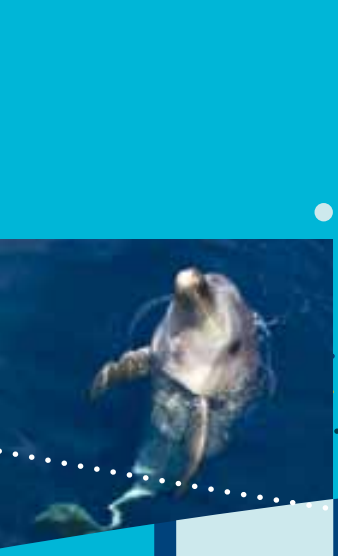
Australian Government
Department of Sustainability, Environment,
Water, Population and Communities



Detailed Analysis of the Proposed North-west Commonwealth Marine Reserve Network

Images:
Dolphin– R.Freeman, Red and yellow feather star (crinoids) – Tourism WA, Sea Grass meadow – Lochman Transparencies, Raccoon butterfly fish – N.Wolfe, Blue spotted fantail ray – N.Wolfe, Display of colourful coral – Tourism WA, Whale shark – GBRMPA, Black tip reef shark – N.Wolfe, Loggerhead turtle – Kevin Crane (CALM)

CONTENTS

1 PURPOSE OF THIS DOCUMENT

This document supplements the *Proposal for the North-west Commonwealth Marine Reserve Network – Consultation Paper* and provides further information to support public consultation on the proposal. The proposal for the North-west Commonwealth Marine Reserve Network has been released concurrently with the draft North-west Marine Bioregional Plan, which is also open for public comment.

This document describes how the proposed marine reserve network was designed and; the information used to support it, and provides a more detailed analysis against the *Goals and principles for the establishment of the National Representative System of Marine Protected Areas in Commonwealth waters.*

Online submission forms, documents and information resources about the North-west Commonwealth Marine Reserve Network proposal and the draft North-west Marine Bioregional Plan and are available at: **www.environment.gov.au/coasts/mbp/north-west/index.html**

2 POLICY CONTEXT

2.1 The National Representative System of Marine Protected Areas

The Australian Government, states and the Northern Territory first agreed to establish the National Representative System of Marine Protected Areas (NRSMPA) in 1998 when ministers meeting as the Australian and New Zealand Environment and Conservation Council, approved guidelines for establishing the NRSMPA[1]. The primary goal of the NRSMPA is to establish and manage a comprehensive, adequate and representative system of marine protected areas to contribute to the long-term ecological viability of marine and estuarine systems, to maintain ecological processes and systems, and to protect Australia's biological diversity at all levels.

The Australian Government is developing networks of marine protected areas (also called marine reserves and marine parks) for each of the five large marine planning regions of the Commonwealth marine area (Figure 2.1)[2] as part of the NRSMPA. The first regional network of Commonwealth marine reserves was established in 2007 in the South-east Marine Region. Marine reserve networks are now being developed for the South-west, North-west, North and East marine regions.

1 For more information see **www.environment.gov.au/coasts/mpa/nrsmpa/index.html**

2 The Commonwealth marine area generally includes waters from 3 nautical miles of the coast to the edge of Australia's exclusive economic zone (up to 200 nautical miles from shore).

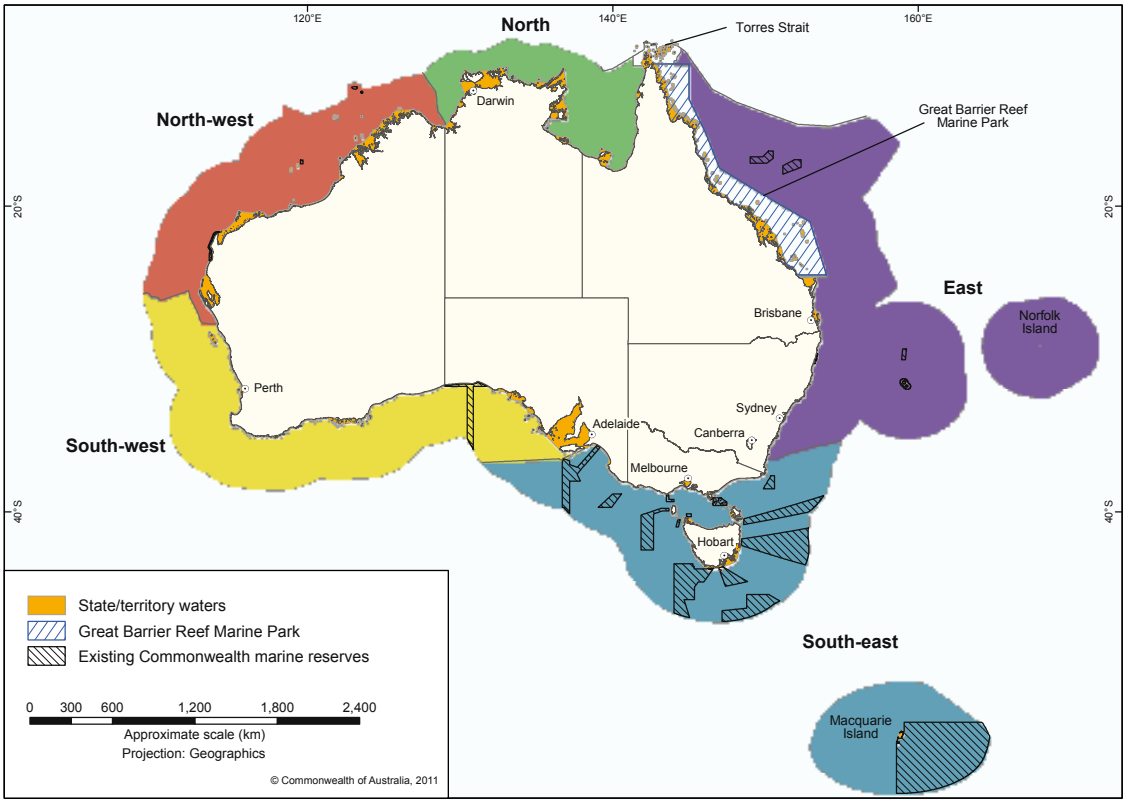


Figure 2.1: Australia's marine planning regions and existing Commonwealth marine reserves

The NRSMPA guidelines identified the Interim Marine and Coastal Regionalisation of Australia (IMCRA v3.3) as providing the national and regional planning framework for developing the NRSMPA, with ecosystems used as the basis for determining representativeness. The IMCRA v3.3 focused on inshore waters and as such was not sufficient to support development of the NRSMPA in Commonwealth waters. It was updated in 2006 and became the Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0), covering both inshore waters and waters off the continental shelf of Australia. The provincial bioregions identified in IMCRA v4.0 are the key ecosystem planning units used by the Australian Government in identifying the Commonwealth waters component of the NRSMPA.

The NRSMPA guidelines describe principles to be followed in developing the NRSMPA. They include the CAR principles – Comprehensiveness, Adequacy and Representativeness.

Comprehensiveness: the NRSMPA will include the full range of ecosystems recognised at an appropriate scale within and across each bioregion.

Adequacy: the NRSMPA will have the required level of reservation to ensure the ecological viability and integrity of populations, species and communities.

Representativeness: those marine areas that are selected for inclusion in marine reserves should reasonably reflect the biotic diversity of the marine ecosystems from which they derive.

2.2 The Goals and Principles for the establishment of the National Representative System of Marine Protected Areas in Commonwealth waters

The NRSMPA guidelines set out high level criteria for the identification and selection of marine reserves, but include only limited guidance as to how the guidelines are to be applied to achieve a CAR system. This limitation led the Australian Government to develop, in 2007, the *Goals and Principles for the establishment of the National Representative System of Marine Protected Areas in Commonwealth waters*. The purpose of the Goals and Principles is to provide guidance about how to identify regional networks of marine reserves that meet the CAR principles. They seek to do this in circumstances where the complex nature of marine ecosystems, together with the absence of fine scale data, particularly for off-shore waters, make it difficult to confidently assess the extent to which the CAR principles have been satisfied. The use of an adaptive approach to management based on monitoring, research and performance review linked to biodiversity conservation objectives can be expected over time to increase confidence that the CAR principles are being met.

In the North-west Marine Region, as in other marine regions, there is a lack of detailed information on the distribution of biodiversity, mainly due to the vastness, remoteness and often inaccessibility of Australia's offshore ocean environment. For this reason, surrogates for biodiversity (such as water depth, substrate and seafloor features) have been used extensively to design the proposed reserve network. This approach has been taken because scientific studies indicate that different habitats and species are associated with different physical features in the ocean. The use of surrogates is a key component of the four Goals that are guiding the development of Commonwealth marine reserves.

- **Goal 1** states that each **provincial bioregion** occurring in a marine region should be represented in the marine reserve network. The 41 provincial bioregions identified in IMCRA v4.0 have been determined largely on the basis of different assemblages of fish species and sponges that live at the seafloor as well as different types of offshore habitats and seafloor sediments.
- **Goal 2** states that all **oceans depths** should be represented in the marine reserve network. Scientific assessment has shown that different biological communities live at different depths. Therefore, including different ocean depths within Commonwealth marine reserve networks will ensure that examples of all types of marine biodiversity will be represented.
- **Goal 3** states that examples of all types of marine benthic/demersal **biological features** should be represented in the marine reserve network including those features found in the water column and at the seafloor. Marine biological features have been determined through scientific analysis of fine-scale information on distribution patterns of fish and invertebrate species as well as physical features such as sediment grain size and composition, seabed temperatures, and bathymetry. Scientists have also analysed marine biological features to identify large scale ecological features that support distinct or important ecological communities at a regional scale. Large scale ecological features that are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity have also been identified for inclusion in the network under this goal. These features are known as key ecological features.
- **Goal 4** states that examples of all different types of physical **seafloor features** should be represented in the marine reserve network. Seafloor features include underwater pinnacles, canyons, and reefs. Including samples of all different seafloor features in marine reserves will ensure that the different ecological communities associated with these features are included in the marine reserves network.

Box 1.1 Goals and Principles for the establishment of the NRSMPA in Commonwealth waters

Goal 1 - Each provincial bioregion occurring in the marine region should be represented at least once in the marine reserve network. Priority will be given to provincial bioregions not already represented in the National Representative System.

Goal 2 - The marine reserve network should cover all depth ranges occurring in the region or other gradients in light penetration in waters over the continental shelf.

Goal 3 - The marine reserve network should seek to include examples of benthic/demersal biological features (for example, habitats, communities, sub-regional ecosystems, particularly those with high biodiversity value, species richness and endemism) known to occur in the marine region at a broad sub provincial (greater than hundreds of kilometres) scale.

Goal 4 - The marine reserve network should include all types of seafloor features. There are 21 seafloor types across the entire Exclusive Economic Zone. Some provincial bioregions will be characterised by the presence of a certain subset of features, such as continental slope or seamounts.

In developing options that meet the four goals, the following location principles will be applied:

1. Marine reserves will be located taking into account the occurrence and location of existing spatial management arrangements (for example, existing protected areas and sectoral measures) that contribute to the goals.
2. The goals should be met with the least number of separate marine reserves (that is, a smaller number of larger marine reserves rather than many small marine reserves) to maximise conservation outcomes.

Where different options that meet the Goals exist, the following selection principles should be considered in selecting areas suitable for inclusion in the National Representative System of Marine Protected Areas:

3. The capacity of a marine reserve to mitigate identified threats to conservation values.
4. The occurrence of spatially defined habitats for and/or aggregations of threatened and/or migratory species.
5. The occurrence of ecologically important pelagic features which have a consistent and definable spatial distribution.
6. The occurrence of known small-scale (tens of kilometres) ecosystems associated with the benthic/demersal environment.
7. Relevant available information about small-scale distribution of sediment types and sizes and other geo-oceanographic variables.
8. Occurrence of listed heritage sites (where inclusion in the marine reserve network would improve administration of protection regimes).
9. Socio-economic costs should be minimised.

Once the broad location of marine reserves has been determined, the following design principles should be applied to further refine the size and shape of individual marine reserves:

10. Individual areas should, as far as practicable, include continuous depth transects (for example, from the shelf to the abyss).
11. Whole seafloor features (such as geomorphic features) should be included.
12. Features should be replicated wherever possible within the system of marine reserves (that is, included more than once).
13. Size and shape should be orientated to account for inclusion of connectivity corridors and biological dispersal patterns within and across marine reserves.

14. Boundary lines should be simple, as much as possible following straight latitudinal/longitudinal lines.

15. Boundary lines should be easily identifiable, where possible coinciding with existing regulatory boundaries.

16. The size and shape of each area should be set to minimise socio-economic costs.

The following zoning principles will be applied in developing the regional systems of marine reserves:

17. Zoning will be based on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)/the World Conservation Union (IUCN) categories of protection.

18. The regional marine reserve network will aim to include some highly protected areas (IUCN Categories I and II) in each provincial bioregion.

19. Zoning will be based on the consideration of the threat that specific activities pose to the conservation objectives of each marine reserve.

20. Zoning of marine reserves will seek to ensure that the conservation objectives of the area are protected, taking into account a precautionary approach to threats as well as the relative costs and benefits (economic, social and environmental) of different zoning arrangements.

2.3 Minimising socio-economic impacts

A key element of the Australian Government's approach to developing regional marine reserve network proposals is the objective, embedded in the Goals and Principles, of establishing the reserve network in a way that minimises social and economic costs. Therefore, the design of regional networks seeks, wherever possible, to avoid restrictions on access to areas of significance to a range of cultural, recreational and commercial interests. These include: recreational, charter and commercial fishing; aquaculture and pearling operations; existing petroleum and greenhouse gas storage titles, acreage release areas, areas prospective for petroleum resources; tourism activities; non-commercial Indigenous uses and the exercise of non-commercial native title rights; defence and border protection activities; port-related activities, pipelines and submarine cables; and shipping lanes. Shipping rights of innocent passage under the United Nations Convention on the Law of the Sea are not expected to be affected.

The development of the Commonwealth marine reserve network proposal for the North-west Marine Region was also informed by consultation undertaken by the department on Areas for Further Assessment (AFAs). The identification of AFAs was an important step in refining information on human uses and socio-economic values in the marine environment. The AFAs were large areas that encompassed examples of the range of biodiversity and ecosystems within each marine region. They were identified to aid further analysis of information at a more detailed scale and assist in the design of new marine reserves. Consultations on the AFAs assisted in identifying potential social and economic impacts that may occur with the establishment of marine reserves in these areas and how those impacts could be minimised.

Section 3.2 outlines the social and economic data and information that have been used in the design of the Commonwealth marine reserve network proposal for the North-west Marine Region. Section 4.4 reports on the preliminary assessment of the impacts arising from the marine reserve network proposal.

An accurate assessment of the extent of impact and the flow-on effects into regional communities requires input from potentially affected users and industries. A socioeconomic impact assessment will be conducted by the Australian Bureau of Agricultural and Resource Economics and Sciences in parallel with the public consultation process. Industries, communities and stakeholders potentially affected by the proposed reserves will be consulted as part of the socioeconomic assessment. The outcomes of the assessment, together with the submissions received about the marine reserve network proposal will inform government decisions on the final network.

The government has committed to considering adjustment assistance for affected commercial fishing businesses and fishing-dependent regional communities based on impacts evaluated as part of the socio-economic assessment and on other relevant inputs received through the public consultation process. Decisions on the scope, type and level of adjustment assessment will be based on the government's Fisheries Adjustment Policy released on 3 May 2011 and available at **www.environment.gov.au/coasts/mbp/about/policy.html**

3 THE APPROACH TO DESIGNING THE NETWORK

3.1 Systematic conservation planning

The proposal for the North-west Commonwealth Marine Reserve Network has been designed to meet the Goals and Principles outlined above. The process of marine reserve identification has been undertaken using a systematic conservation planning approach and has been supported by the software Marxan (see Box 3.1). This approach is recognised as best practice and is widely used for designing terrestrial and marine protected areas, both in Australia and overseas.

