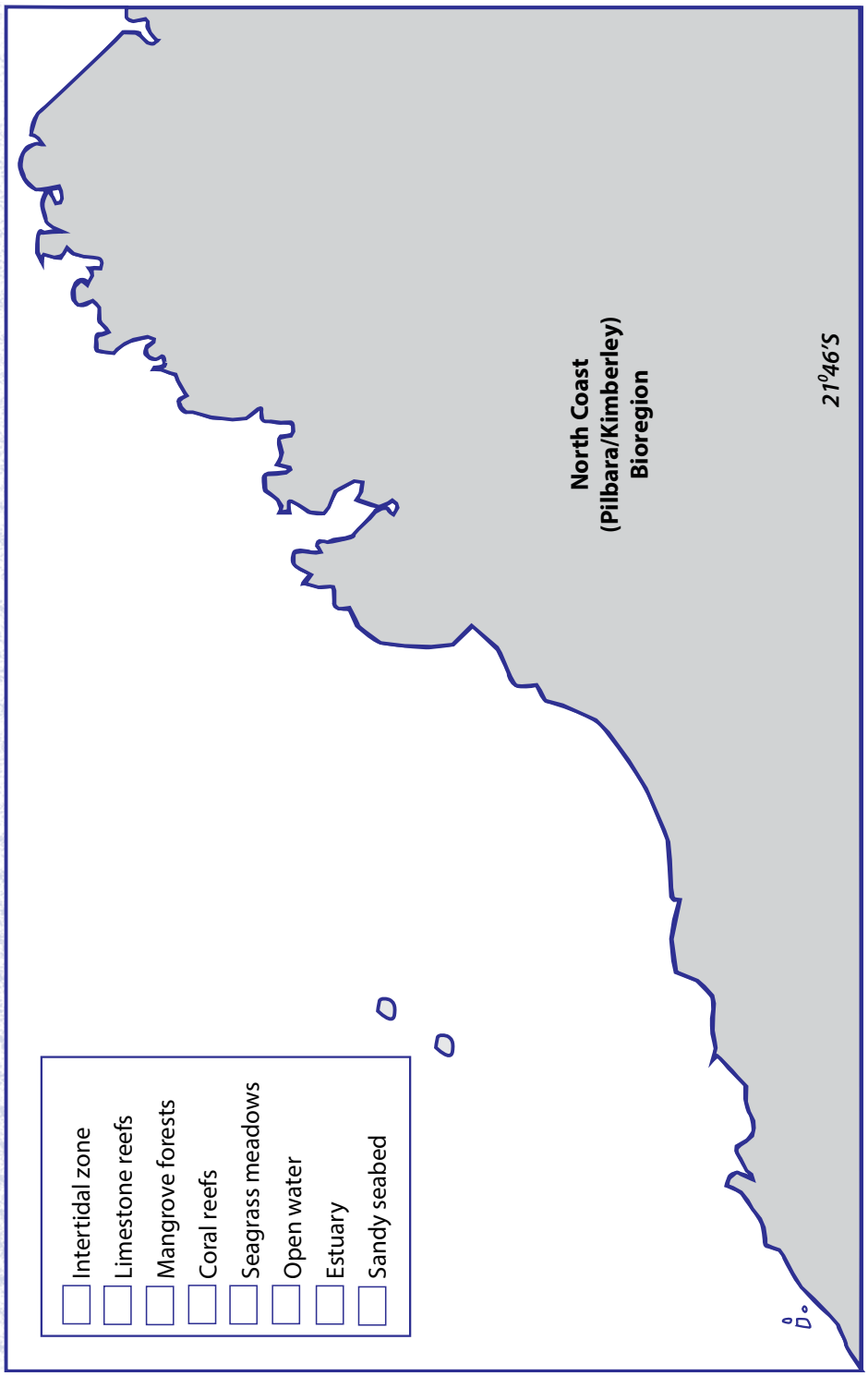
How does your habitat help ocean plants and animals? For example, some habitats provide places for baby fish to hide, or others have lots of food for adults.

List three interesting facts about your habitat.

-
-
-

Mapping marine habitats

1. Mark and label Port Hedland, Broome, One Arm Point, Derby, Kalumburu, Wyndham and Kununurra on the map. Add your town or community, too.
2. Choose a different colour for each type of habitat. Colour in the box next to each habitat type to create a legend for your map.
3. Mark and label at least one location of each habitat type on your map using the colours you have chosen.



Lesson two: Shorebirds away

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Parks and Wildlife**

Department of **Fisheries**

Students focus on adaptations that assist migratory shorebirds in making their long annual journeys, as well as identifying some of the challenges that shorebirds face through an interactive card game.

Australian Curriculum - Science

Year 4	Year 5	Year 6
Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) *Predicting the effects when living things in feeding relationships are removed or die out in an area.*	Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) *Explaining how particular adaptations help survival; describing and listing adaptations of living things suited for particular Australian environments; exploring general adaptations for particular environments.*	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) *Considering the effects of physical conditions causing migration.*

Teacher notes:

Roebuck Bay is known internationally as a major feeding site for migratory shorebirds. Many of these birds breed in the Arctic regions of the northern hemisphere, in places like Siberia, before travelling south to wait out the northern winter. Roebuck Bay and Eighty Mile Beach are both key stops on the East Asian-Australasian Flyway (the route the birds take each year), providing bountiful feeding grounds and wide sandy shores with plenty of space for large flocks to gather. Many birds rest at Roebuck Bay or Eighty Mile after their long journey south before heading on to other Australian destinations, and gather again in the Kimberley again at the end of the wet season before heading back to the northern hemisphere.

Shorebirds exhibit many unique adaptations that allow them to make their intrepid annual migration. These include the ability to consume large quantities of food to fuel their long journey, probing beaks that can find food down in the mud, aerodynamic wings, and a salt gland to process excess salt in their diet. Shorebirds are generally smaller than other water birds such as ibis, pelicans, ducks and cormorants, and spend most of their time feeding on open beaches and mudflats.

The Broome Bird Observatory at Roebuck Bay is a key birdwatching destination that attracts visitors from around Australia and the world to study the flocks of shorebirds that gather there. Researchers undertake regular monitoring programs including bird counts, bird catching and bird banding. Results from these studies are compared with other sites from around the flyway to gain an understanding of migration routes and habits of these global travellers. Consideration must be given to potential threats right across the flyway when determining how best to conserve shorebird populations.

For more information:

birdlife.org.au/projects/shorebirds-2020

birdlife.org.au/projects/shorebirds-2020/educational-material

Birdlife Australia's Farewell Shorebirds YouTube series – some episodes inappropriate for young viewers

birdlife.org.au/documents/EDU-Western-Port-Shorebird-Kit.pdf

http://birdlife.org.au/campaigns

Resources: Shorebird adaptations card game (print, cut & laminate cards - a black and white version is available in the Resource Pack**,** print rules), one set per group of 4-5 students

For each student: *The Wing Thing* www.birdlife.org.au/documents/SB-Wing-Thing.pdf or order from BirdLife Australia

Optional: *Life and Tides of Roebuck Bay*: http://www.ictv.com.au/video/item/1113 or from library; *The Amazing Shorebirds of Roebuck Bay* smartboard presentation: http://www.roebuckbay.org.au/shorebirds/index.php

Introduction: What are shorebirds?

Give each student or pair of students a copy of *The Wing Thing*. Give students 15-30 minutes to look through the magazine. Announce that when the time is up you want each student to tell the class one thing they have learnt about shorebirds.

When the time is up, ask each student to share what they have learnt. Brainstorm ways such small birds can survive a long journey from Siberia to Australia. Introduce the term 'adaptation'. Adaptations are physical features that allow a living thing to survive in a particular environment or situation. Talk about the sorts of situations shorebirds would experience over the course of their life (born in the Arctic, begin migrating once they are old enough, need to be able to fly long distances, need to find food, need to find a mate, need to look after eggs etc). What adaptations do shorebirds have that help them survive? These adaptations help birds negotiate natural challenges that they encounter, but may not be enough to help birds survive some newer, human-made threats that they encounter across the flyway such as habitat destruction, litter and pollution (see if students can identify the five threats in the 'Where's Ruddy?' game).

If you have time, let students finish reading the magazine and work through the puzzles.

Activity: Shorebird adaptation card game

Divide students into groups of 4-5. Each group sits in a circle on the floor or around a desk.

Give each group of students a set of cards and a copy of the rules. Explain that there are three types of cards: adaptation cards, environmental challenge cards and human made threat cards. The aim is to match environmental challenges with their corresponding threat (e.g. the challenge 'You have to fly 5000km in one journey' matches with the adaptation 'a lot of fat for energy'). Human-made threats do not have a matching adaptation.

Read through the rules as a class. Set a time limit for when your games will end (e.g. 20-30 minutes). If groups finish before the time is up they may play again.

Groups play game according to rules.

Reflections: Shorebird case study

Ask each group to share something they learnt about shorebirds with the rest of the class. Can students think of any other human made threats that shorebirds may encounter? What are some things we can we do to protect birds from these threats?

Watch *Life and Tides of Roebuck Bay* or look up tagged shorebirds to find their migration patterns and explore individual species on the Farewell Shorebirds webpage: http://birdlife.org.au/campaigns.

Common greenshank.

Shorebird adaptation card game

Adapted from: www.fws.gov/sfbayrefuges/murre/WUW/Seabird%20Survival%20Card%20Game.pdf

Rules:

1. **The object of the game is to collect as many environmental challenge and adaptation card matches as possible. Human-made threat challenge cards do not have matches.**
2. **One student shuffles the blue adaptation cards and deals four cards to each player. The rest of the adaptation cards are placed face down in the centre of the playing area.**
3. **The green environmental challenge and red human-made threat cards are shuffled together and placed face-down in a separate pile.**
4. **The player to the left of the dealer goes first. Continue clockwise.**
5. **When it is your turn, pick up a challenge card from the pile.**
6. **If you have the adaptation card that matches that challenge, you get to keep both cards and lay your match in front of you.**
7. **After a match, draw another adaptation card from the pile so you always have four adaptation cards.**
8. **Repeat steps 5 to 7 until you cannot make a match or you draw a human-made threat card. At the end of your turn you should have four adaptation cards left.**
9. **If you cannot make a match leave the challenge card face-up next to the challenge card pile. This ends your turn.**
10. **If you pick up a human-made threat challenge card, tell others how you can help the threat on the card and keep the card. This card does not have a match. This ends your turn for that round.**
11. **Read your cards out loud and share the information with the other players.**
12. **The next player tries to match any or all of the face up challenge cards. If they match all of the face up challenge cards, then they can draw from the challenge card pile. If they can't match any of the turned up challenge cards, they can draw from the challenge card pile.**
13. **The game ends when there are no cards left in the adaptation pile or the time is up.**
14. **The winner is the player with the most pairs at the end of the game.**

	Adaptation	Environmental challenge	Human-made threat
Coloured set	blue	green	red
Black and white	white	grey	black

Adaptation cards (print 3 copies per set so you have 3 cards for each adaptation)

Adaptation

Bar-tailed godwit

A lot of fat for energy

Up to 50% of a migrating bird's bodyweight is deposited as fat. This fat provides the energy for long distance flight.

If you don't have this adaptation your turn is over

Adaptation

Common sandpiper

Long pointed wings

The shape of a shorebird's wing is designed for flying long distances at fast speeds. Some shorebirds can fly up to 100 kilometres per hour!

If you don't have this adaptation your turn is over

Adaptation

Red knot

Courtship displays

Male shorebirds reach the nesting grounds first and set up their territory. Once the females arrive, the males begin elaborate courtship displays, involving wing fluttering, tail moving, feet scraping and singing.

If you don't have this adaptation your turn is over

Adaptation

Red-capped plover

Large eyes

Large eyes help some birds to see their prey. These birds usually have shorter beaks.

If you don't have this adaptation your turn is over

Adaptation cards (print 3 copies per set so you have 3 cards for each adaptation)

Adaptation

Sharp-tailed sandpiper

Coloured feathers that match the surroundings

Shorebird feathers, or plumage, match their environment so that they are harder for predators to see.

If you don't have this adaptation your turn is over

Adaptation

Common greenshank

Brood patches

Both parents develop bald spots on their belly, called 'brood patches', for keeping eggs warm when they're sitting on the nest.

If you don't have this adaptation your turn is over

Adaptation

Black-winged stilt

Long legs

for wading in shallow water and mud.

If you don't have this adaptation your turn is over

Adaptation

Terek sandpiper

Long bills

These bills are specially designed for collecting food. Long-billed shorebirds probe in the mud, opening just the tip of their bills.
This helps them pick out their food without getting a mouthful of mud or sand.

If you don't have this adaptation your turn is over

Adaptation cards (print 3 copies per set so you have 3 cards for each adaptation)

Adaptation

Great knot

Oily glands

A special oil gland at the base of their tail helps to keep their feathers in good condition. The birds spread the oil from the gland with their bills.

If you don't have this adaptation your turn is over

Adaptation

Red-necked stint

Salt glands

Shorebirds can drink salt water or eat salty sea creatures since they have salt glands above their eye sockets which remove extra salt.

If you don't have this adaptation your turn is over

Adaptation

Curlew sandpiper

Staying in a group, or flock

Shorebirds lift off and travel in flocks to protect individuals. Large flocks zig zag back and forward, making it difficult for predators to attack.

If you don't have this adaptation your turn is over

Adaptation

Eastern curlew

Hollow bones

Birds have hollow bones to keep their weight down so it is easier for them to fly.

If you don't have this adaptation your turn is over

Environmental challenge cards (print 2 copies per set so you have 2 cards for each challenge)

Environmental challenge

Bar-tailed godwit

You have to fly 5000 kilometres in one journey!