Systematic conservation planning involves the following steps:

- setting out the objectives that the network seeks to achieve, including conservation features that should be included and areas and values that should be avoided (in order to minimise economic and social impacts)
- selecting and using spatial data that best represents those objectives
- generating and evaluating a network of areas that, taken together, meet those objectives.

The objectives that the network seeks to achieve are derived directly from the *Goals and Principles* and:

- include examples of each of the eight provincial bioregions (Goal 1; Figure 3.1)
- include examples of each of the 11 meso-scale bioregions (Goal 1; Figure 3.2)
- include examples of each of the 19 depth ranges within provincial bioregions (Goal 2; Figure 3.3; Table 3.3)
- include examples of benthic/demersal key ecological features (Goal 3; Figure 3.4)
- include examples of all biological seascapes (Goal 3; Figure 3.5; Table 3.4)
- include examples of all 19 seafloor types (Goal 4; Figure 3.6)
- preferentially incorporate the existing Commonwealth marine reserves (Ningaloo, Mermaid, Ashmore and Cartier) (Principle 1)
- preferentially incorporate areas in proximity to existing state marine parks (Principle 1)
- preferentially select areas to include biologically important areas for species listed as threatened and migratory (Principle 4)
- avoid areas of value to current users and existing interests (Principles 9 and 16).

Box 3.1: What is Marxan?

Marxan is a computer software decision support tool that can be applied to a range of conservation planning problems, including designing new reserves and reporting on the performance of proposed or existing reserve networks. Its use is recognised internationally as a best practice approach to reserve design. Marxan is the most widely used conservation planning software in the world.

Marxan is used to inform decision-making in relation to the location of new reserve networks, with user-defined levels of biodiversity representation, for the least possible cost (Ball et al. 2009). It uses data layers of conservation features (such as bioregions and depth ranges), and socio-economic values (such as the value of fisheries and other industries) that represent the potential cost of the reserves, and produces potential network solutions that optimise the conservation outcomes against the potential cost of achieving them. More information about Marxan is available at the University of Queensland website: **www.uq.edu.au/marxan/**

The marine reserve network proposal presented in this document is the result of iterative development and assessment of multiple configurations of marine reserves that meet the set of objectives outlined above. The identification process was guided by the 20 principles, facilitated by the initial application of Marxan and informed by input obtained from stakeholders during consultation on the AFAs.

3.2 The information base

A broad range of datasets were used to inform the development of the marine reserve network proposal. Tables 3.1 and 3.2 explain the relationship between the marine reserve network objectives and the relevant datasets used in the design process.

Key inputs to the marine reserve network design process included information about:

- Biodiversity values
- Existing spatial management measures
- Socio-economic values

3.2.1 Biodiversity values

Unlike most terrestrial environments, information about the full range of habitats and species in marine environments is generally poor. This is especially the case in some of the offshore parts of the North-west Marine Region where waters are remote and there has been little detailed study or data collection. In these circumstances, the detailed and peer-reviewed data that does exist is supplemented with information on known or predicted linkages between the physical environment and biodiversity. This concept is known as surrogacy. Surrogates that are commonly used to represent marine biodiversity include depth, substrate, geomorphology (seafloor features), latitude, light and currents. Each of these factors will have an influence on where particular species, habitats or ecological communities occur.

The following information about the biodiversity values of North-west Marine Region has been incorporated into the design of the marine reserve network proposal:

- bioregions
- depth
- benthic and demersal biological features
- seafloor features
- species.

Bioregions (Goal 1)

The bioregions in Australia's marine jurisdiction have been identified based on the patterns of bottom-dwelling species through the Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0).

Marine bioregions have been identified at two scales: provincial bioregions, which encompass the entire area of Australia's marine jurisdiction (Figure 3.1); and smaller meso-scale bioregions, which are confined to the continental shelf (Figure 3.2). Information on IMCRA is available at: **http://www.environment.gov.au/coasts/mbp/publications/imcra/imcra-4.html**

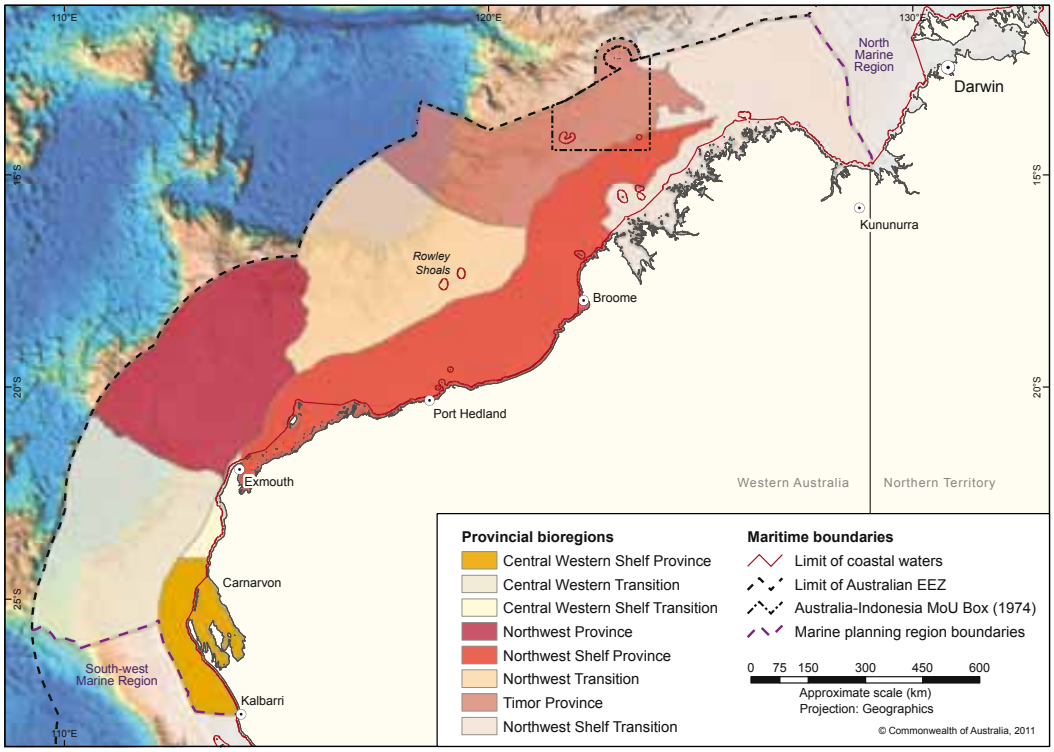


Figure 3.1: Provincial bioregions of the North-west Marine Region

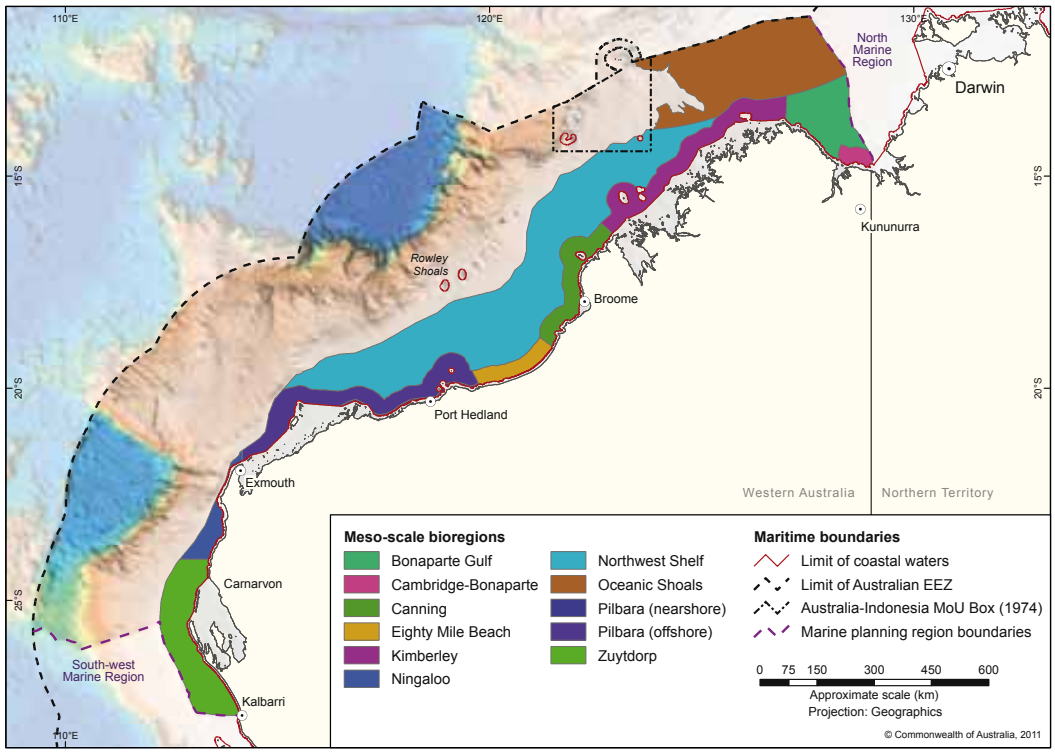


Figure 3.2: Meso-scale bioregions of the North-west Marine Region

Table 3.1: Biophysical datasets used in the design of the North-west Commonwealth marine reserve network proposal

Network design objecitves	Relevant Goals and Principles	Dataset	Description	Source[3]
Include examples of all provincial bioregions	Goal 1	Provincial bioregions	• Large planning units based on ecological patterns (bottom-dwelling invertebrates and fish that live close to the seafloor) • Eight provincial bioregions occur in the North-west Marine Region	IMCRA v4.0
Include examples of all meso-scale bioregions	Goal 1	Meso-scale bioregions	• Smaller planning units confined to continental shelf waters based on ecological patterns • Eleven meso-scale bioregions occur in the North-west Marine Region	IMCRA v4.0
Include examples of all depth ranges within provincial bioregions	Goal 2	Depth within bioregions	• Depth ranges selected based on species distribution • Nineteen occur in the North-west Marine Region	CERF Marine Biodiversity Hub CSIRO
Include examples of all key ecological features	Goal 3	Key ecological features (KEFs)	• Areas, species or communities regionally or nationally important for ecological functioning • Thirteen KEFs occur in the North-west Marine Region	DSEWPaC
Include examples of all biological seascapes	Goal 3	Biological seascapes	• Areas with similar seabed assemblages of marine fauna • Based on predictive modelling using physical and biological data on demersal fish and benthic invertebrates	CERF Marine Biodiversity Hub
Include examples of all seafloor types	Goal 4	Seafloor features	• Landscape-scale physical structures of the seafloor (geomorphology), e.g. canyons and reefs • Nineteen different types in the North-west Marine Region	IMCRA v4.0
Include examples of biologically important areas for species listed as threatened and migratory	Principle 4	Biologically important areas	• Areas where aggregations of individuals of a protected species display behaviours such as breeding, foraging, resting and migration	DSEWPaC

3 For full source names refer to the Acronyms and Abbreviations table appended to this document.

Table 3.2: Socio-economic datasets used in the design of the North-west Commonwealth marine reserve network proposal

Name	Relevant Goals and Principles	Description	Network design objectives	Source[3]
Commercial fishing	Principles 9, 16	• State data was available as 60 minute reporting grids (generally for 2000-2006), while Commonwealth data was available as 6 minute reporting grids (2003-2008)	Seek to avoid areas of value to commercial fisheries	AFMA; BRS; WA DoF
Charter fishing	Principles 9, 16	• Data on broad distribution of catch and effort from state and national surveys	Seek to avoid areas of value to charter fishing operations	Henry & Lyle 2003; WA DoF;
Recreational fishing	Principles 9, 16	• Data on broad distribution of catch and effort from state and national surveys; additional information on important recreational fishing ports and iconic areas from state based recreational fishing organisations	Seek to avoid areas of value to recreational fishers and boating	Henry & Lyle 2003; Recfish Australia ; Recfish West
Offshore aquaculture/ Pearling	Principles 9, 16	• A number of sites for pearl shell collection and pearl grow-out extend into the region, predominantly along Eighty Mile Beach and in the Kimberley	No objective set in Marxan; data used for contextual purposes	WA DoF; Pearl Producers' Association
Native Title	Principles 9, 16	• There are 8 registered Native Title claims and 5 Native Title Determinations in or adjacent to the region	No objective set in Marxan; data used for contextual purposes	National Native Title Tribunal
Defence	Principles 9, 16	• A large training area exists off the coast from North-west Cape Exmouth and a Defence Carrier Vessel Operating Area exists in the far north of the region	No objective set in Marxan; data used for contextual purposes	Department of Defence
Petroleum	Principles 9, 16	• As at June 2011 there were 178 petroleum exploration titles, 57 petroleum production titles, 39 retention leases and 50 Gazettals in the region, as well as current petroleum acreage releases	Seek to avoid petroleum leases and acreages, where possible	DRET; GPInfo

Name	Relevant Goals and Principles	Description	Network design objectives	Source[3]
Petroleum prospectivity	Principles 9, 16	• Relative petroleum prospectivity based on sedimentary basins; a number of areas of high prospectivity exist in the region	Seek to avoid basins with medium to high prospectivity, where possible	Geosciences Austalia
Shipping and ports	Principles 9, 16	• Distribution of shipping routes, volume of traffic, existing and proposed ports	No objective set in Marxan; data used for contextual purposes	AMSA; DSEWPaC
Fisheries closures	Principles 1, 9 and 16	• Permanent fisheries closures and habitat protection areas	Preferentially select permanent fisheries closures	AFMA; WA DoF
Marine reserves	Principle 1	• Existing and proposed state and Commonwealth marine reserves within and adjacent to the region	Preferentially select areas in proximity to existing Commonwealth and state marine reserves	WA DEC; DSEWPaC
Submarine cables	Principle 1	• 2 telecommunication cable linking Australia with South-East Asia exist; these generally have a protection zone 1 nautical mile either side of the cable	No objective set in Marxan; data used for contextual purposes	ACMA
Historic shipwrecks	Principle 8	• Four declared historic shipwrecks exist in the region	No objective set in Marxan; data used for contextual purposes	DSEWPaC

Depth (Goal 2)

The North-west Marine Region ranges from shallow waters of less than 15 metres depth to approximately 6000 metres depth. Many marine assemblages are stratified by depth and similar depth ranges in different bioregions support different suites of species, so depth ranges within bioregions should be represented.

The CERF Marine Biodiversity Hub has analysed the available data on the distribution of over 1500 bottom dwelling fish species and used this to develop a species-based depth stratification of the continental shelf waters (0–200 metres) (Lyne et. al. 2009). These depth ranges have been expanded, based on advice from the CSIRO (see also Last et al. 2005), to include the deeper waters of the upper continental slope, continental rise and deep ocean floor (Figure 3.3; Table 3.3). Further information on depth ranges is available at: **www.marinehub.org**. This depth classification has been used in addressing Goal 2.