Adaptation: A lot of fat for energy

If you don't have this adaptation your turn is over

Environmental challenge

Common sandpiper

You need to fly long distances at fast speeds

Adaptation: Long pointed wings

If you don't have this adaptation your turn is over

Environmental challenge

Red knot

You need to attract a mate

Adaptation: Courtship displays

If you don't have this adaptation your turn is over

Environmental challenge

Red-capped plover

You need to see your prey to easily catch it

Adaptation: Large eyes

If you don't have this adaptation your turn is over

Environmental challenge cards (print 2 copies per set so you have 2 cards for each challenge)

Environmental challenge

Sharp-tailed sandpiper

You need to hide from predators

Adaptation: Coloured feathers that match the surroundings

If you don't have this adaptation your turn is over

Environmental challenge

Common greenshank

You need to keep your eggs warm in the cold Arctic summer

Adaptation: Brood patches on both parents

If you don't have this adaptation your turn is over

Environmental challenge

Black-winged stilt

You need to spend a lot of time wading through the mud and shallow water in search of food

Adaptation: Long legs

If you don't have this adaptation your turn is over

Environmental challenge

Terek sandpiper

You need to probe in the mud to reach your food

Adaptation: Long bill

If you don't have this adaptation your turn is over

Environmental challenge cards (print 2 copies per set so you have 2 cards for each challenge)

Environmental challenge

Great knot

You need to keep your feathers dry and stay warm

Adaptation: Oily glands

If you don't have this adaptation your turn is over

Environmental challenge

Red-necked stint

You need to remove the salt from sea water so that you can drink

Adaptation: Salt glands

If you don't have this adaptation your turn is over

Environmental challenge

Curlew sandpiper

You need to protect yourself from predators

Adaptation: Staying together in a group or flock

If you don't have this adaptation your turn is over

Environmental challenge

Eastern curlew

You need to keep your weight down so it's easier to fly

Adaptation: Hollow bones

If you don't have this adaptation your turn is over

Human-made threat (print one copy per set so you have one of each human-made threat)

There are factories being built on the mudflats where you usually eat so you can't find any food

Adaptation: none

Name three kinds of food shorebirds like to eat

Your turn is over

There is plastic in the mud that you mistake for food

Adaptation: none

Name three kinds of plastic you might find in the ocean

Your turn is over

You are caught in some fishing line and hooks

Adaptation: none

Explain what you should do with your rubbish when you go fishing

Your turn is over

There are lots of cars on the beach that keep scaring you and you cannot eat enough food to fly such a long distance

Adaptation: none

Describe how a bird might feel if it can't get enough food

Your turn is over

Lesson three: Design your own marine park

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Parks and Wildlife**

Department of **Fisheries**

Students discuss how marine parks protect places of value, and learn the purpose of different marine park zones before having a go at creating their own marine parks.

Australian Curriculum - Science

Year 4

The importance of environments to animals and people, and different views on how they can be protected (ACHGK022)

Explaining how people's connections to the environment can also be aesthetic, emotional and spiritual.

Recognising that there are different perspectives on what constitutes environmental sustainability and considering the role of people in protecting the environments that provide habitats for animals and discussing ways of doing this.

Exploring strategies to protect particular environments that provide habitats for animals.

Year 5

The influence people have on the human characteristics of places and the management of spaces within them (ACHGK029)

Examining how the use of space within their local place is organised through zoning.

Investigation of a current local planning issue, exploring why people have different views on the issue, and developing a class response to it.

Year 6

The effects that people's connections with, and proximity to, places throughout the world have on shaping their awareness and opinion of those places (AHCGK036)

Identifying factors that influence people's awareness and opinions of places, for example, the media, significant known events, proximity to places, and personal relationships with places.

Explaining various generalisations about people and places and researching their accuracy.

Teacher notes: Marine protected areas

Marine nature reserves are created for conservation and scientific research. Although low-impact tourism may be permitted, they are 'look but don't take' areas given the highest level of environmental protection. Hamelin Pool Marine Nature Reserve at Shark Bay is the only marine nature reserve in WA.

Marine management areas provide an integrated management structure over areas that have both high conservation value and intensive multiple use. There are currently two marine management areas in Western Australia (at the Muiron Islands and Barrow Island).

Fish habitat protection areas (FHPA) are developed at the suggestion of the local community to conserve and protect fish and their surrounding habitat, usually a reef system. The community who proposed the area play a key role in looking after it, through practical measures and by raising awareness and appreciation for the marine environment. There are six FHPAs in Western Australia, in locations such as the Abrolhos Islands, Cottesloe Reef, and Lancelin Island Lagoon.

Like national parks, **marine parks** protect natural features and aesthetic values while enabling recreational and commercial uses that do not compromise conservation values. Within marine parks there are four types of management zones:

- **Recreation zones** provide for conservation and recreation, including recreational fishing, but exclude commercial activities.
- **General use zones** are managed to conserve natural resources while allowing sustainable commercial fishing and petroleum exploration and production where they will not affect sensitive marine habitats. There are very few restrictions on recreational activities in such zones, which form the bulk of most marine parks.
- **Sanctuary zones** are 'look but don't take' areas that provide the strongest form of protection for the marine environment. Scientific evidence shows that sanctuary zones usually boost the abundance, diversity and size of marine species living within their borders. The public is encouraged to visit and enjoy sanctuary zones, whether by snorkelling, diving or boating.
- **Special purpose zones** are managed for a particular use or issue, such as protection of habitat or nursery grounds, seasonal events such as whale watching or a particular type of commercial fishing. Commercial and recreational activities may be allowed if they are compatible with the primary purpose of a special purpose zone.

Eighty Mile Beach Marine Park is Western Australia's 13th marine park, declared in Kimberley waters in January 2013. The area is conserved for its high biodiversity and cultural value and is jointly managed by Parks and Wildlife and the Karajarri, Nyangumarta and Ngarla traditional owners. The park protects internationally significant shorebird feeding and resting sites, key turtle breeding areas, fish, dolphin and dugong populations, and sites of cultural significance. The park encompasses sandy beaches, mudflats, mangrove forests, coral reefs, seagrass meadows and tidal creeks. Popular activities for visitors to the park include beach fishing, camping, four-wheel driving, turtle watching, bird watching, swimming and beachcombing.

Resources: Smartboard with access to Parks and Wildlife's **Marine Parks WA education portal** www.dpaw.wa.gov.au/management/marine/marine-parks-wa and National Geographic's YouTube video ***Weird Fish Marine Reserve*** www.youtube.com/watch?v=uAQQAcbtl5w, props or costumes for community role play (optional)

For each student: *Eighty Mile Beach: know your zones* worksheet (note there are black and white and smartboard versions of the map in the Resource Pack), *Design your own marine park* worksheet, coloured pencils

Introduction: Know your zones

Explain to students that marine parks, like national parks, are special places that are protected to look after the plants and animals that live there. There are special rules for these places to make sure all the plants and animals are conserved (kept safe for the future). Some rules in national parks are that you can't take dogs into the park, and that you can only camp in allocated campgrounds or drive and walk on designated roads and tracks. You also can't take any living or non-living things out of the park (e.g. visitors can't pick flowers or collect rocks). Do students know any other rules for national parks? What is the nearest national park to your school? Have students visited the park? What did they do or see there? What animals and plants live in the park? For information on specific parks see Parks and Wildlife's Park Finder.