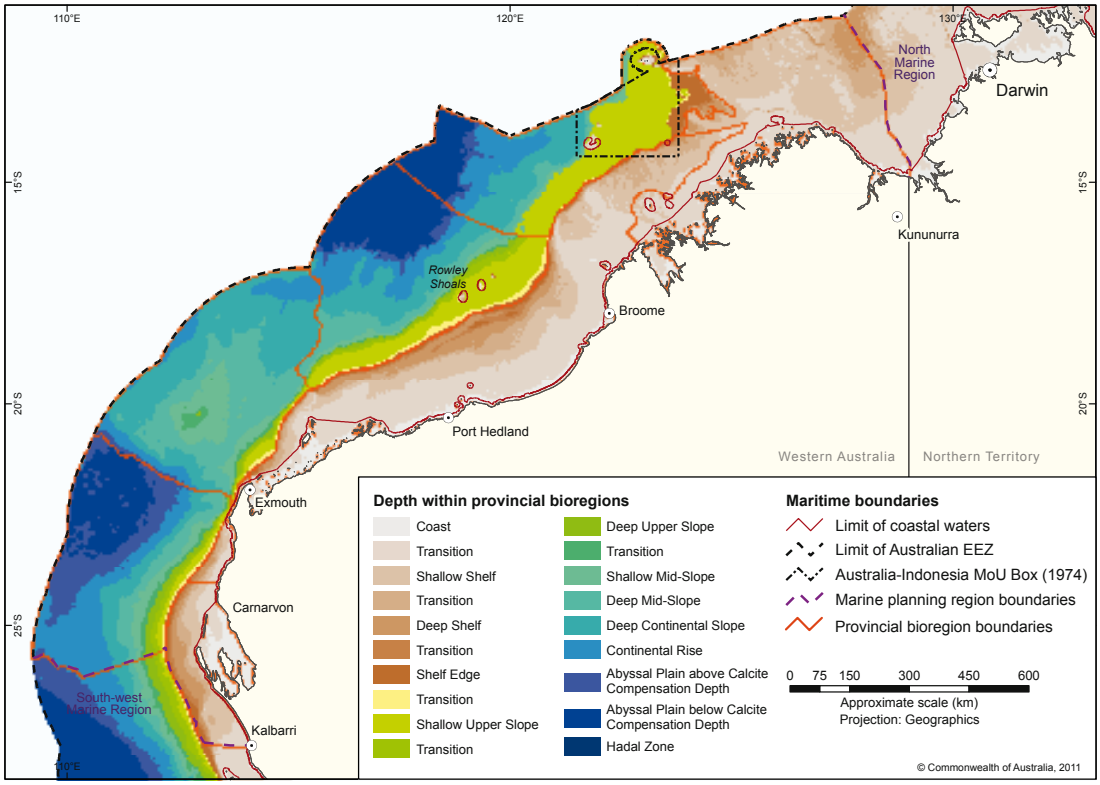


Figure 3.3: Depth ranges within provincial bioregions in the North-west Marine Region

Table 3.3: Depth ranges within the provincial bioregions used in the reserve design process for the North-west Marine Region

	Shelf Provincial Bioregions	Off shelf Provincial Bioregions			
Depth range	Central Western Shelf Province Central Western Shelf Transition Northwest Shelf	Northwest Transition	Timor Province	Central Western Transition	Northwest Province
Shallow Water	0–15	0–15	0–15	-	-
Shallow Water to Shallow Shelf Transition	15–70	15–70	15–70	-	-
Shallow Shelf	70–100	70–100	70–100	-	-
Shallow Shelf to Deep Shelf Transition	100–120	100–120	100–120	-	-
Deep Shelf	120–150	120–150	120–150	-	-
Deep Shelf to Shelf Edge Transition	150–165	150–165	150–165	-	-
Shelf Edge	165–variable	165–225	165–220	-	-
Shelf Edge to Shallow Upper Slope Transition	-	225–260	220–225	230–300	225–300
Shallow Upper Slope	-	260–515	225–500	300–520	300–530
Shallow Upper Slope to Deep Upper Slope Transition	-	515–650	-	520–650	530 – 650
Shallow Upper Slope to Shallow Mid-Slope Transition	-	-	500–750	-	-
Deep Upper Slope	-	650–780	-	650–790	650–780
Deep Upper Slope to Shallow Mid-Slope Transition	-	780–825	-	790–895	780–900
Shallow Mid-Slope	-	825–1050	750–1000	895 –1085	900–1100

	Shelf Provincial Bioregions	Off shelf Provincial Bioregions			
Depth range	Central Western Shelf Province Central Western Shelf Transition Northwest Shelf	Northwest Transition	Timor Province	Central Western Transition	Northwest Province
Deep Mid-Slope	-	1050–1500	1000–1500	1085–1500	1100 1500
Deep Continental Slope	-	1500–2500			
Continental Rise	-	2500 – 4000			
Abyssal Plain above Calcite Compensation Depth	-	-	4000–5000		
Abyssal Plain below Calcite Compensation Depth	-	-	5000–6000		

Benthic and demersal biological features (Goal 3)

The physical composition of the seabed strongly affects the distribution of many benthic organisms. Information about key ecological features and biological seascapes has been used to represent the benthic and demersal biological features of the North-west Marine Region in addressing Goal 3.

Key ecological features are elements of the Commonwealth marine environment that are of particular importance for ecological functioning, ecological integrity and biodiversity. The North-west Marine Region has 13 key ecological features (Figure 3.4), all of which have been spatially defined and mapped (Figure 3.4).

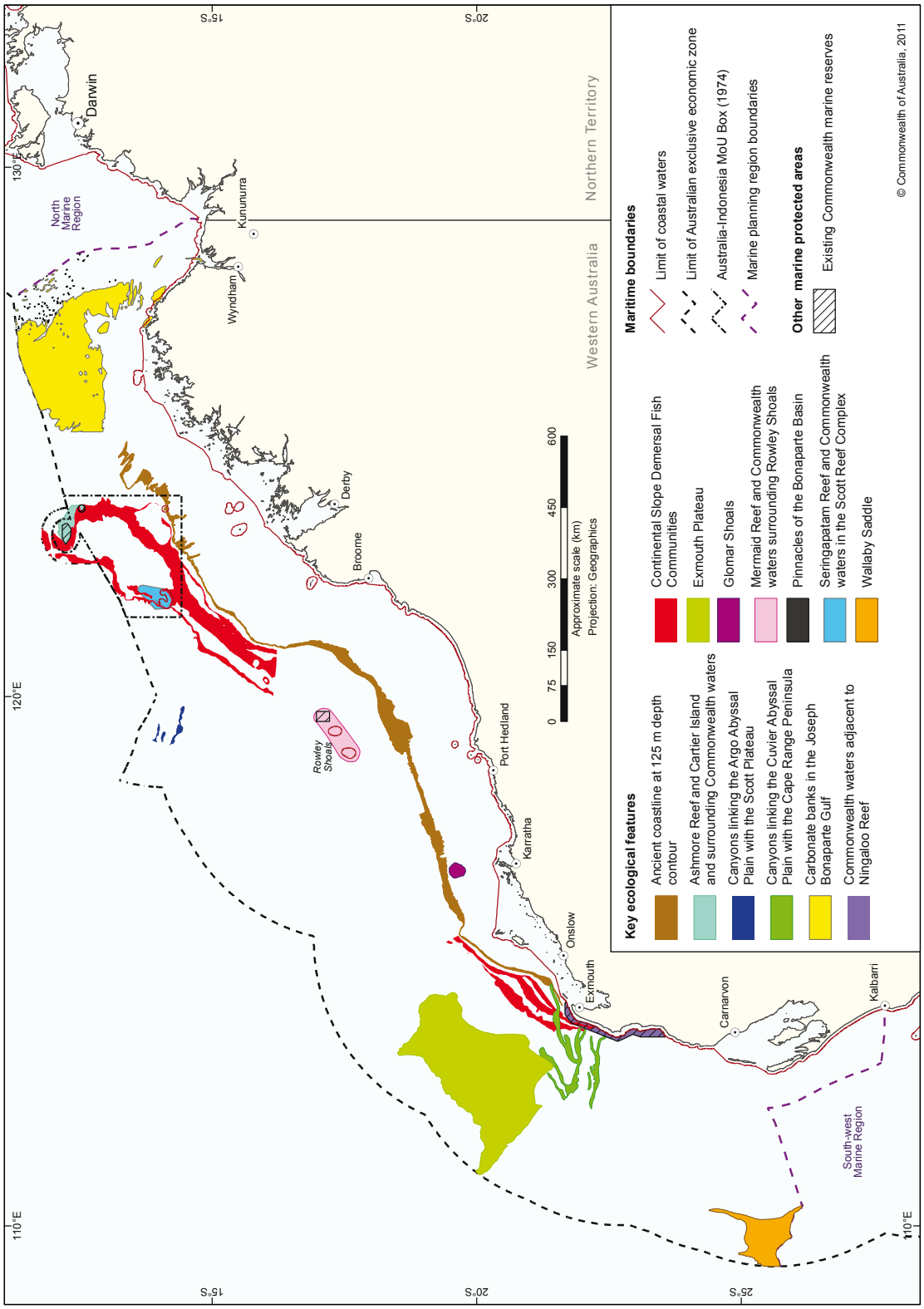


Figure 3.4: Key ecological features of the North-west Marine Region

Biological seascapes represent a combination of physical and biological information that predicts where species are likely to occur using scientific modelling of ecosystems (Figure 3.5; Table 3.4). The inclusion of these as a surrogate for biodiversity allows the variety of biodiversity associated with different substrates to be captured within the marine reserve network. The CERF Marine Biodiversity Hub (Ellis et al., 2009) has developed the biological seascapes based on the original seascapes developed by Geosciences Australia. Further information is available at: **www.marinehub.org.**

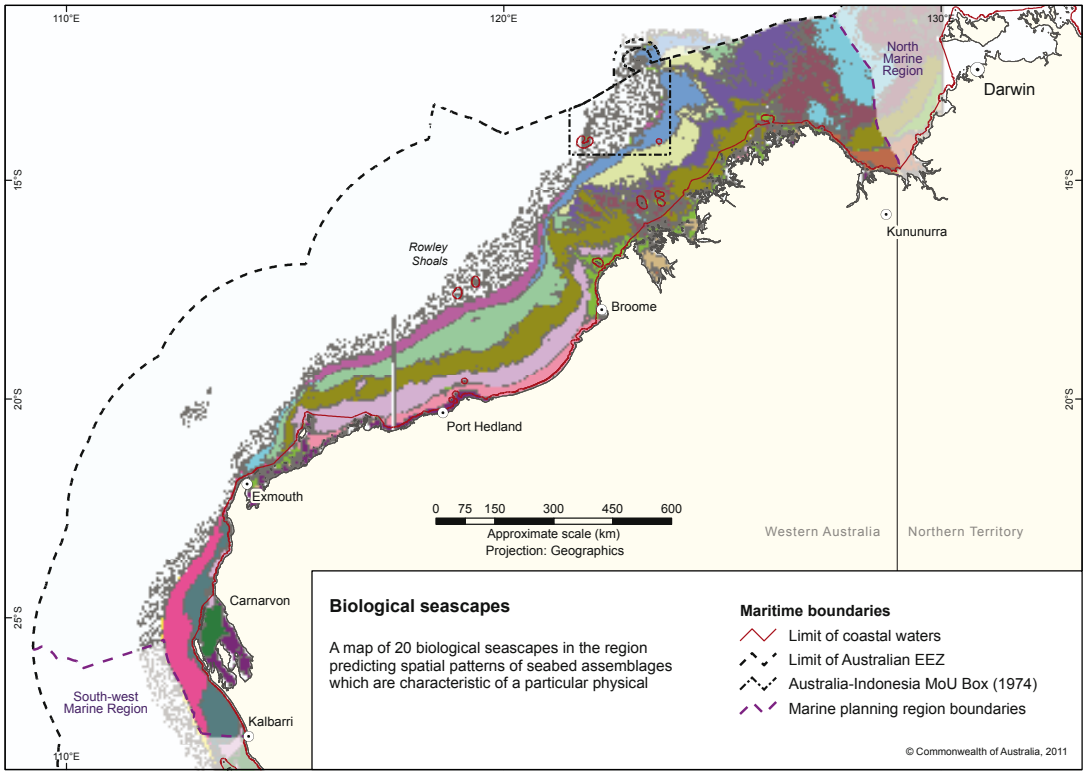


Figure 3.5: Biological seascapes of the North-west Marine Region

Table 3.4: Description of the CERF Marine Hub biological seascapes clusters used in the marine reserve network design for the North-west Marine Region

Cluster	Location	Description
Cluster 1	Carnarvon offshore	Depth: 66–89 m, very high sediment sand content
Cluster 2	Kimberley / Timor mid-shelf	Depth: 63–83 m, low sediment carbonate, high variation in seabed oxygen, high variation in salinity, high variation in silicate
Cluster 3	Kimberley inner-shelf	Depth: 17–28 m (moderately low), high average water temperature
Cluster 4	Timor mid-shelf	Depth: 97–125 m, very low sediment sand content, very high average sea surface temperature
Cluster 5	North-west deep slope	Depth: 569–821 m (very high), very high nitrate, very high phosphate, very low average water temperature, very high silicate, low chlorophyll A, low turbidity, very low benthic irradiance, very low variation in benthic irradiance
Cluster 6	Carnarvon outer shelf	Depth: 121–168 m, very low variation in chlorophyll A, very low variation in turbidity
Cluster 7	North-west mid-shelf	Depth: 50–71 m, high bottom stress, high variation in bottom stress
Cluster 8	North-west shallow coastal strip	Depth: 2–8 m (very low), very low nitrate, very low phosphate, very high variation in chlorophyll A, high turbidity, high variation in sea surface temperature, very high benthic irradiance, high variation in benthic irradiance
Cluster 9	Kimberley outer-shelf	Depth: 98–113 m, very high variation in nitrate, very high variation in phosphate, high variation in water temperature, very high variation in silicate, very low variation in sea surface temperature
Cluster 10	North-west upper slope	Depth: 306–415 m (high), high nitrate, high phosphate, very low average seabed oxygen, very low variation in salinity, low average water temperature, low variation in water temperature, high silicate average, very low chlorophyll A, very low turbidity, low benthic irradiance, low variation in benthic irradiance
Cluster 11	North-west inshore	Depth: 19–34 m, very high bottom stress, very high variation in bottom stress very low sediment carbonate, very high sediment gravel content, low nitrate, very high average water temperature, very high chlorophyll A, very high turbidity
Cluster 12	Timor outer-shelf	Depth: 76–90 m, high variation in phosphate, very high variation in seabed oxygen, very low salinity, low variation in sea surface temperature

Cluster	Location	Description
Cluster 13	Western upper slope	Depth 204 – 296 m (moderately high) , very high slope, very high average seabed oxygen, very high salinity average, very low silicate average, very low variation in silicate, low benthic irradiance, low variation in benthic irradiance
Cluster 14	Western shelf	Depth: 12–37 m (moderately low), low nitrate, very low variation in nitrate, low phosphate average, high average seabed oxygen, low silicate average, very low average sea surface temperature, high benthic irradiance, very high variation in benthic irradiance
Cluster 15	West-North-west inner shelf	Depth: 34–50 m, low slope, high sediment carbonate, high sediment sand content, low sediment mud content
Cluster 16	North-west outer shelf	Depth: 107–139 m, very high sediment carbonate
Cluster 17	North-west shelf break	Depth: 232–287 m (high), very high aspect, high nitrate, high phosphate average, low average water temperature, low variation in water temperature, low chlorophyll A, low turbidity
Cluster 18	Kimberley shelf break	Depth: 180–236 m (moderately high), low average seabed oxygen, very low variation in seabed oxygen, high silicate average, low variation in sea surface temperature
Cluster 19	North-west coast	Depth: 9–18 m (low), very low sediment mud content, low phosphate average, very high variation in water temperature, very high variation in turbidity, very high variation in sea surface temperature, high benthic irradiance, high variation in benthic irradiance
Cluster 20	Kimberley coast	Depth: 7–19 m (low), very low variation in phosphate, very high variation in salinity, high average water temperature at the seabed, high chlorophyll A, high turbidity, high variation in sea surface temperature .