Ask if students know about any marine parks near where you live. Display the map of WA's marine parks on the smartboard. Navigate to some of the Kimberley parks to find out why these places are protected and learn about some of the plants and animals that live there. Learn about different zones found in marine parks under 'Know your Zones'. To learn more about why we have marine reserves, you may like to watch *Weird Fish Marine Reserve* (you can explain that marine reserve is the American term for marine park, or the American equivalent of a sanctuary or 'look but don't take' zone, depending on the level of your students).

Navigate to the Eighty Mile Beach Marine Park page of the marine parks website. Read the description of the park and discuss why this area might have been chosen to be protected as a marine park.

Give each student a copy of the *Eighty Mile Beach: know your zones* worksheet. Explain that the map shows what activities you can do in the different areas (zones) of Eighty Mile Beach Marine Park. Students use the information on the map to complete the questions. Discuss your answers as a class.

Activity: design a marine park

Review what a marine park is. Ask students to name the four different zones found in marine parks (recreation, general use, sanctuary, special purpose - prompt them if necessary). Write each of the four zones on the board, and note down the main rules for each zone.

Give each student a copy of the *Design your own marine park* worksheet.

As a class, read through the scenario and discuss different features found on the map.

Ask students to choose what features they will protect in their marine park, and to draw their boundaries on the map.

Students use a different colour to create some sanctuary zones within their park. All other areas within the marine park are general use zones (as an extension students could also include recreation and special purpose zones).

Students complete the questions on the worksheet, explaining why they have made these decisions for their park.

Reflection: Community debate role play

Display a large copy of the Turtle Bay map on the smartboard. Ask a few students to draw their marine park boundaries and sanctuary zones on to the map and explain why they chose these areas.

Explain that when deciding what features to include in a park, and choosing which areas will be included in each zone, park planners need to consider all the different ways people use the area. If the people of Turtle Bay all have jobs taking tourists out fishing and whale watching, what might happen if boats were banned from the park? What about if the beaches became popular for shell collecting and visitors were allowed to take shells home with them?

Announce that each student is going to be given the role of a Turtle Bay community member. Allocate roles such as Parks and Wildlife and Indigenous rangers, Fisheries officers, whale watching tour guide, fishing tour guide, student, teacher, dugong scientist, commercial fishing operator, caravan park owner, shop owner, dive instructor and any other roles that students are familiar with. Give students five minutes to think about their role and what that person might think about a marine park, then have a roundtable discussion to share differing points of view as to how the marine park should be created. You may need to appoint a responsible student as chairperson or adjudicate the debate yourself. If you can't come to an agreement through discussion, what other ways could be used to reach a decision?

Eighty Mile Beach Marine Park: know your zones

You have been appointed as a ranger for the Eighty Mile Beach Marine Park. The marine park includes Western Australia's longest sandy beach and is home to many wildlife species including shorebirds, turtles, dugongs, dolphins and many other species.

Before you can start work, you need to 'know your zones' so you can teach visitors about which activities they can and can't do in each zone. Use the map and table on the back of this worksheet to find out which activities are allowed in each zone, then answer the following questions:

1. In which zones are you allowed to fish from the beach?

_____

_____

2. List three activities that are allowed in all zones of the marine park:

_____

_____

3. One activity isn't allowed anywhere in the marine park. What activity is it?

_____

4. Why do you think it isn't allowed?

_____

5. A sanctuary zone is an area from which no animal or plant can be removed at all. Which activities are not permitted in marine park sanctuary zones?

_____

6. Which activities are welcome in sanctuary zones of marine parks?

_____

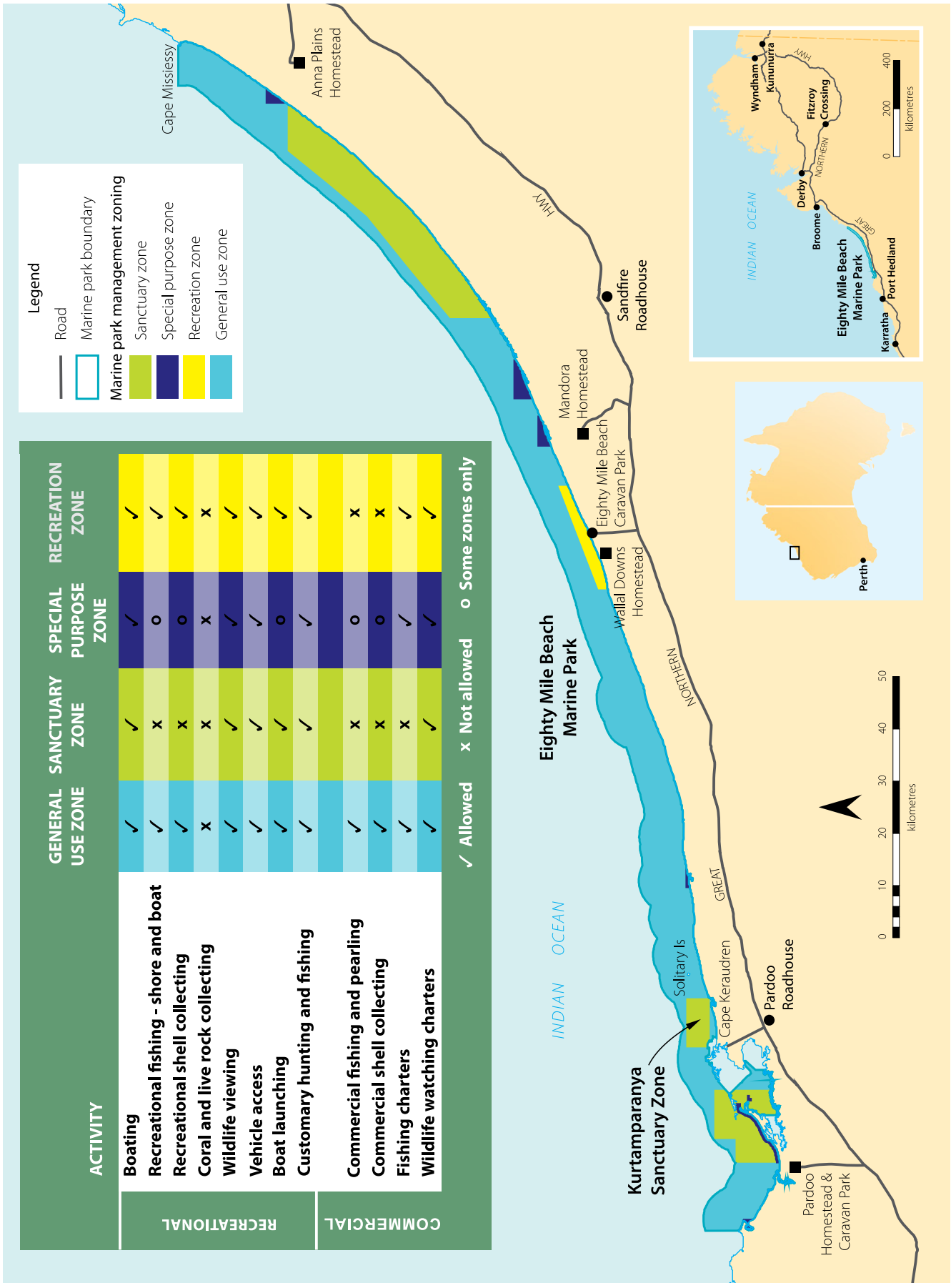
_____

7. The Kurtamparanya Sanctuary Zone at Cape Keraudren includes coral reefs and seagrass meadows. Why do you think this area was chosen to be a sanctuary zone?