Seafloor features (Goal 4)

The landscape-scale physical structure of the seafloor is important in determining where habitats or species occur. Large physical seafloor structures (tens to hundreds of kilometres in scale) are referred to as geomorphic or seafloor features and includes, for example, seafloor pinnacles, canyons and reefs. There are 19 types of seafloor features in the North-west Marine Region (Figure 3.6). Information on the seafloor features of the continental margin of Australia is available at: **www.environment.gov.au/coasts/mbp/publications/general/nmb-geomorphic-report.html**

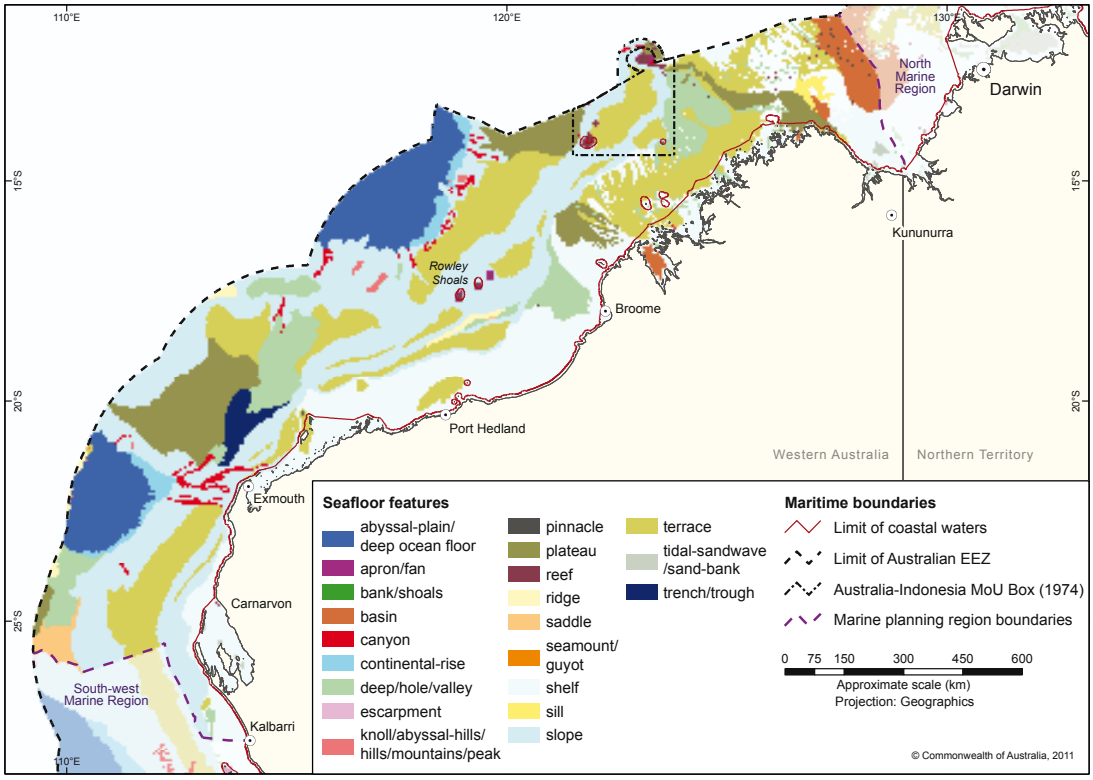


Figure 3.6: Seafloor features of the North-west Marine Region

Species

Biologically important areas are areas where aggregations of individuals of a protected species display behaviours such as breeding, foraging, resting and migration. Biologically important areas highlight those parts of the region that are particularly important for the protection and conservation of protected species. The areas have been identified based on published literature and advice from scientific experts. Information on the distribution, relative abundance and types of activities, such as foraging, breeding, migration, nesting and internesting, were compiled for whales, whale sharks, marine turtles, dolphins, sawfish, seabirds and dugongs in the North-west Marine Region.

3.2.2 Existing spatial management measures

Principle 1 requires that existing spatial closures be incorporated into the marine reserve network wherever possible and appropriate. Existing spatial management measures considered in the design of the marine reserve network include:

- existing or proposed marine reserves
- historic shipwrecks
- submarine telecommunication cable protection zones.

Marine reserves

There are four existing Commonwealth marine reserves within the North-west Marine Region:

- Ningaloo Marine Park
- Mermaid Reef Marine National Nature Reserve
- Ashmore Reef National Nature Reserve
- Cartier Island Marine Reserve.

Several state marine reserves as well as areas identified for inclusion in future state reserves are situated adjacent to the region (Figure 3.7). These are:

- Ningaloo Marine Park (State waters)
- Barrow Island Marine Management Area and the Barrow Island Marine Park
- Montebello Islands Marine Park
- Muiron Islands Marine Management Area
- Shark Bay Marine Park
- Rowley Shoals Marine Park
- proposed Dampier Archipelago Marine Park
- proposed Regnard Marine Management Area
- proposed Eighty Mile Beach
- proposed Camden Sound Marine Park
- proposed Roebuck Bay Marine Park
- proposed North Kimberley Marine Park.

Mermaid Reef, Ashmore Reef, Seringapatam Reef, the Commonwealth waters of the Ningaloo marine area and Scott Reef are on the Commonwealth Heritage List. In Western Australian waters adjacent to the region, Shark Bay and the Dampier Archipelago (including the Burrup Peninsula) are on the National Heritage List. The Shark Bay World Heritage Area lies in state waters and is adjacent to the region. Ningaloo Reef and Cape Range have recently been added to the World Heritage List.

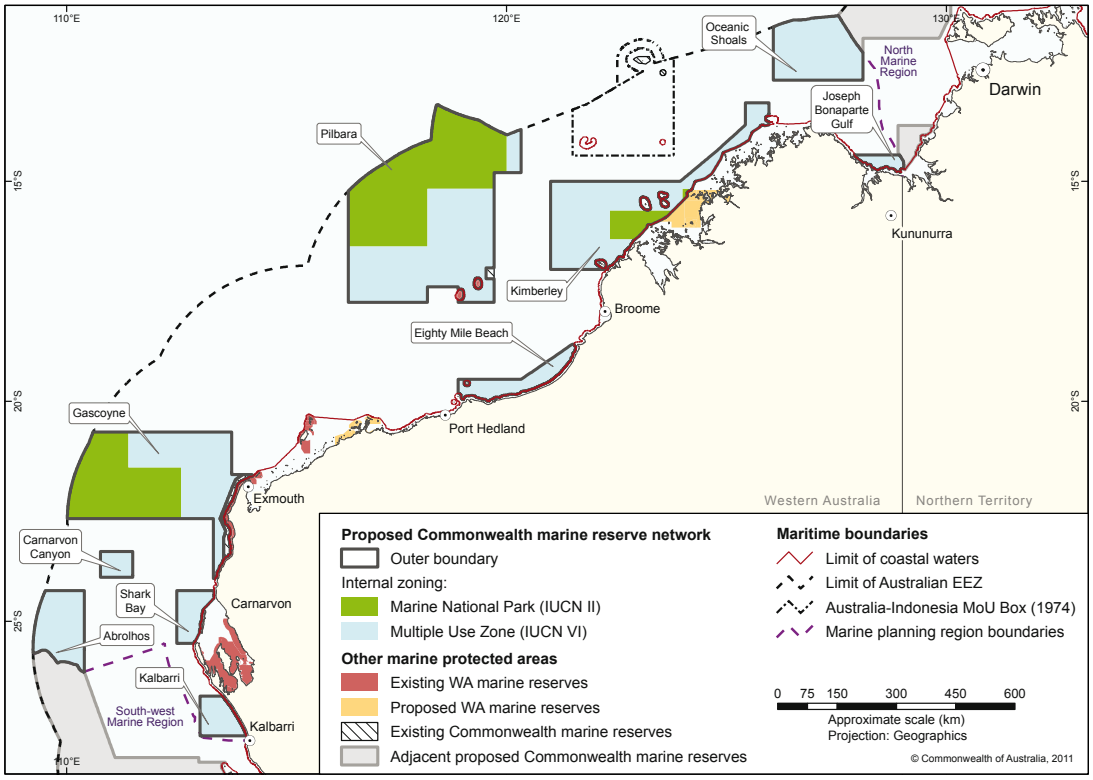


Figure 3.7: Location of existing and proposed state and Commonwealth marine reserves in the North-west Marine Region

Historic shipwrecks

There are four historic shipwrecks protected under the *Historic Shipwrecks Act 1976* in the North-west Marine Region: the Ann Millicent, the Lively, the Trial and the Crown of England. More information is available from **www.environment.gov.au/heritage/shipwrecks**.

Submarine cables

There are two telecommunication cables linking Australia with South-East Asia: the SEA_ME_WE3 and the JASURAUS; both are of national significance. The protection zones over the cables are generally one nautical mile either side of the cable. Two further cables are proposed. More information is available from the Australian Communications and Media Authority web site **www.acma.gov.au**.

3.2.3 Socio-economic values

Principles 9 and 16 require that in considering alternative reserve locations, sizes and shapes, a key consideration should be to minimise socio-economic impacts.

Information incorporated into the marine reserve network design process about existing human uses of the North-west Marine Region included commercial, recreational and traditional uses. The majority of human uses are concentrated on the continental shelf, with limited activities in the deeper waters of the slope and deep ocean floor. Socio-economic data has been used to inform selection of marine reserve locations and, the delineation of boundaries and zoning to minimise socio-economic costs. Information about the following uses has been used in the design of the proposed network:

- commercial fishing
- charter fishing
- recreational uses, including fishing and diving
- offshore aquaculture and pearling
- native title
- defence
- petroleum
- shipping and ports.

Commercial fishing

Commercial wild-catch fishing is the one of the most widespread activities in the North-west Marine Region. Sixteen commercial fisheries operate in the region with an average annual gross value of production[3] around $408 million. The most valuable fisheries operating in the North-west Marine Region include the West Coast Rock Lobster Fishery and Northern Prawn Fishery; both of which operate primarily in the adjacent South-west and North marine regions respectively. Fishing effort is relatively evenly distributed across the North-west region, with the highest efforts concentrated along the continental shelf and slope and in state waters adjacent to the region.

Data on the distribution of commercial fishing for the Commonwealth-managed fisheries covered the period 2003–08; data for Western Australian-managed fisheries covered 2000–06.

Application and interpretation of fisheries data was informed by industry representatives and fisheries managers during consultation by the department on the areas for further assessment for the North-west Marine Region.

3 Fisheries data was used in the marine reserve network design process as annual average gross value of production (GVP) which is the value of commercial fishery products at the point of landing. GVP does not take into account the cost to fishers of catching the fish, or the cost of transporting, processing and marketing the fish products for wholesale and retail markets. It also does not take into account flow-on effects such as value-adding and other potential benefits to individuals and communities.

Charter fishing

In Western Australia in 2008, there were more than 250 charter fishing licenses, including for eco-tourism ventures. There is limited information on the distribution of fishing effort for the charter fishing sector. Information sources include the 2001 National Recreational and Indigenous Fishing Survey (Henry & Lyle 2003) and the Western Australian Department of Fisheries.

Recreational uses, including fishing

Recreational fishing is a popular activity in the North-west region, although most recreational fishing occurs in state waters adjacent to the region. Limited information on the distribution of effort is available for the recreational fishing sector. Information sources include:

- The 2001 National Recreational and Indigenous Fishing Survey (Henry & Lyle 2003);
- Western Australian recreational fishing organisations who provided advice on important recreational fishing ports and iconic recreational fishing areas during consultation on the areas for further assessment for the North-west Marine Region.

Pearling and off-shore aquaculture

Western Australia is the world's largest source of high quality South sea pearls. In 2008 this industry was worth approximately $90 million. Data on the value and location of areas of importance to the pearling industry was made available by the Western Australian Department of Fisheries (including the Western Australian State of the Fisheries Reports) and by the Pearl Producers' Association of Australia.

Apart from pearling activities, no offshore aquaculture occurs in the (Commonwealth waters) of the region although aquaculture may develop in the future. In state waters in the Kimberley, the tropical aquaculture facility near the Bardi Aboriginal community at One Arm Point has been producing trochus shell for a number of years. Sea-cage barramundi farming occurs in Lake Argyle and a project is underway to commercialise the farming of black tiger prawn by the Kimberley Aquaculture Aboriginal Corporation.

Native title

Native title rights can exist in waters over which Australia asserts sovereign rights under the *Seas and Submerged Lands Act* 1973. Native title determinations need not have been made in order for native title rights to exist. Native title information was provided by the National Native Title Tribunal; including all claims within and adjacent to the North-west Marine Region. Further information is available from the National Native Title Tribunal at: **www.nntt.gov.au/Publications-And-Research/Maps-and-Spatial-Reports/Pages/default.aspx**

Defence

The Australian Defence Force uses the entire marine estate in the course of their activities, with specific areas set aside for training activities. Within the North-west Marine Region there are two military practice and training areas. These are located west of North-West Cape and in the far north of the region.

Petroleum and mining

The North-west Marine Region is Australia's premier resource area for petroleum exploration and production. As at July 2011, the region overlaps with 240 existing leases including 46 production leases and 160 exploration leases as well as 38 acreage release areas. Large areas of the North-west Marine Region are prospective for oil and gas and for carbon capture and storage.

Further information is available from the Department of Resources, Energy and Tourism at: **http://www.ret.gov.au/resources/upstream_petroleum/Pages/UpstreamPetroleum.aspx**

Shipping and ports

Most major ports in the region are either in the process of expanding or are earmarked for expansion in order to service the expanding resources sector in Western Australia. Spatial information on the distribution of shipping routes, volume of traffic and existing and proposed ports was used to avoid impacts on the shipping industry (AMSA 2006; DSEWPaC 2003).

3.3 Approach to zoning

The *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) sets out the legal framework for declaring and managing Commonwealth marine reserves. It requires that, upon proclamation each Commonwealth marine reserve must be assigned to one of the World Conservation Union's (IUCN) internationally recognised set of seven protected area management categories.[4] Schedule 8 of the regulations under the EPBC Act outlines the Australian IUCN reserve management principles[5]. A Commonwealth reserve proclamation can also divide a reserve into zones and assign an IUCN category to each zone.

The approach to zoning is informed by Principles 18, 19 and 20. There are two components to the approach to zoning:

- determining the location, size and shape of different zones
- determining what activities are allowed in the different zones.

4 For further information see **www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories**. Categories are based on the Guidelines for Protected Area Management Categories published by the World Conservation Union (IUCN) in 1994.

5 For further information, see **www.environment.gov.au/coasts/mpa/publications/pubs/iucn-principles.pdf**

Determining the location, size and shape of different zones

The selection of areas to be zoned as highly protected was based on Principle 18; that the network should aim to include some highly protected areas in each provincial bioregion (i.e. IUCN Categories I or II). The principle that each provincial bioregion is represented within a highly protected zone, considered jointly with both the aim to minimise socio-economic impacts and information about the finer scale distribution of conservation features in the region, was the primary driver for the location, size and shape of the highly protected zones.

Determining what activities are allowed in the different zones

The proposed North-west Commonwealth Marine Reserve Network is proposed to include areas that are highly protected and areas where some natural resource use is allowed, as long as it is consistent with the objective of protecting and maintaining biodiversity in the long-term. Biodiversity conservation is the primary objective for all parts of the NRSMPA. This objective informs decisions about the compatibility of activities in marine reserves and requires the application of precaution in decision-making about the potential impacts of human activities. Therefore, although the mitigation of threats to biodiversity is not the basis on which the marine reserve networks in Commonwealth waters are identified, threat mitigation within proposed reserves is a consideration in decisions about proposed reserve zoning and about which activities can be permitted within zones.

Highly protected areas exclude most activities. Multiple use zones generally allow sustainable use of the marine environment and its resources where they are compatible with the overarching objective of conserving biodiversity.

The zoning scheme proposed for the North-west Commonwealth Marine Reserve Network includes Marine National Park zones (IUCN Category II) designed to provide the highest level of protection to conservation features and Multiple Use zones (IUCN Category VI), which allow a range of existing activities but exclude activities that carry a high risk to the conservation values.

The zoning arrangements that apply to each zone type are outlined in Table 3.5. Details of the conditions and approval or permit requirements that apply to specific activities within a Commonwealth marine reserve will be included in the North-west Commonwealth Marine Reserves Network Management Plan, which will be prepared once the network proposal is finalised and the marine reserves are proclaimed under the EPBC Act. The development of the management plan is a statutory process and will involve two periods of public consultation.

Under the proposed zoning scheme, some activities may be undertaken subject to general approvals, operator registration or individual permit. Some activities, including exploration for and development of petroleum resources in multiple use areas, will be subject to individual project assessment and approval under the EPBC Act by both the Minister (or his delegate) and the Director of National Parks.