_____

_____

Eighty Mile Beach Marine Park: know your zones



Design your own marine park

Look at the map of Turtle Bay. Scientists have suggested a marine park should be created in this area to protect an important whale breeding area, reefs, shorebird resting areas, seagrass beds, turtles, dugongs and other natural values. The area is also important to the local economy for fishing and tourism and many of the locals like to fish from the beach and from boats.
The government has assessed the area and agrees that it needs protection but they still want to allow sustainable use by tourists and fishers where this doesn't conflict with conservation.
You are a marine park planner. Think about the special marine features that need protection and the areas where people would like to fish. Some of these are in the same places. Remember that you can still fish inside marine parks but not inside marine park sanctuary zones.
When you are designing your marine park think about what kinds of recreation activities might not fit in well with conserving certain types of marine animals.

Draw a boundary showing the area you will include in your new marine park on the map.
Add in some sanctuary zones within the boundaries (areas where you can't fish at all).

1. Which features did you include inside the park boundaries?

_____

_____

2a. Which areas did you put inside sanctuary zones?

_____

_____

2b. Why did you include these locations in sanctuary zones?

_____

_____

_____

3a. Which features did you leave out of the park?

_____

_____

3b. Why?

_____

_____

4a. Would the whale breeding area be a good place to allow water skiing?

_____

4b. Why or why not?

_____

_____

_____

5a. Would the shorebird feeding grounds be a good place for fishing nets?

_____

5b. Why or why not?

_____

_____

_____

6a. Would you allow fishing in the dugong nursery area (this is also where the smaller fish shelter from predators)?

_____

6b. Why or why not?

_____

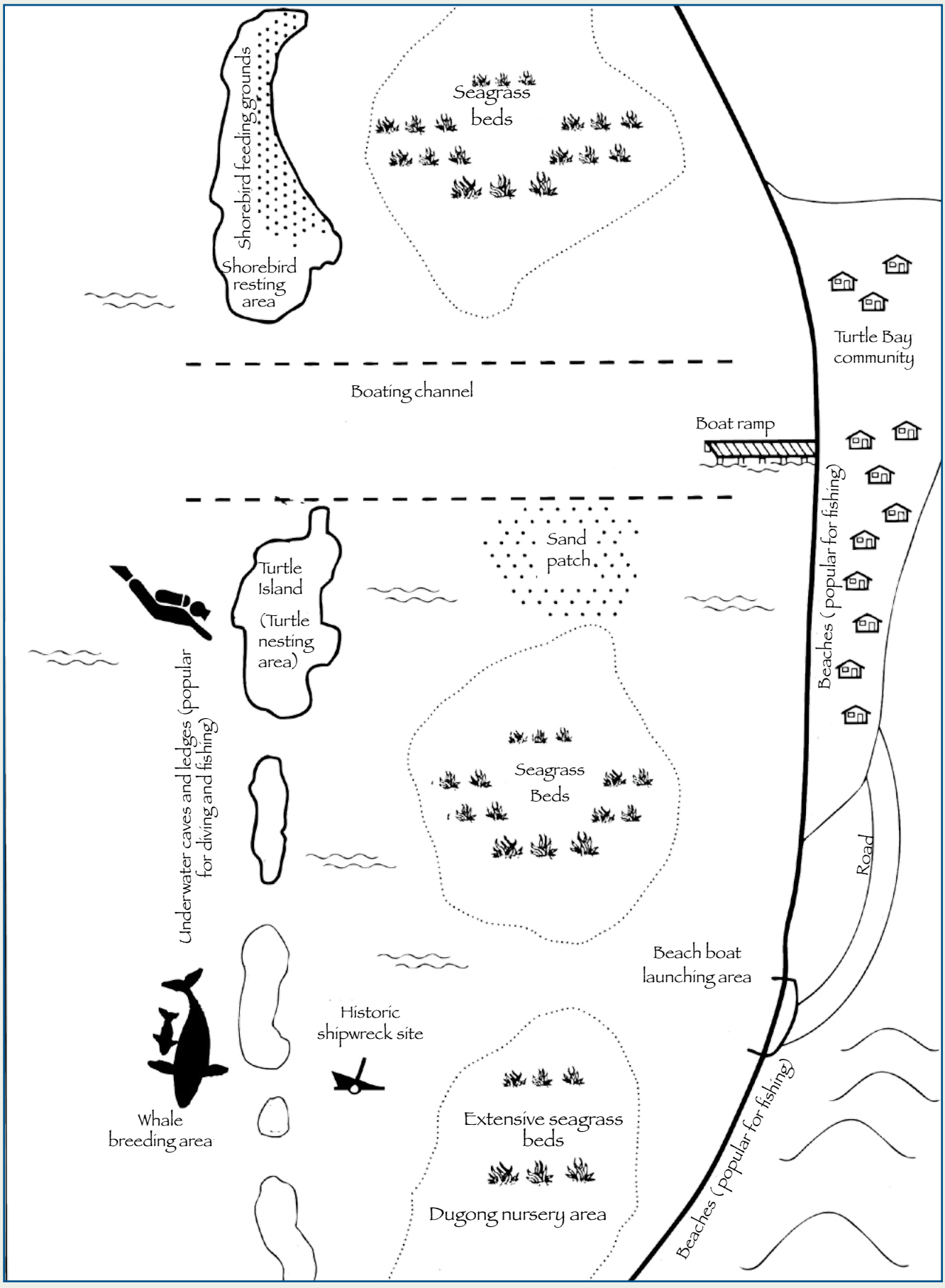
_____

_____

7. Suggest a name for your new marine park.

_____

Design your own marine park



Lesson four: Fish fact files

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Parks and Wildlife**

Department of **Fisheries**

Students learn that the Western Australian marine environment is divided into bioregions, each exhibiting a unique distribution of marine habitats and species, and examine a species found in the North Coast Bioregion.

Australian Curriculum - Science

Year 4	Year 5	Year 6
Science knowledge helps people to understand the effect of their actions (ACSHE062) *Exploring how science has contributed to a discussion about an issue such as loss of habitat for living things or how human activity has changed the local environment.* Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) *Investigate the roles of living things in a habitat.*	Living things have structural features and adaptations that help them survive in their environment (ACSSU043) *Describing and listing adaptations of living things suited for particular Australian environments.* *Exploring general adaptations for particular environments.*	Scientific knowledge is used to inform personal and community decisions (ACSHE220)

Teacher notes:

Bag limit: restriction on the number of a particular marine organism that a fisher may catch and keep, usually over a 24 hour period.

Bioregion: a geographic area characterised by a combination of physical and biological characteristics, for example, terrain, climate and ecological communities. Further information on fisheries bioregions can be found in status reports of the fisheries and aquatic resources of Western Australia on the Department of Fisheries WA website.

Closed season: the closure of a fishing ground for a defined period of time, used as a tool in the management of a fishery, frequently to protect a stock during a spawning season or reduce fishing effort.

Possession limit: the maximum number or amount of species that a person can possess or transport at any one time.

Recreational fishing: fishing for pleasure, to catch a feed of fish (not for commercial gain).

Size limit: the legal size which individuals of the prescribed fish species, if caught, may not to be retained.

Resources: Smartboard, coloured pencils, computers with internet to access Recreational fishing guide and Recreational fishing identification guide (access online at www.fish.wa.gov.au or ask Fisheries for a class set), atlases or Google Maps, access to Fisheries species fact sheets (available at www.fish.wa.gov.au/About-Us/Publications/Recreational-Fishing/Pages/Fact-Sheets.aspx) or a selection of printed fact sheets.

For each student: *Western Australia's Fisheries Bioregions* worksheet, *Fish Profile* worksheet

Introduction: Fisheries bioregions

Students will locate Western Australia's four marine fisheries bioregions on a map.

Access the recreational fishing rules page of the Department of Fisheries WA website and display the map illustrating the bioregions on the smartboard (scroll down, it's under the list of rule changes).

Explain that Western Australia has an extensive coastline with different fish and marine habitats and because of this, the State has been separated into four marine fisheries bioregions for management purposes. This can be explained in the context of a school, for example, it is easier to manage one class of students rather than all students at a school. Each bioregion (or class) is unique, so will be managed in a slightly different way.

Access maps or atlases for students to use.

Give each student a copy of the *Western Australia's Fisheries Bioregions* worksheet.

On the worksheet, correctly label each bioregion, shade in the land area with coloured pencils.

Use an atlas or Google Maps to label key coastal cities and towns (e.g. Esperance, Albany, Bunbury, Perth, Geraldlton, Carnarvon, Exmouth, Port Hedland, Broome, Derby and Wyndham).

Ask students to remember back to Lesson One where they located different marine habitats found in the North Coast bioregion (display a sample map if you have one available). Explain that each bioregion is full of these different habitats, although some bioregions will have more of some types of habitats than others as the water is warmer or cooler and the area might have different landforms. Because of these differences, there are sometimes different fishing rules for different areas.

Ask students what fishing rules they are aware of (e.g. barramundi size and catch limits). Why do these rules exist? What might happen if no one followed these rules? How are rules about size and catch limits similar to rules about different zones in marine parks? They all protect the species that live there.

Activity: Fish profiles

Students will research a fish species found in the North Coast Bioregion.

Give each student or pair of students a set of the two fisheries booklets (or a computer with which they can access the booklets). Give each student a copy of the *Fish Profile* worksheet.

Ask students to choose a marine animal from the Recreational Fisheries Identification Guide that is found in the North Coast bioregion (look for the 'NC' code). You may prefer to allocate well known Kimberley species such as barramundi, threadfin and mudcrabs. Fact sheets for each of these can be found on the Department of Fisheries WA website and on the Marine WATERs website.

Students use the booklets to complete a profile of their fish. Some questions may need further internet research.

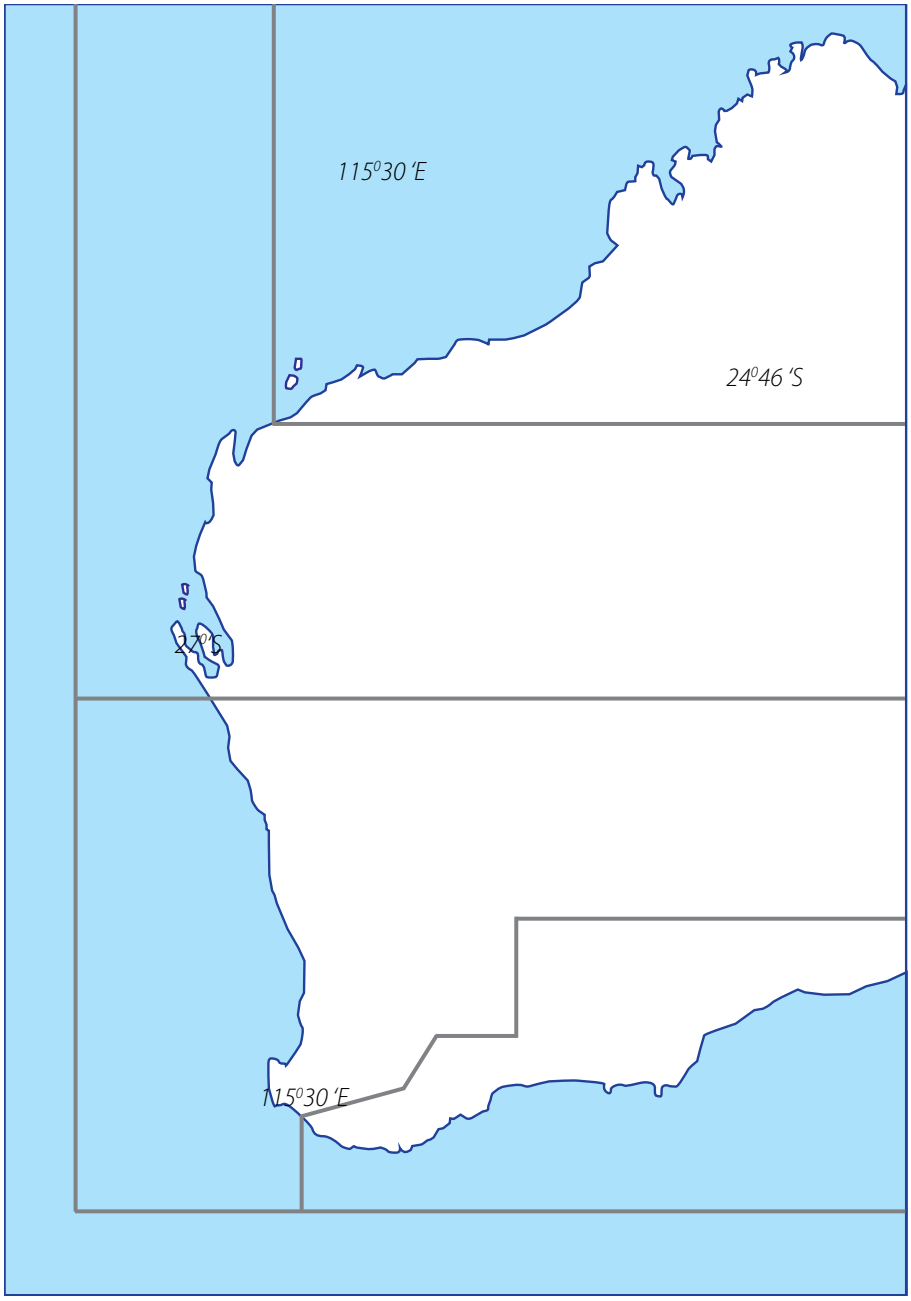
Reflection: Sharing

Pair teams up to compare the species they researched. Collect all the profiles into a book or PowerPoint presentation to share with others.