Table 3.5: Overview of the proposed zoning scheme for the Commonwealth marine reserve network proposal for the North-west Marine Region

Activity	Multiple use zone (IUCN category VI)	Marine national park zone (IUCN category II)
Recreational fishing[a]	✓	✗
Recreational scuba diving and snorkelling	✓	✓
Research and monitoring[b]	✓	✓
Tourism, including dive/snorkel tours and nature watching[b]	✓	✓
Mining, including petroleum exploration and development[c]	✓	✗
Non-commercial Indigenous harvesting and hunting (consistent with the *Native Title Act 1993*)	✓	✓
Shipping[d]	✓	✓
Charter fishing[e]	✓	✗
Offshore aquaculture[e]	✓	✗
Commercial fishing (except as indicated below)	✓	✗
— demersal trawl	✗	✗
— demersal gillnet	✗	✗
— demersal longline	✗	✗

a Recreational fishing is managed by the states. All state rules and regulations (e.g. size and bag limits) will apply in Commonwealth marine reserves unless otherwise specified in statutory management plans.

b Authorisation will be required for these activities (e.g. approval or permit) in Marine National Park Zones (IUCN Category II).

c Proposed mining operations currently require approval from the Director of National Parks unless they are carried out under usage rights that existed immediately before the declaration of a reserve. Mining operations are also subject to the assessment and approval provisions of the *Environment Protection and Biodiversity Conservation Act 1999* where a proposed operation is likely to have a significant impact on the environment or on listed threatened or migratory species

d Ballast water exchange is managed under national arrangements. Restrictions may apply in sensitive areas.

e Authorisation will be required for these activities (e.g. approval or permit) in multiple use zones (IUCN category VI).

4. PERFORMANCE OF THE MARINE RESERVE NETWORK PROPOSAL AGAINST THE GOALS AND PRINCIPLES

4.1 Summary of the network

The North-west Commonwealth Marine Reserve Network proposal (Figure 4.1) consists of **ten** individual reserves:

- Abrolhos (Wallaby extension) Commonwealth marine reserve
- Carnarvon Canyon Commonwealth marine reserve
- Kalbarri Commonwealth marine reserve
- Shark Bay Commonwealth marine reserve
- Gascoyne Commonwealth marine reserve
- Pilbara Commonwealth marine reserve
- Eighty Mile Beach Commonwealth marine reserve
- Kimberley Commonwealth marine reserve
- Oceanic Shoals Commonwealth marine reserve
- Joseph Bonaparte Gulf Commonwealth marine reserve.

The marine reserve network proposal covers an area of approximately 377 297 square kilometres, which equates to about 35 per cent of the area of the North-west Marine Region (Table 4.1).

Approximately 33 per cent of the network, or 11.6 per cent of the North-west Marine Region, has been zoned as highly protected with the remainder zoned for multiple use (details at Table 4.2).

Table 4.1: Overview of the North-west Commonwealth marine reserve network proposal[1]

Total network area	377 297 km^2
Area highly protected (IUCN Category II)	123 528 km^2
Proportion of region in network	35%
Proportion of region highly protected (IUCN Category II)	11.6%
Proportion of network over continental shelf	33.5%
Bioregions	All provincial and meso-scale bioregions are represented within the network.
Depth ranges within provincial bioregions	All but one of the depth ranges within bioregions is represented within the network.
Key ecological features	All but three of the 13 key ecological features are represented within the network[1].
Biological seascapes	All of the biological seascapes are represented in the region.
Seafloor features (geomorphology)	All of the 19 seafloor features are represented within the network.

1 Ashmore Reef and Cartier Island and surrounding Commonwealth waters are also a key ecological feature for the region. Although they are not represented in the North-west Commonwealth Marine Reserve Network proposal they are already represented in the existing Commonwealth Ashmore Reef National Nature Reserve and Cartier Island Marine Reserve.

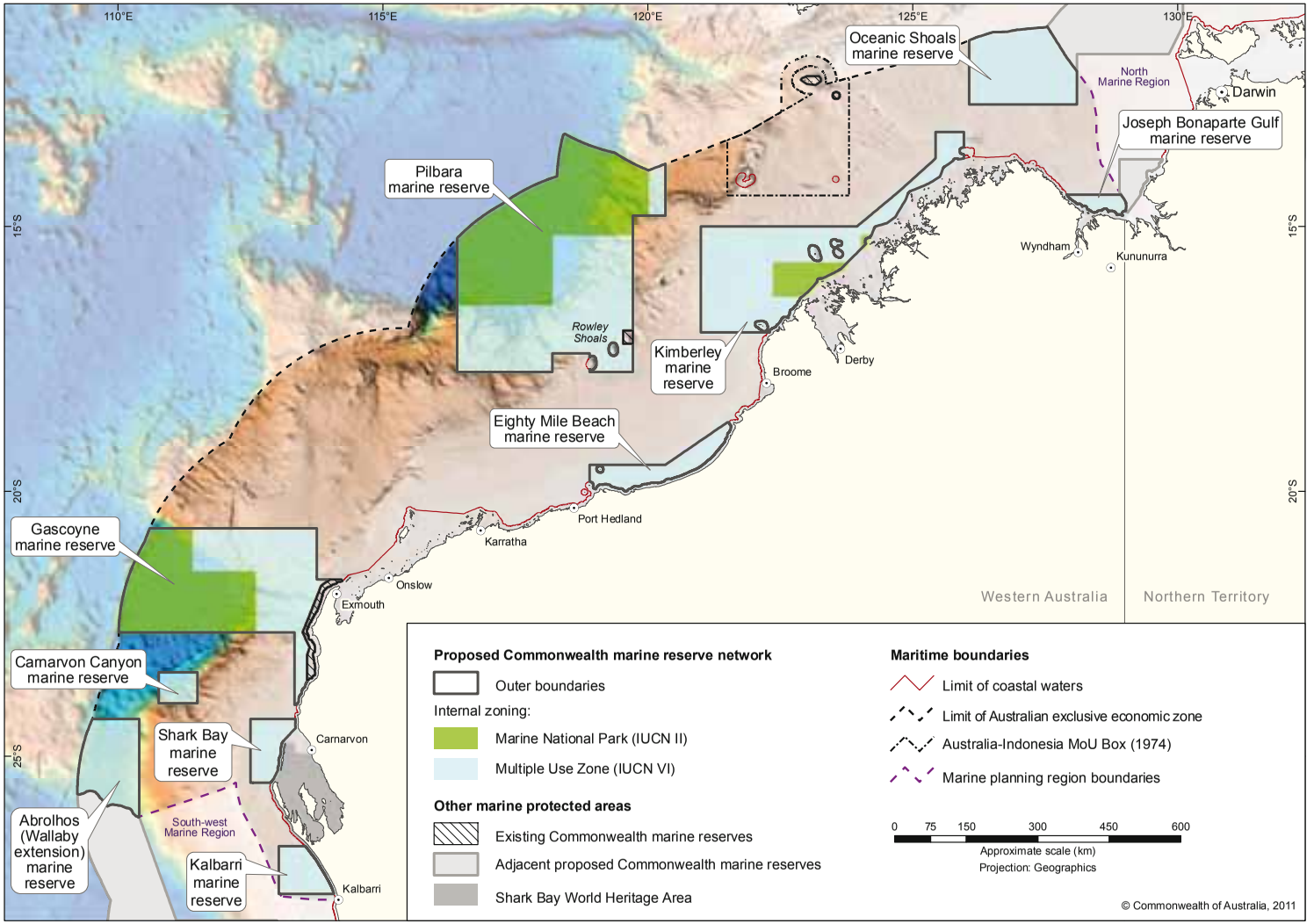


Figure 4.1: The North-west Commonwealth marine reserve network proposal

Table 4.2: Areas of each reserve within in the North-west Commonwealth Marine Reserve Network proposal

Draft proposed reserve	Total Area (km²)*	Proportion of the network	Proportion of the region	Marine national park zone (km²)	Multiple use zone (km²)
Abrolhos (Wallaby Extension)	19 009	4.99%	1.78%	-	19 009
Carnarvon Canyon	4 832	1.27%	0.45%	-	4 832
Kalbarri	7 955	2.09%	0.75%	-	7 955
Shark Bay	8 263	2.17%	0.77%	-	8 263
Gascoyne	81 762	21.46%	7.66%	42 395	39 367
Pilbara	145 833	38.27%	13.6%	73 228	72 605
Eighty Mile Beach	12 105	3.18%	1.13%	-	12 105
Kimberley	62 791	16.48%	5.88%	7 905	54 886
Oceanic Shoals	31 362	8.23%	2.94%	-	31 362
Joseph Bonaparte Gulf	3 385	0.89%	0.32%	-	3 385
TOTAL*	**377 297**	**100%**	**35.34%**	**123 528**	**253 769**

* The total area of the North-west Marine Region is 1 067 731 km²

4.2 Achieving the goals

The North-west Commonwealth Marine Reserve Network proposal achieves the four Goals to a large extent, by representing:

- each of the eight provincial bioregions and each of the eleven meso-scale bioregions in the North-west Marine Region (Goal 1 – *Each **provincial bioregion** occurring in the marine region should be represented at least once in the marine reserve network*)
- all but one depth range within provincial bioregions (Goal 2 – *The marine reserve network should cover all **depth ranges** (15-5000+ m) occurring in the region or other gradients in light penetration in waters over the continental shelf.*)
- all but three of the key ecological features of the region (Glomar Shoals, Seringapatam Reef and the Commonwealth waters in the Scott Reef complex and Ashmore Reef and Cartier Island and surrounding Commonwealth waters) and all of the biological seascapes. Ashmore Reef and Cartier Island and surrounding Commonwealth waters are represented in an existing Commonwealth marine reserve. (Goal 3 – *The marine reserve network should seek to include examples of **benthic/demersal biological features** known to occur in the marine region at a broad sub-provincial* (greater than hundreds of kilometres) scale
- all of the 19 seafloor features found in the region (Goal 4 – *The marine reserve network should include all **types of seafloor*** features).

In total, of the 153 primary conservation features present in the North-west Marine Region, 149 are represented in the marine reserve network proposal (Tables 4.3 and 4.4).

Table 4.3: Primary features included in the North-west Commonwealth Marine Reserve Network proposal

Primary Conservation Features		Features in the region	Features represented within network
Goal 1	Provincial bioregions (PB)	8	8
	Meso-scale bioregions (MB)	11	11
Goal 2	Depth ranges within PB	82	81
Goal 3	Key ecological features	13	10
	Biological seascapes	20	20
Goal 4	Seafloor types	19	19
	Total	**153**	**149**

Table 4.4: Representation of conservation features in the North-west Commonwealth Marine Reserve Network proposal

Feature	Name	Included in the network
Provincial bioregions	Central Western Shelf Province	✓
	Central Western Shelf Transition	✓
	Central Western Transition	✓
	Northwest Province	✓
	Northwest Shelf Province	✓
	Northwest Shelf Transition	✓
	Northwest Transition	✓
	Timor Province	✓
	Central Western Province	✓

Feature	Name	Included in the network
Meso-scale bioregions	Bonaparte Gulf	✓
	Cambridge-Bonaparte	✓
	Canning	✓
	Eighty Mile Beach	✓
	Kimberley	✓
	Ningaloo	✓
	Northwest Shelf	✓
	Oceanic Shoals	✓
	Pilbara (nearshore)	✓
	Pilbara (offshore)	✓
	Zuytdorp	✓
Depth Range within Central Western province	Continental Rise	✓
	Abyssal Plain above Calcite Compensation Depth	✓
Depth Range within Central Western Shelf province	Shallow Waters to Shallow Shelf Transition	✓
	Shallow Shelf	✓
	Shallow Shelf to Deep Shelf Transition	✓
	Deep Shelf	✓
	Deep Shelf to Shelf Edge Transition	✓
	Shelf Edge	✓
Depth range within Central Western Shelf Transition	Shallow waters	✓
	Shallow waters to Shallow Shelf Transition	✓
	Deep Shelf	✓
	Deep Shelf to Shelf Edge Transition	✓
	Shallow Shelf	✓
	Shallow Shelf to Deep Shelf Transition	✓
	Shelf Edge	✓

Feature	Name	Included in the network
Depth range within Central Western Transition	Abyssal Plain above Calcite Compensation Depth	✓
	Abyssal Plain below Calcite Compensation Depth	✓
	Continental Rise	✓
	Deep Continental Slope	✓
	Deep Mid-slope	✓
	Deep Upper Slope	✓
	Deep Upper Slope to Shallow Mid-slope Transition	✓
	Shallow Mid-slope	✓
	Shallow Upper Slope	✓
	Shallow Upper Slope to Deep Upper Slope Transition	✓
	Shelf Edge to Shallow Upper Slope Transition	✓
Depth range within Northwest Province	Abyssal Plain Above Calcite Compensation Depth	✓
	Abyssal Plain below Calcite Compensation Depth	✓
	Continental Rise	✓
	Deep Continental Slope	✓
	Deep Mid-slope	✓
	Deep Upper Slope	✓
	Deep Upper Slope to Shallow Mid-slope Transition	✓
	Shallow Mid-slope	✓
	Shallow Upper Slope	✓
	Shallow Upper Slope to Deep Upper Slope Transition	✓
	Shelf Edge to Shallow Upper Slope Transition	✓
Depth range within Northwest Shelf Province	Shallow Waters	✓
	Shallow Waters to Shallow Shelf Transition	✓
	Deep Shelf	✓
	Deep Shelf to Shelf Edge Transition	✓
	Shallow Shelf	✓
	Shallow Shelf to Deep Shelf Transition	✓
	Shelf Edge	✓

Feature	Name	Included in the network
Depth range within Northwest Shelf Transition	Shallow Waters	✓
	Shallow Waters to Shallow Shelf Transition	✓
	Shallow Shelf	✓
	Shallow Shelf to Deep Shelf Transition	✓
	Deep Shelf	✓
	Deep Shelf to Shelf Edge Transition	✓
	Shelf Edge	✓
Depth range within Northwest Transition	Abyssal Plain Above Calcite Compensation Depth	✓
	Abyssal Plain below Calcite Compensation Depth	✓
	Shallow Waters	✓
	Shallow Waters to Shallow Shelf Transition	✓
	Continental Rise	✓
	Deep Continental Slope	✓
	Deep Mid-slope	✓
	Deep Shelf	✓
	Deep Shelf to Shelf Edge Transition	✓
	Deep Upper Slope	✓
	Deep Upper Slope to Shallow Mid-slope Transition	✓
	Shallow Mid-slope	✓
	Shallow Shelf	✓
	Shallow Shelf to Deep Shelf Transition	✓
	Shallow Upper Slope	✓
	Shallow Upper Slope to Deep Upper Slope Transition	✓
	Shelf Edge	✓
	Shelf Edge to Shallow Upper Slope Transition	✓

Feature	Name	Included in the network
Depth range within Timor Province	Abyssal Plain Above Calcite Compensation Depth	✓
	Abyssal Plain below Calcite Compensation Depth	✓
	Shallow Waters	✓
	Shallow Waters to Shallow Shelf Transition	✓
	Continental Rise	✓
	Deep Continental Slope	✓
	Deep Mid-slope	✓
	Deep Shelf	✓
	Deep Shelf to Shelf Edge Transition	✓
	Shallow mid-slope	✗
	Shallow Shelf	✓
	Shallow Shelf to Deep Shelf Transition	✓
	Shallow Upper Slope	✓
	Shallow Upper Slope to Shallow Mid-slope Transition	✓
	Shelf Edge	✓
	Shelf Edge to Shallow Upper Slope Transition	✓

Feature	Name	Included in the network
Key ecological features	Carbonate banks in the Joseph Bonaparte Gulf	✓
	Limestone pinnacles in the Bonaparte Basin	✓
	Ashmore Reef and Cartier Island and surrounding Commonwealth waters	×
	Seringapatam Reef and the Commonwealth waters surrounding the Scott Reef complex	×
	Continental Slope Demersal fish communities	✓
	Canyons linking the Argo Abyssal Plan with the Scott Plateau	✓
	Ancient coastline at 125m depth contour	✓
	Glomar Shoals	×
	Mermaid Reef and the Commonwealth waters surrounding the Rowley Shoals	✓
	Exmouth Plateau	✓
	Canyons linking the Cuvier Abyssal Plain with the Cape Range Peninsula	✓
	Commonwealth waters adjacent to Ningaloo Reef	✓
	Wallaby Saddle	✓

Feature	Name	Included in the network
Biological seascapes	Cluster 1	✓
	Cluster 2	✓
	Cluster 3	✓
	Cluster 4	✓
	Cluster 5	✓
	Cluster 6	✓
	Cluster 7	✓
	Cluster 8	✓
	Cluster 9	✓
	Cluster 10	✓
	Cluster 11	✓
	Cluster 12	✓
	Cluster 13	✓
	Cluster 14	✓
	Cluster 15	✓
	Cluster 16	✓
	Cluster 17	✓
	Cluster 18	✓
	Cluster 19	✓
	Cluster 20	✓

Feature	Name	Included in the network
Seafloor features	Abyssal-plain/deep ocean floor	✓
	Apron/fan	✓
	Bank/shoals	✓
	Basin	✓
	Canyon	✓
	Continental-rise	✓
	Deep/hole/valley	✓
	Knoll/abyssal-hills/hills/mountains/peak	✓
	Pinnacle	✓
	Plateau	✓
	Reef	✓
	Ridge	✓
	Saddle	✓
	Shelf	✓
	Sill	✓
	Slope	✓
	Terrace	✓
	Tidal sand-wave/bank	✓
	Trench/trough	✓

4.3 Applying the principles

Twenty principles guide the location, selection, design and zoning of the proposed reserve network. This section outlines how the principles were addressed in the development of the proposed network.