Western Australia's fisheries bioregions

Name:_____ Date:_____

1. Label each marine fisheries bioregion.
2. Use coloured pencils to shade in the land area of each bioregion based on the colours used in Department of Fisheries' publications.
3. Label the following Western Australian cities and towns: Albany, Broome, Bunbury, Carnarvon, Esperance, Eucla, Exmouth, Geraldton, Kalbarri, Karratha, Kununurra, Perth and Port Hedland. Include a label for the town your school is located in, if not included in the above list.
4. Mark any locations where you have been fishing before with a star.



Fish profile

Name _____ **Date** _____

Common name _____

Bioregion _____

What other names do people call me? _____

What is my scientific name? _____

Describe what I look like _____

_____

Make a sketch of me in the box below

How big do I grow? _____

How long do I live for? _____

What habitat am I found in? _____

Do I have any special adaptations for my habitat (e.g. colourful fish can hide in coral)?

_____

_____

What do I eat? _____

Are people allowed to fish for me? _____

_____

Is there a limit of how many of my species can be caught per day (i.e. bag limit or boat limit)?

_____

Do I have any legal size limits – minimum or maximum? _____

_____

What other fishing rules would people need to be aware of when fishing for me?

_____

_____

List three interesting facts about me

-
-
-

Lesson five: Turtle life cycles

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Parks and Wildlife**

Department of **Fisheries**

Students recognise the different stages of the turtle life cycle, focusing on adaptations turtles have developed to respond to the unique behaviours exhibited at each stage, and identify threats to marine turtles at different life stages.

Australian Curriculum - Science

Year 4	Year 5	Year 6
Living things have life cycles ACSSU072 *Describing the stages of life cycles of different living things.* *Recognising environmental factors that can affect life cycles.*	Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) *Explaining how particular adaptations help survival.* *Describing and listing adaptations of living things suited for particular Australian environments; Exploring general adaptations for particular environments.*	The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) *Considering the effects of physical conditions causing migration.*

Teacher notes:

Six of the world's seven species of sea turtles are found in WA waters:

- green
- hawksbill
- loggerhead
- flatback
- leatherback
- olive ridley.

Marine turtles have existed in the world's oceans for more than 100 million years. They migrate long distances between their feeding grounds and nesting sites.

Turtles have a large shell called a carapace, four strong, paddle-like flippers and like all reptiles, lungs for breathing air. Their beak-like mouth is used to shear or crush food.

Marine turtles generally live for a long time and are slow to reach sexual maturity. It can take between 10 and 50 years for a turtle to begin to breed. The only time they leave the ocean is when the adult females lay their eggs on beaches, and occasionally to bask during the nesting season.

Different species of marine turtle have cultural, spiritual and economic importance to coastal Indigenous Australians. Turtles feature in many stories, ceremonies, traditions and contemporary activities of Indigenous people, and are often a food source in remote coastal communities.

Male and female turtles return to the region where they were born to mate and nest, sometimes migrating thousands of kilometres between their nesting and feeding grounds - a mean feat when it may have been decades since they were last there! Females nest every two to eight years, and lay between one and 10 clutches of 30 to 180 eggs. The number of eggs laid and the number of times a turtle nests in each season varies between species and also between different populations of the same species.

Marine turtle populations have declined in many places across the globe. Threats to their survival include:

- entanglement in fishing nets, fishing lines and marine debris
- boat strikes
- unsustainable harvesting
- coastal development
- disturbance by tourists
- inappropriate 4WD vehicle use on nesting beaches
- predation by introduced animals such as foxes and pigs
- artificial lighting along the coast and on islands.

For more information, see the brochure *Marine Turtles of the Kimberley Coast*.

Information on turtles from an Aboriginal perspective can be found in the Northern Australia Indigenous Land and Sea Management Alliance *Dugong and Marine Turtle Knowledge Handbook*.

Resources: Coloured pencils or textas, *Marine Wildlife of WA's Northwest* from Resource Pack or contact Parks and Wildlife for a class set, *Marine Turtles of the Kimberley Coast* from Resource Pack or contact Parks and Wildlife for a class set, https://www.dpaw.wa.gov.au/management/marine/marine-parks-wa/fun-facts

For each student: 2 x paper plates and 1 x split pin

Introduction: Turtle knowledge

Ask students to tell you about the types of marine turtles they have encountered. Where did they see them? What type of habitat were they found in? What were the turtles doing? What do they eat? What time of year do they nest? Do students' families have any special names, stories, or rules about turtles that they can share with the class? Have students eaten turtles? What kinds of turtles do they eat? Are there any rules about who can hunt turtles or how turtles are hunted?

If students don't have their own turtle stories, you may like to share some from the *Dugong and Marine Turtle Knowledge Handbook*.

You may also like to follow some turtles that scientists have been tracking at www.seaturtle.org.

Activity: Turtle life cycles

Give each pair of students a copy of the *Marine Turtles of the Kimberley Coast* brochure and *Marine Wildlife of WA's Northwest.* Ask students to name the different kinds of turtles that are found in the Kimberley. If students were unable to name the types of turtles they discussed in the introduction, see if you can find the answer in the brochures.

Ask students to look at the life cycle shown in *Marine Turtles of the Kimberley Coast*. Read aloud the nine stages of the life cycle. Ask students to think back to what they learnt about shorebirds. How are the lives of shorebirds and turtles similar? They both migrate and travel large distances over their lifetimes. Can students recollect some of the threats that shorebirds faced, such as pollution, marine litter, habitat destruction, and people and cars on the beach? How would these threats impact turtles at different stages of their life cycle?

As a class, identify four key stages of the turtle's life cycle (such as egg hatches, juveniles live out in the open ocean, adult turtles return close to shore to breed, female turtles lay eggs on the beach back where they hatched). Write these stages on the board with arrows joining the stages to form a circle.

Give each student a paper plate. Ask them to divide the plate into quarters and draw a picture of each stage of the life cycle into a quarter. Make sure they are in order. Write a fact or two about each stage next to the picture

Give students a second paper plate. Ask students to cut out a quarter of the plate to create an empty wedge. Use the split pin to attach this plate over the first plate to create a movable life cycle wheel.