Principle 1—*Marine reserves will be located taking into account the occurrence and location of existing spatial management arrangements (for example, existing protected areas and sectoral measures) that contribute to the goals.*

Two of the existing Commonwealth marine reserves, Ningaloo Marine Park (Commonwealth waters) and Mermaid Reef Marine National Nature Reserve, have been incorporated into the design of the network. The existing Ashmore Reef National Nature Reserve and Cartier Island Marine Reserve are within an area in which a 1974 memorandum of understanding between Australia and the Republic of Indonesia allows fishing by traditional Indonesian fishers (the MoU box). The Australian Government has chosen not to include areas within the MoU box in the North-west Commonwealth Marine Reserve Network proposal.

Five of the ten proposed marine reserves are adjacent to four existing and three proposed state marine reserves:

- the proposed Shark Bay Commonwealth Marine Reserve is adjacent to the Shark Bay World Heritage Area and the Western Australian Shark Bay Marine Park
- the proposed Pilbara Commonwealth Marine Reserve is adjacent to the Western Australian Rowley Shoals Marine Park
- the proposed Kimberley Commonwealth Marine Reserve is adjacent to the proposed Western Australian Camden Sound Marine Park and the proposed Western Australian North Kimberley Marine Park
- the proposed Eighty Mile Beach Commonwealth Marine Reserve is adjacent to the proposed Western Australian Eighty Mile Beach Marine Park
- the proposed Gascoyne Commonwealth Marine Reserve is adjacent to the Western Australian Muiron Islands Marine Management Area
- the proposed Gascoyne Commonwealth Marine Reserve is also adjacent to the Western Australian Ningaloo Marine Park (State waters) along the southern boundary.

Principle 2—*The goals should be met with the least number of separate marine reserves that is, a smaller number of larger marine reserves rather than many small marine reserves) to maximise conservation outcomes.*

The network proposal represents 149 primary conservation features within ten reserves of 3385 to 145 833 square kilometres in size.

Fewer larger reserves have a number of benefits over a larger number of smaller reserves, including better conservation outcomes and more efficient management. Conservation benefits are enhanced by minimising boundary length and maximising area of the reserves, and by maintaining connections among features within reserves. Large reserves have a greater chance of capturing the entire range of habitats required for an organism's life cycle, which enhances the conservation benefits.

Establishing fewer larger reserves generally leads to more efficient and effective management than is the case for many smaller reserves; less compliance effort is needed to manage the network as the overall length of boundaries will be lower for an equivalent area.

Principle 3—*The capacity of a marine reserve to mitigate identified risks to conservation values.*

The draft North-west Marine Bioregional Plan identifies climate change as the most pervasive pressure on the North-west Marine Region's ecosystems[2]. The marine reserve network proposal offers the opportunity to mitigate risks arising from climate change.

There is a growing scientific consensus on the role of marine reserve networks in maintaining the resilience of marine ecosystems in the face of the complex and poorly understood pressures associated with global climate change. Ecosystem resilience is the ability of an ecosystem to maintain, or reinstate quickly, key functions and processes when disrupted or under pressure. Networks of representative marine reserves contribute to ecosystem resilience by providing key refuges for species and by reducing human pressures on the natural environment.

The capacity of a marine reserve network to contribute to ecosystem resilience is improved by applying best practice reserve design, such as replicating features across its range, ensuring the size and level of protection of a reserve is adequate, and by protecting critical areas that are biologically or ecologically important. The North-west Commonwealth Marine Reserve Network proposal has been designed to contribute to ecosystem resilience in the region and to provide refuges for species.

2 see the *Marine Environment Report Card* at **www.environment.gov.au/coasts/mbp/north-west/index.html**

Principle 4 —*The occurrence of spatially defined habitats for and/or aggregations of threatened and/or migratory species.*

Biologically important areas for threatened and migratory species including whales, whale sharks, dolphins, marine turtles, dugongs, seabirds and sawfish have been included in the marine reserve network proposal (Table 4.5). For example, the proposed Kimberley Commonwealth marine reserve includes, and is adjacent to, a number of biologically important areas for migratory seabirds, marine turtles, Australian snubfin and Indo-Pacific humpback and bottlenose dolphins, dugongs, and humpback whales. Including biologically important areas in the proposed Kimberley Commonwealth marine reserve will help with the ongoing conservation of these species.

Principle 5—*The occurrence of ecologically important pelagic features which have a consistent and definable spatial distribution.*

Detailed information necessary to identity the spatially predictable and, ecologically important pelagic features is currently lacking in the North-west Marine Region.

Table 4.5: Biologically Important Areas for threatened and migratory species that are represented within the North-west Commonwealth Marine Reserve Network proposal

Species	Threatened	Migratory	Abrolhos (Wallaby extension)	Carnarvon Canyon	Shark Bay	Kalbarri	Gascoyne	Pilbara	Eighty Mile Beach	Kimberley	Oceanic Shoals	Joseph Bonaparte Gulf
Cetaceans												
Australian snubfin dolphin		Migratory								✓		✓
Humpback whale	Vulnerable	Migratory			✓		✓		✓	✓		
Indo-Pacific humpback dolphin		Migratory								✓		
Indo-Pacific bottlenose dolphin		Migratory								✓		

Species	Threatened	Migratory	Abrolhos (Wallaby extension)	Carnarvon Canyon	Shark Bay	Kalbarri	Gascoyne	Pilbara	Eighty Mile Beach	Kimberley	Oceanic Shoals	Joseph Bonaparte Gulf
Sirenia												
Dugongs		Migratory			✓		✓		✓	✓		
Seabirds												
Brown booby		Migratory							✓	✓		
Fairy tern		Migratory			✓		✓					
Greater frigatebird		Migratory								✓		
Lesser crested tern		Migratory			✓		✓		✓	✓		
Lesser frigatebird		Migratory							✓	✓		
Little tern		Migratory						✓	✓	✓		
Red-footed booby		Migratory								✓		
Roseate tern		Migratory			✓		✓		✓	✓		
Wedge-tailed shearwater		Migratory			✓	✓	✓					
White-tailed tropicbird		Migratory						✓				

Species	Threatened	Migratory	Abrolhos (Wallaby extension)	Carnarvon Canyon	Shark Bay	Kalbarri	Gascoyne	Pilbara	Eighty Mile Beach	Kimberley	Oceanic Shoals	Joseph Bonaparte Gulf
Marine turtles												
Flatback turtle	Vulnerable	Migratory				✓			✓	✓		
Green turtle	Vulnerable	Migratory								✓		✓
Hawksbill turtle	Vulnerable	Migratory				✓						
Loggerhead turtle	Endangered	Migratory					✓				✓	
Olive ridley turtle	Endangered	Migratory								✓	✓	✓
Sawfish												
Dwarf sawfish									✓			
Freshwater sawfish									✓	✓		
Green Sawfish	Vulnerable								✓			
Whale shark												
Whale shark							✓					

Principle 6—*The occurrence of known small-scale (tens of kilometres) ecosystems associated with the benthic/demersal environment.*

Seafloor (geomorphic) features and biological seascapes have been used as surrogates for small-scale ecosystems associated with benthic/demersal environments (see Chapter 3). All of the seafloor features and all of the biological seascapes have been represented within the proposed network.

Additionally the biological communities associated with seafloor features can differ between bioregions and with depth. When representation of the seafloor features within bioregions and within depth ranges is examined, 230 of the 330 of these features are represented within the marine reserve network proposal.

Principle 7—*Relevant available information about small-scale distribution of sediment types and sizes and other geo-oceanographic variables.*

The biological seascapes data set provides information on the small scale distribution of sediment types and sizes, and other geological and oceanographic variables and their relationship to associated seabed invertebrates and fish. All of the biological seascapes have been represented in the proposed network.

Principle 8—*Occurrence of listed heritage sites (where inclusion in the MPA network would improve administration of protection regimes).*

The proposed Shark Bay Commonwealth Marine Reserve is adjacent to the existing Shark Bay World Heritage Area. The proposed Gascoyne Commonwealth Marine Reserve is adjacent to the Ningaloo Reef-Cape Range-Exmouth Gulf and the Muiron Islands Marine Management Area, all of which are considered to have outstanding natural heritage values. The Ningaloo Coast was recently included on the World Heritage List. There are four historic shipwrecks in the marine region, although none have been captured in the proposed network.

Principle 9—*Socio-economic costs should be minimised.*

The development of the marine reserve network proposal has been guided by the principle of minimising socio-economic impacts. Where different options were available to meet conservation objectives, the location with the least impact on existing users was chosen. Information on commercial fisheries; pearling and aquaculture; recreational and charter fishing; petroleum prospectivity; exploration and extraction; defence activities; ports; shipping; native title claims and future development were considered in the design of the network proposal.

Principle 10—*Individual areas should, as far as practicable, include continuous depth transects (e.g. from the shelf to the abyss).*

By including a range of depths within a reserve, connectivity between habitats is better maintained. This is important as many species use a range of habitats in different depths during their life cycle.

The proposed Gascoyne Commonwealth Marine Reserve covers a continuous depth transect from shallow waters (shelf) out to the deep ocean floor. The proposed reserves that do not cover all depth ranges are confined either to the continental shelf and slope or extend from the slope out to the deep ocean floor. The proposed Pilbara Commonwealth marine reserve provides connectivity between the slope and terrace areas around the Rowley Shoals out to the abyssal plain and deep water canyons. The proposed Kimberley Commonwealth marine reserve provides connectivity between shelf and slope habitats as well as with a large proportion of the Kimberley coastline.

Principle 11—*Whole seafloor (geomorphic) features should be included.*

The large size of most of the proposed Commonwealth marine reserves allows whole seafloor features to be represented. For example, the Wallaby Saddle has been identified as a key ecological feature of the North-west Marine Region and is entirely within the proposed Abrolhos (Wallaby extension) Commonwealth marine reserve. The proposed Pilbara Commonwealth marine reserve includes the whole of the canyons linking the Argo Abyssal Plain with the Scott Plateau, which have also been identified as a key ecological feature of the marine region. Other whole seafloor features captured within the proposed network include the Carnarvon Canyon in the proposed reserve of the same name, other large canyons, pinnacles, reefs, banks, shoals, terraces and plateaux.

Principle 12—*Features should be replicated wherever possible within the system of marine reserves (that is, included more than once).*

Most of the marine reserves proposed with the North-west Marine Region are large allowing replication of many of the features within the proposed network. Of the 153 primary conservation features related to the four goals, 64 are represented in multiple reserves (Table 4.6). This includes all of the provincial bioregions and all of the meso-scale bioregions.

A number of the features have not been replicated because the features either have a single occurrence in the region or have a confined spatial distribution such as the depths within provincial bioregions. In many cases where features have not been replicated a large proportion of these features have been incorporated into the reserve network.

Table 4.6: Replication of conservation features within multiple reserves in the North-west Marine Region

Feature	Total number	Number represented in more than one reserve
Provincial bioregions	8	5
Meso-scale bioregions	11	5
Depth ranges within provincial bioregions	82	26
Key ecological features	13	3
Biological seascapes	20	19
Seafloor features	19	13
Total	**153**	**64**

Principle 13—*Size and shape should be orientated to account for inclusion of connectivity corridors and biological dispersal patterns within and across marine reserves.*

Very little is known about connectivity and biological dispersal patterns in the North-west Marine Region. The proposed Commonwealth marine reserves take connectivity into account through their generally large size, coverage of a range of depths and representation of large scale systems like the banks and pinnacles of the Oceanic Shoals. The network proposal includes a number of areas known or thought to be important for the movement of whales, dolphins, dugong and turtles between different habitats for foraging, mating and breeding as well as nursery areas.

The proposed Commonwealth marine reserves have been sited adjacent to state-managed marine reserves (both existing and proposed), which will aid connectivity between coastal and shelf waters. The proposed Eighty Mile Beach Commonwealth marine reserve and the proposed Kimberley Commonwealth marine reserve are adjacent to proposed reserves in Western Australian waters, while the proposed Pilbara Commonwealth marine reserve is adjacent to the Rowley Shoals Marine Park.

Principles 14 and 15—*Boundary lines should be simple, as much as possible following straight latitudinal/longitudinal lines* and *Boundary lines should be easily identifiable, where possible coinciding with existing regulatory boundaries.*

The boundaries of the marine reserve network proposal are generally straight lines, which primarily lie along lines of latitude and longitude or lines that follow existing maritime boundaries (i.e. coastal waters limit or the limit of the Australian exclusive economic zone). Wherever

possible, the reserve boundaries have been aligned to existing boundaries including existing marine reserves (such as Ningaloo Marine Park and the Mermaid Reef Marine National Nature Reserve) and are adjacent to a number of existing or proposed state marine reserves. Straight, simple boundaries, especially those following lines of latitude or longitude and coinciding with existing management lines, have benefits for management and compliance. For example, from both a user and compliance perspective, it is easier to determine whether a vessel is inside or outside a reserve when it is based on a straight line of latitude or longitude. Facilitating identification, enforcement and compliance of the proposed network is important as the majority of the proposed network is well offshore, away from prominent land marks.

Principle 16—*The size and shape of each area should be set to minimise socio-economic costs.*

The proposed Commonwealth marine reserve network has been designed to minimise socio-economic costs by avoiding overlap with existing users where consistent with the conservation objectives of the network. In cases where areas of high economic or social value overlapped with conservation values needed to build a representative reserve network, zoning was used to minimise impacts on existing users. In addition, overlaps with existing petroleum permits and acreage leases, as well as with areas of medium to high petroleum prospectivity, were avoided where possible.

The size and shape of the proposed marine reserves also incorporate existing spatial management arrangements (Principle 1), such as existing marine reserves, which further minimise socio-economic impacts.

Principle 17—*Zoning will be based on the EPBC Act/IUCN categories of protection.*

Zoning of the proposed network is based on the IUCN Protected Area Management Categories, as required under section 346 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The principles guiding the management for each IUCN Category zone are set out in Schedule 8 of the EPBC Regulations 2000.

Principle 18—*The regional marine reserve network will aim to include some highly protected areas (IUCN Categories I and II) in each provincial bioregion.*

The Commonwealth marine reserve network proposal includes highly protected zones (IUCN Category II) in six of the eight provincial bioregions. The Central Western Shelf Province and the Central Western Shelf Transition are not represented in a highly protected area. However the Central Western Shelf Transition is represented in the existing Commonwealth Ningaloo Marine Park in a highly protected zone (IUCN Category II). These provincial bioregions are based on the shelf and are highly valuable for the commercial fishing sector, recreational fishing and petroleum activities.

Three of the eleven meso-scale bioregions on the shelf are also represented in highly protected zones; these are the Kimberley, Canning and North-West Shelf. The Ningaloo meso-scale bioregion is already well represented in a highly protected zone in the existing Ningaloo Marine Park.

Principles 19 and 20—*Zoning will be based on the consideration of the risk that specific activities pose to the conservation objectives of each marine reserve* and *zoning of marine reserves will seek to ensure that the conservation objectives of the area are protected, taking into account a precautionary approach to threats as well as the relative costs and benefits (economic, social and environmental) of different zoning arrangements.*

A draft zoning framework has been developed with consideration of the risk that specific activities pose to conservation values (see Section 3.3). This zoning framework was informed though assessment of the compatibility of different activities with the conservation objectives of the proposed marine reserve network.

4.4 Minimising the socio-economic impacts of the proposed network

The marine reserve network proposal has been designed with the aim of meeting the reserve design goals and principles, which include the objective of minimising the potential impacts on industry and recreational and cultural uses.

A detailed assessment of the performance of the marine reserve network proposal in minimising socio-economic impacts is yet to be undertaken as this requires detailed feedback and input from those marine users potentially affected. This assessment will be undertaken by the Australian Bureau of Agricultural and Resource Economics and Sciences during the public consultation process (see *Proposal for the North-west Commonwealth Marine Reserves Network – consultation paper*[3]).

A preliminary evaluation of the potential impacts associated with the network proposal indicates that it is likely to have no or minimal implications for most existing marine users and stakeholders (Table 4.7).

Commercial fishing

Commercial fishing is the sector most likely to be affected by the marine reserve network proposal as it is widespread across the North-west Marine Region. Initial analysis indicates that the marine reserve network proposal may displace fisheries catch worth approximately less than one per cent of the annual gross value of production of the fisheries in the region.

The marine reserve network proposal has been designed to avoid the areas of highest use and value to the commercial fishing industry. However, of the 16 fisheries operating in the region, nine fisheries may be affected

3 available at: **http://www.environment.gov.au/coasts/mbp/north-west/index.html**

Potential displacement of the majority of fisheries operating within the North-west Marine Region, has been minimised by avoiding areas of high fisheries value or, where this is not possible, through zoning arrangements. Areas of shelf habitat where many of the most valuable fisheries operate have generally been zoned for multiple use to reduce the social and economic impacts on industry and associated communities.

The extent of displacement in some of the state fisheries is not clear due to the age and coarseness of the data (that is, logbook data are provided for large reporting grids); however, the impact is thought to be low.

The Australian Government has released a Fisheries Adjustment Policy to support the creation of new Commonwealth marine reserves.

Recreational and charter fishing

Available information and initial input from the recreational fishing sector suggests that the marine reserve network proposal does not affect existing areas of interest to this sector.

The potential impacts of the marine reserve network proposal on recreational fishing interests have been minimised by seeking to ensure few highly protected zones occur within a 40 nautical mile radius of each significant port or marina.

Similarly, based on publicly available information, little displacement of the charter fishing sector is expected as a result of the marine reserve network proposal. Important areas for charter fishing were identified using available published information (Henry & Lyle 2003).

Charter and recreational fishing would generally be a permitted activity within all but Marine National Park zones (IUCN Category II) of the marine reserve network proposal. Most of the overlap between the proposed marine reserves and important areas for charter and recreational fishing has been zoned to allow for this activity. More than 88 per cent of the North-west Marine Region remains accessible to recreational and charter fishers.

Native title

Native title rights can exist in waters over which Australia asserts sovereign rights under the *Seas and Submerged Lands Act 1973*. Native title determinations under the Commonwealth *Native Title Act 1993* need not have been made in order for native title rights to exist. Some proposed Commonwealth marine reserves in the North-west Marine Region may overlap to some degree with native title.

The marine reserve network proposal overlaps with four native title determinations:

- the proposed Kimberley Commonwealth marine reserve overlaps with the Bardi Jawi , the Dambimangari, and the Uunguu native title determinations
- the proposed Eighty Mile Beach Commonwealth marine reserve overlaps with the Ngarla and Ngarla 2 (Determination Area A) native title determination.

The marine reserve network proposal also overlaps with six registered native tile claims:

- the proposed Kimberley Commonwealth marine reserve overlaps with the Mayala and Nyul-Nyul native title claim
- the proposed Shark Bay, and Gascoyne Commonwealth marine reserves overlap with the Gnulli native title claim
- the proposed Kalbarri Commonwealth marine reserve overlaps with the Nanda People's native title claim
- the proposed Shark Bay Commonwealth marine reserve overlaps with The Malgana Shark Bay People's Application native title claim
- the proposed Joseph Bonaparte Gulf Commonwealth marine reserve overlaps with the Balanggarra native title claim.

With the establishment of marine reserves the Commonwealth intends to minimise any impact on native title rights and interests, in consultation with native title claimants. Areas of overlap between a reserve and native title may provide opportunities for co-management and other cooperative conservation strategies.

Offshore petroleum exploration and development

The proposed marine reserve network has been designed to minimise impacts on the offshore petroleum industry. Overlap with existing petroleum permits and areas of medium to high prospectivity were avoided where possible. Impact was further reduced by zoning areas that overlap with areas of medium to high prospectivity as Multiple Use zones which allow petroleum exploration and extraction subject to the EPBC Act. The proposed network overlaps with 35 petroleum exploration leases and 16 offshore petroleum acreage release areas. All overlaps involve proposed multiple use zoning only. These overlaps occur in the proposed Gascoyne, Pilbara, Kimberley and Oceanic Shoals Commonwealth marine reserves.

Shipping and ports

Shipping passage is not expected to be affected by the marine reserve network proposal. Shipping and port operations were considered in the marine reserve design process by incorporating information on major shipping routes and ports within the North-west Marine Region. Shipping passage within the marine reserve network proposal will be allowed in all zones. Wherever possible, highly protected zones (marine national parks (IUCN Category II)) have not been placed in areas of high shipping traffic.

Most issues related to shipping are regulated through existing mechanisms. Mandatory ballast water management requirements have been in place since 2001 and are managed through the Australian Quarantine and Inspection Service. While shipping activities are generally allowed in all zone types, some restrictions to ballast water exchange may apply on a case by case basis in sensitive areas.

Pearling and aquaculture

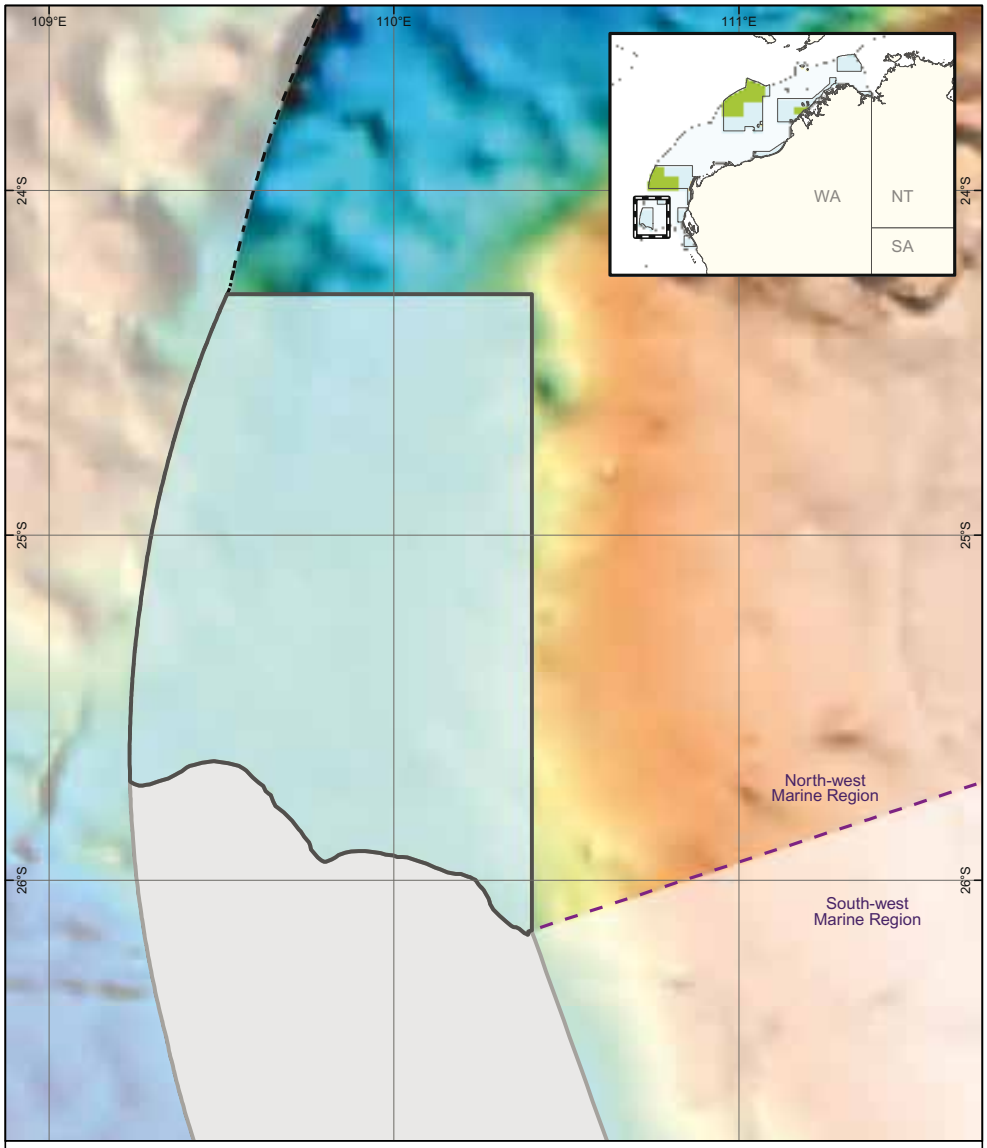
The proposed reserve network overlaps with a number of significant sites for the highly valuable pearling industry, particularly in the proposed Eighty Mile Beach and Kimberley Commonwealth marine reserves. Multiple use zoning has been applied where these overlaps occur to ensure pearling operations can continue.

There are currently no offshore aquaculture sites in the North-west Marine Region. Aquaculture will generally be allowed within multiple use zones (IUCN Category VI) subject to fishing gear restrictions (Table 3.5), however there may be the requirement for an approval process under the EPBC Act.

Table 4.7: Summary of intersection between proposed reserves in the North-west Marine Region and existing rights and uses

Existing rights and uses	Extent of intersection	Preliminary scoping of socio-economic impacts
Charter fishing	Minimal overlap of current effort (based on available data) with IUCN Category II	Minimal impact expected
Commercial fishing activities	Intersection between commercial fishing and proposed network is extensive, due to widespread nature of fishing in the region; impact minimised through zoning and through avoidance of high value locations.	Some impact expected. It is estimated that of 16 fisheries operating in the region 9 might experience some restriction in access.
Registered native title determinations and registered claims	Proposed network intersects with 4 determinations and 6 registered claims.	No impact expected.
Defence training areas	The Department of Defence's North-West Cape Exmouth training area overlaps with the proposed Gascoyne reserve.	Minimal impact expected.
Petroleum leases and acreage releases	35 exploration leases and 16 acreage releases overlap with the network No overlap with IUCN Category II.	No impact expected.
Major shipping routes	All proposed reserves overlap with shipping traffic.	No impact expected on shipping passage.
Existing pearling leases	No overlap with IUCN II.	No impact expected.
Recreational fishing	Minimal to no overlap of IUCN Category II with important recreational fishing areas	Minimal impact expected.

5.1 Proposed Abrolhos (Wallaby extension) Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Abrolhos (Wallaby extension) Commonwealth marine reserve covers approximately 19 009 square kilometres of the Commonwealth marine environment in the deeper water of the North-west Marine Region. It includes the Wallaby Saddle, a seafloor feature connecting the north-west margin of the Wallaby Plateau with the margin of the Carnarvon Terrace on the upper continental slope 4000-4700 metres deep (Falkner et al. 2009). It is a key ecological feature in the region and an important seafloor feature as it represents almost the entire area of this feature type in the North-west Marine Region.

The proposed marine reserve contains areas of probable enhanced productivity although the Wallaby Saddle is associated with low habitat diversity (Brewer et al. 2007). The Wallaby Saddle is shallower than adjoining abyssal areas to the north and south and is the site of suspected upwelling of deeper, more nutrient-rich waters. This upwelling is thought to support aggregations of small pelagic fish and associated predators and historical records indicate that sperm whales aggregated there.

The proposed marine reserve lies within a biogeographic faunal transition between tropical and temperate species and adjoins a proposed Commonwealth marine reserve of the same name in the South-west Marine Region.

Conservation values:

- One key ecological feature:
  - Wallaby Saddle (enhanced productivity)
- Habitats and communities of the Central Western Transition
- Sperm whales.

Existing uses

There is one Commonwealth-managed fishery operating in the area – the Western Tuna and Billfish Fishery. Petroleum prospectivity has not been assessed.

Proposed zoning arrangements and management principles

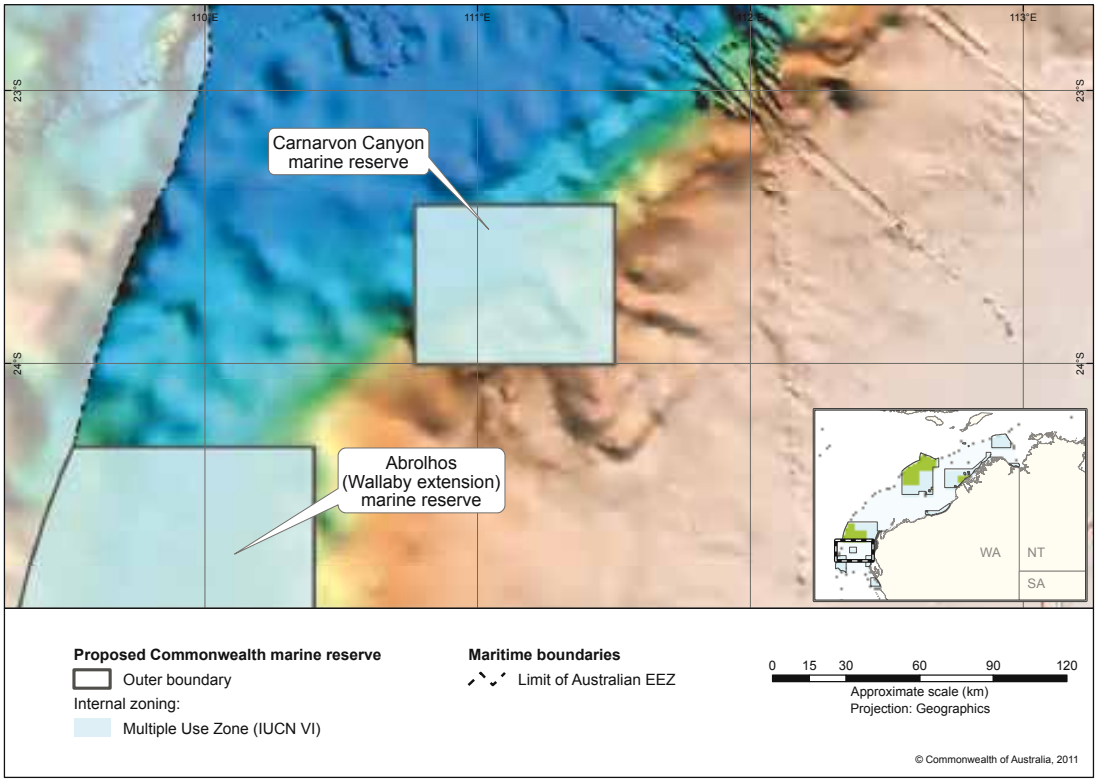
The proposed Abrolhos (Wallaby extension) Commonwealth marine reserve contains one zone. The activities permitted in this zone under the proposed management arrangements are shown in Table 3.5:

The entirety of the proposed reserve (19 009 square kilometres) is zoned for multiple use, to protect the biological diversity of the Central Western Transition while allowing the sustainable use of the region's resources. This zone would be managed in accordance with the management principles for IUCN Category VI. A number of commercial and recreational activities would be allowed in this zone subject to environmental approvals and existing regulations. Some fishing methods would not be permitted in this reserve under the proposed zoning framework for the North-west Marine Region. The overall management objective for this zone is to ensure the long-term protection of the reserve's biological diversity and other natural values, while allowing the ecologically sustainable use of its resources.