Students write a title (e.g. Life Cycles of Kimberley Marine Turtles) on their top plate.

Talk through the stages shown on the life cycle wheels. Where are the turtles living at each of these stages? What do they eat? What threats might they encounter? What physical adaptations do turtles have to survive each of these life stages (e.g. strong shell to protect from predators, well-developed flippers to swim long distances and dig out nests, beak-like mouth for eating shellfish)?

Reflection: Teaching turtles

Ask students to share their turtle life cycle wheels and some of the facts they have learnt about turtles with buddies from a younger class.

Lesson six: Save our turtles

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Parks and Wildlife**

Department of **Fisheries**

Students consolidate their new-found understanding of the Kimberley marine environment and the challenges it faces, carrying out a community campaign to encourage simple actions that can improve outcomes for Kimberley species.

Australian Curriculum - Geography

Year 4	Year 5	Year 6
The importance of environments to animals and people, and different views on how they can be protected (ACHGK022) *Explaining how people's connections to the environment can also be aesthetic, emotional and spiritual.* *Recognising that there are different perspectives on what constitutes environmental sustainability and considering the role of people in protecting the environments that provide habitats for animals and discussing ways of doing this.* *Exploring strategies to protect particular environments that provide habitats for animals.*	The influence people have on the human characteristics of places and the management of spaces within them (ACHGK029) *Examining how the use of space within their local place is organised through zoning.* *Investigation of a current local planning issue, exploring why people have different views on the issue, and developing a class response to it.*	The effects that people's connections with, and proximity to, places throughout the world have on shaping their awareness and opinion of those places (AHCGK036) *Identifying factors that influence people's awareness and opinions of places, for example, the media, significant known events, proximity to places, and personal relationships with places.* *Explaining various generalisations about people and places and researching their accuracy.*

Teacher notes:

Six of the seven species of marine turtle found in the Kimberley are either critically endangered or endangered (IUCN Red List 2010). The status of the flatback turtle remains unknown due to insufficient information. So while they may have outlived the dinosaurs, the future for marine turtles appears bleak unless we take immediate action.

Marine turtles face a wide range of potentially devastating threats in the tropical waters of Australia. These include incidental capture in fishing gear, boat strike, ingestion of and entanglement in marine debris, feral predation, illegal hunting, unsustainable traditional hunting, and coastal development that impacts on nesting beaches and hatching success. These threats directly reduce the ability of turtle populations to adapt to and recover from the impacts of climate change.

Habitat loss and degradation

Coastal development has led to the destruction and degradation of critically important turtle nesting beaches and is affecting other critical habitats such as seagrass beds. Lights from roads and traffic, altered currents and beach erosion from sea walls and jetties, sediment run-off from land and tourism are all causes of marine turtle habitat loss and degradation.

Illegal take and feral animals

Unsustainable hunting of adult turtles, collecting of eggs for food and the predation of eggs by feral animals are other major factors in the drastic decline in marine turtle populations around the world.

Additional threats, some of them preventable, include:

- incidental capture in fishing gear
- increases in global temperatures, which disrupt the turtles' temperature-dependent sex determination and could lead to population instability
- choking on pollution/rubbish that they mistake for food
- becoming entangled in discarded fishing gear, which can render a turtle unable to feed or swim
- disease, some of which may be caused by run-off or marine pollution.

For more information:

www.nmfs.noaa.gov/pr/species/turtles/threats.htm

conserveturtles.org/seaturtleinformation.php?page=threats

Resources: Parks and Wildlife's YouTube video: *The Turtle Nesting Experience at Eighty Mile Beach*, poster making materials or video cameras

Introduction: What have we learnt?

Ask students to think back through all the lessons in this topic. They have looked at different marine habitats, studied shorebirds, turtles and fish, and examined some of these creatures' special adaptations. Students have explored some of the natural challenges and new human-made threats these animals encounter, and have discussed a number of management strategies including keeping beaches and oceans clean, creating (and following) fishing rules, and setting aside special areas as marine parks. What do students think is the most important point they have learnt? What can they and their community do to protect our marine environment? Explain that while students aren't in a position to create a marine park or set new fishing restrictions just yet, they and their families can take simple actions that will help protect our marine wildlife.

As a class, watch *The Turtle Nesting Experience at Eighty Mile Beach*. Recall the turtle facts students learnt in previous lessons, and the points discussed in the video. The Kimberley is home to many beaches used by nesting turtles, from Eighty Mile Beach, south of Broome, right around to Cape Dommett near the Northern Territory border. Explain that while many people use these beaches for fishing, camping and four-wheel driving, they may not know what they can do to help look after the turtles. On the board, brainstorm actions people can take to protect marine turtle nesting areas (you may wish to replay the video and pause after each point).

You may also wish to read *Myrtle's battle against climate change* with your class for more ideas. Ensure you have sufficient time to discuss the heavy themes covered in the story with your students afterwards and end on a positive note with actions you can take to improve the prospects of marine turtles.

Activity: Turtle campaign

Divide students into small groups.

Task each group with making a poster or short video explaining what people can do to protect marine turtles. You may like to allocate one specific action to each group or ask each group to consider actions relevant to the different habitats turtles are found in at different stages of their life cycle (e.g. specific actions for beaches, open ocean or seagrass beds).

Reflection: Take action

Use your posters and the life cycle wheels from Lesson 5 to create a turtle education display for a school or community event. If you made videos, display them for the rest of the school at an assembly.

References

Kimberley Science and Conservation Strategy, Department of Parks and Wildlife. Available online: https://www.dpaw.wa.gov.au/management/kimberley-strategy

'West Kimberley Fact Sheet', Department of Sustainability, Environment, Water, Population and Communities 2011. Available online: https://www.environment.gov.au/resource/west-kimberley-western-australia

'Boat images in the rock art of northern Australia with particular reference to the Kimberley, Western Australia', Sue O'Connor & Steve Arrow 2011. Available online: http://press.anu.edu.au/wp-content/uploads/2011/03/ch25.pdf

'The global geoheritage significance of the Kimberley Coast', M Brocx & V Semeniuk 2011, Journal of the Royal Society of Western Australia, 94: p57–88.

Dugong and Marine Turtle Handbook. Northern Australian Indigenous Land and Sea Management Alliance, 2006. Available online: http://www.nailsma.org.au/sites/default/files/publications/Dugong%20and%20marine%20turtle%20handbook_0.pdf

Protecting the Kimberley: *A synthesis of scientific knowledge to support conservation management in the Kimberley region of Western Australia*, 2009, Department of Environment and Conservation.

Bush Books: Geology and Landforms of the Kimberley, Ian Tyler 1996, Department of Conservation and Land Management.

'Economic Activity', Kimberley Development Commission website, http://kdc.wa.gov.au/economic-activity/. Accessed 20 March 2015.

'Global Forest Resources Assessment 2010', Food and Agriculture Organization of the United Nations. Available online: http://www.fao.org/docrep/013/i1757e/i1757e.pdf

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Parks and Wildlife**

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KIMBERLEY REGION

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