Table 5.1: Conservation features represented in the proposed Abrolhos (Wallaby extension) Commonwealth marine reserve

Feature	Name
Provincial bioregions	Central Western Transition
Meso-scale bioregions	Not applicable
Depth ranges within bioregions	**Central Western Transition**
	Continental Rise
	Abyssal Plain above Calcite Compensation Depth
Key ecological features	Wallaby Saddle
Biological seascapes	Not applicable
Seafloor features	Deep/hole/valley
	Plateau
	Saddle
	Slope

5.2 Proposed Carnarvon Canyon Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Carnarvon Canyon Commonwealth marine reserve covers an area of approximately 4832 square kilometres. It includes the entirety of the Carnarvon Canyon, a relatively small, single channel canyon that occurs on the slope between the Carnarvon Terrace and the deep abyss of the Cuvier Abyssal Plain. There has been limited research on the biology in this area and the role the canyon plays in this part of the North-west Marine Region. Generally canyon heads are believed to be sites of relatively higher productivity and the soft-bottom environment at the bases of canyons are likely to support species (i.e. holothurians, polychaetes and sea-pens) that are typical of the deep seafloor (Brewer et al. 2007).

The proposed marine reserve lies within a biogeographic faunal transition between tropical and temperate species.

Conservation values

- Seafloor and pelagic habitats and communities of the Central Western Transition provincial bioregion.

Existing uses

The Commonwealth-managed Western Tuna and Billfish Fishery operate in this area. Other activities in the area include petroleum exploration and shipping. Petroleum prospectivity has not been assessed.

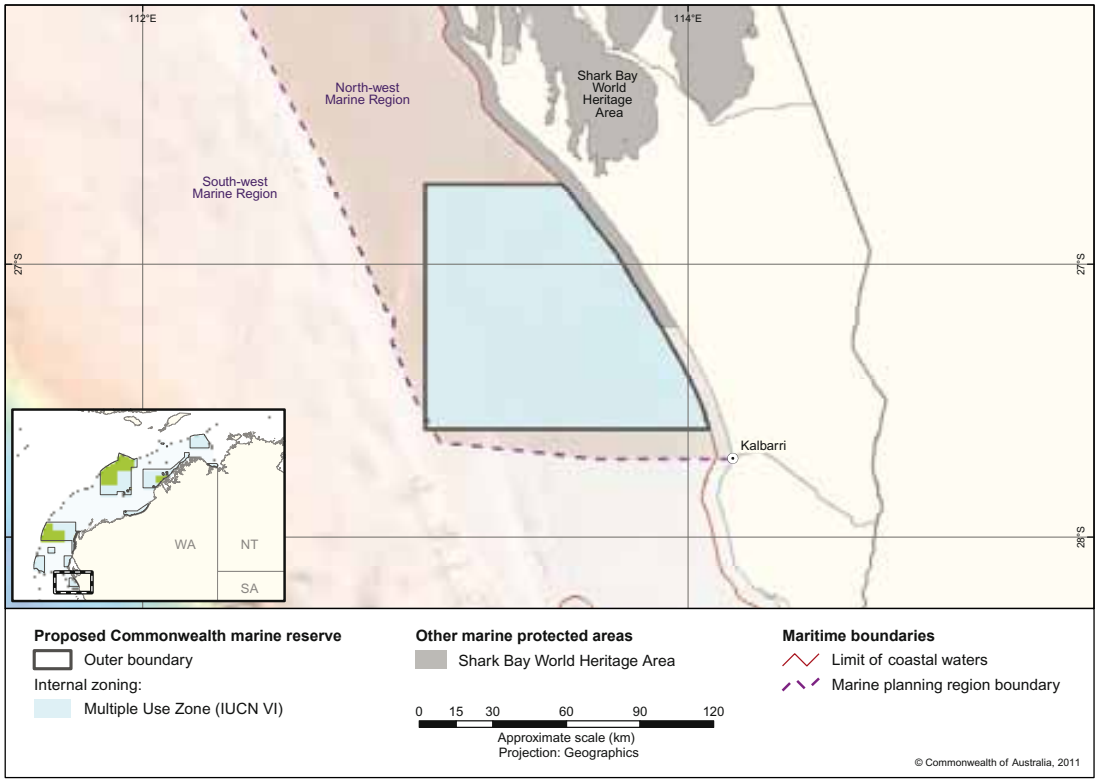
Proposed zoning arrangements and management principles

The proposed reserve is zoned for multiple use. This zone would be managed in accordance with the management principles for IUCN Category VI. A number of commercial and recreational activities would be allowed in this zone subject to environmental approvals and existing regulations. The activities permitted in this zone under the proposed management arrangements are shown in Table 3.5.

Table 5.2: Conservation features represented in the draft proposed Carnarvon Canyon Commonwealth marine reserve

Feature	Name
Provincial bioregions	Central Western Transition
Meso-scale bioregions	Not applicable
Depth ranges within bioregions	**Central Western Transition**
	Deep Continental Slope
	Continental rise
	Abyssal Plain above Calcite Compensation Depth
Key ecological features	None
Biological seascapes	Not applicable
Seafloor features	Canyon
	Continental rise
	Deep hole/valley
	Slope

5.3 Proposed Kalbarri Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Kalbarri Commonwealth marine reserve covers approximately 7955 square kilometres in the Commonwealth waters over the continental shelf off shore from Kalbarri. Topographic features of the proposed marine reserve include a deep hole and associated area of banks and shoals. These are of note because they occur at latitudes significantly south of banks and shoals elsewhere in the North-west Marine Region (Baker et al. 2008) and are likely to have different species assemblages.

The major surface current throughout the proposed marine reserve is the Leeuwin Current which is characterised as warm and low in nutrients. The Shark Bay Outflow and Capes Current are seasonal influences on the oceanography and hence ecology of this area which consists predominantly of temperate flora and fauna similar to that of the adjoining South-west Marine Region.

Humpback whales in both their northern and southern migrations traverse the proposed marine reserve, as do green and loggerhead turtles. The proposed reserve also includes breeding and foraging areas for the wedge tailed shearwater and is adjacent to coastal areas that are considered important breeding sites for the roseate tern.

Conservation values

- Ecosystems of the Central Western Shelf Province (including the Zutydorp meso-scale bioregion)
- Banks and shoals, (the most southerly example in the North-west Marine Region)
- Important breeding areas for wedge-tailed shearwaters
- Part of the migration pathway for humpback whales

Existing uses

The Nanda People's Native Title claim extends into Commonwealth waters and overlaps with this proposed reserve.

A number of important fisheries operate in this area, including the state-managed Western Rock Lobster, West Coast Demersal Scalefish, West Coast Demersal Gillnet and Demersal Longline; and the Commonwealth-managed Western Tuna and Billfish and Western Deepwater Trawl fisheries.

Recreational and charter fishing are also important, mainly in the state waters off Kalbarri.

Prospectivity for oil and gas is considered low and there are no current petroleum leases within the proposed reserve boundaries.

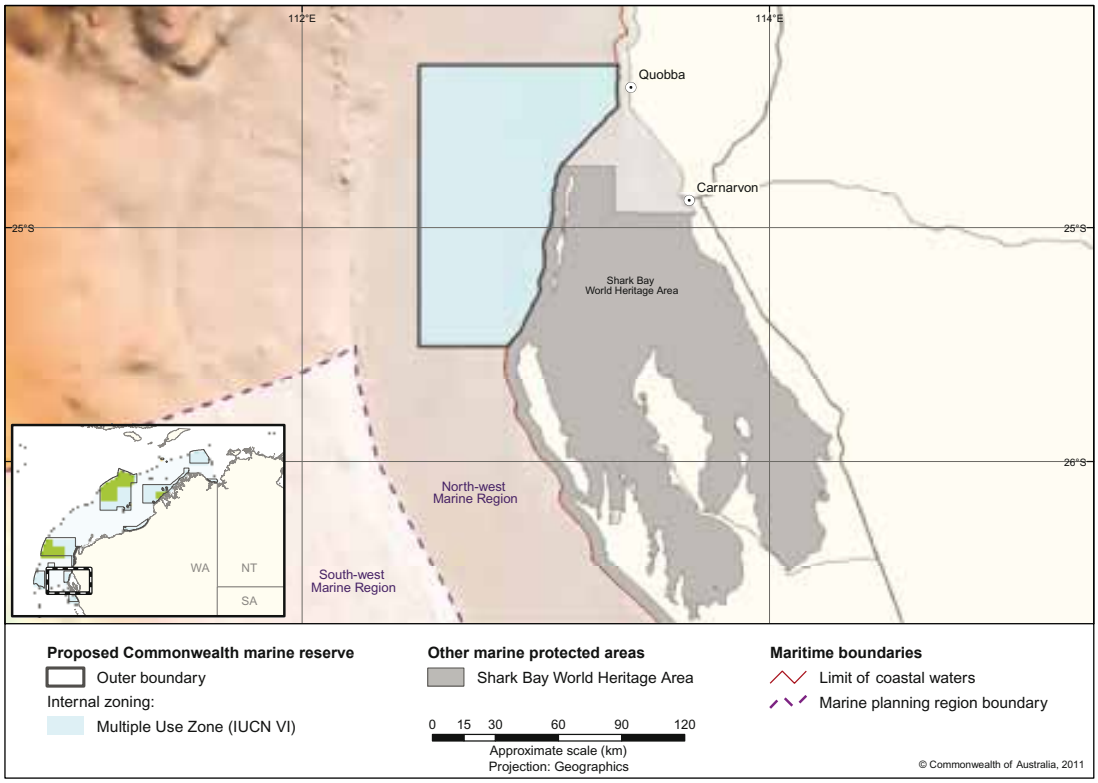
Proposed zoning arrangements and management principles

The proposed Kalbarri Commonwealth marine reserve is zoned for multiple use reflecting the level of existing uses within the proposed boundaries. The activities permitted in this zone under the proposed management arrangements and subject to any relevant environmental approvals, are shown in Table 3.5. This zone would be managed in accordance with the management principles for IUCN Category VI.

Table 5.3: Conservation features represented in the draft proposed Kalbarri Commonwealth marine reserve

Feature	Name
Provincial bioregions	Central Western Shelf Province
Meso-scale bioregions	Zuytdorp
Depth ranges within bioregions	**Central Western Shelf Province**
	Shallow Waters to Shallow Shelf Transition
	Deep Shelf
	Deep Shelf to Shelf Edge Transition
	Shallow Shelf
	Shallow Shelf to Deep Shelf Transition
	Shelf Edge
Key ecological features	None
Biological seascapes	Cluster 1
	Cluster 6
	Cluster 13
	Cluster 14
	Cluster 15
Seafloor features	Bank/shoals
	Deep hole/valley
	Shelf
	Slope
	Terrace

5.4 Proposed Shark Bay Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Shark Bay Commonwealth marine reserve is in Commonwealth waters adjacent to the Shark Bay World Heritage Area. It is approximately 8263 square kilometres and is located in relatively shallow waters on the shelf (15-200 metres). It is representative of the Central Western Transition provincial bioregion and the Central Western Shelf Province provincial bioregion; the latter generally demonstrates strong connectivity between biophysical and ecological processes occurring in state and Commonwealth waters.

The proposed reserve and adjacent coastal areas are important areas for shallow water snapper (*Pagrus auratus*) which has three distinct breeding populations, one in each inner gulf of Shark Bay and a third within the proposed marine reserve (Moran et al. 2003).

The proposed marine reserve includes waters used for the northern and southern migration of humpback whales and is adjacent to important resting areas in Shark Bay. Green turtles are also found within the proposed reserve as are loggerhead turtles, which in adjacent coastal areas have important nesting and internesting habitat. The Commonwealth waters in the area provide an important food source for wedge tailed shearwaters and fairy and roseate terns, which breed in coastal areas adjacent to the proposed reserve. The proposed reserve is also adjacent to coastal waters considered to be internationally significant for dugong.

Conservation values

- Representation of two provincial bioregions: the Central Western Shelf Province and the Central Western Transition. The proposed reserve also represents the northern end of the Zuytdorp meso-scale bioregion
- Important breeding and foraging areas for migratory seabirds
- Important for migrating humpback whales

Existing uses

The area is important for several fisheries, including the state-managed Western Rock Lobster, West Coast Deep Sea Crab, Shark Bay Snapper (Gascoyne Demersal Scalefish) fisheries, and the Commonwealth-managed Western Deepwater Trawl Fishery.

Recreational and charter fishing are important activities, but are mostly limited to state waters.

Petroleum prospectivity in the area is considered to be low with a small area in the north of the reserve rated as low to medium. There is one existing petroleum lease overlapping with the proposed reserve.

The Gnulli Native Title claim and the Malgana Shark Bay People's Native Title claim extend into Commonwealth waters in this area.

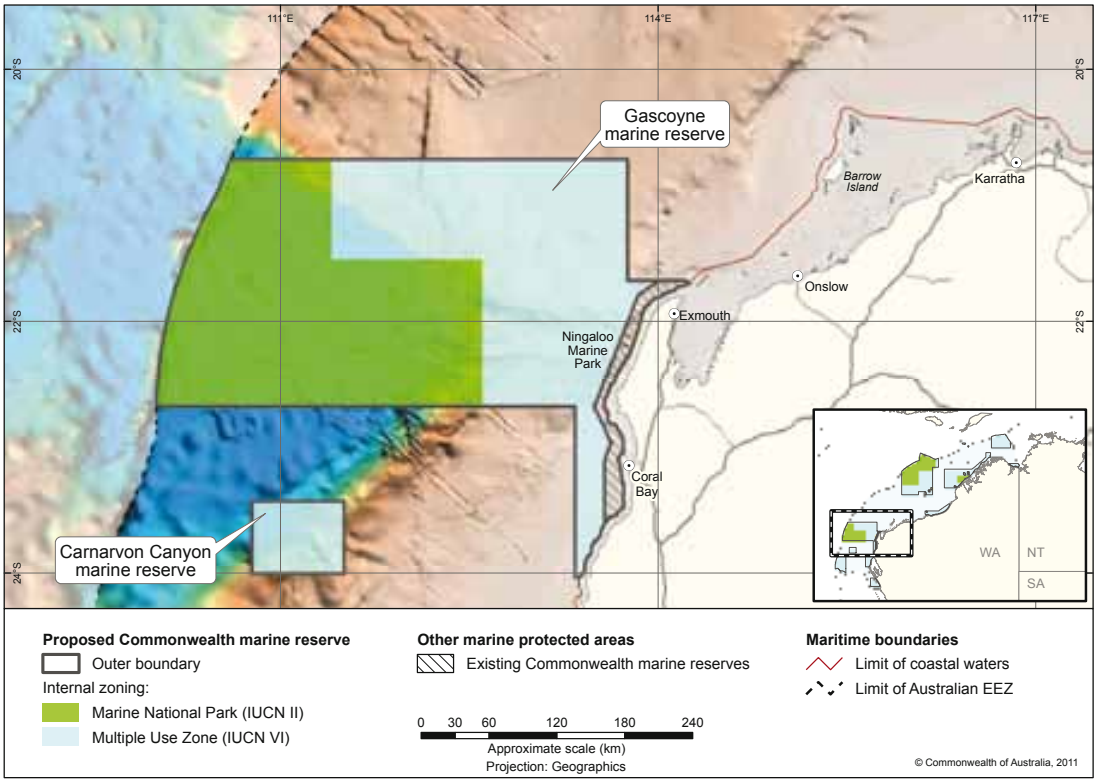
Proposed zoning arrangements and management principles

The proposed Shark Bay Commonwealth marine reserve is zoned for multiple use reflecting the existing level of activities. The activities permitted in this zone under the proposed management arrangements and subject to any relevant environmental approvals, are shown in Table 3.5. This zone would be managed in accordance with the management principles for IUCN Category VI.

Table 5.4: Conservation features represented in the draft proposed Shark Bay Commonwealth marine reserve

Feature	Name
Provincial bioregions	Central Western Shelf Province Central Western Transition
Meso-scale bioregions	Zuytdorp
Depth ranges within bioregions	**Central Western Shelf Province**
	Shallow Waters to Shallow Shelf Transition
	Deep Shelf
	Deep Shelf to Shelf Edge Transition
	Shallow Shelf
	Shallow Shelf to Deep Shelf Transition
	Shelf Edge
	Central Western Transition
	Shelf Edge to Shallow Upper Slope Transition
Key ecological features	None
Biological seascapes	Cluster 1 Cluster 6 Cluster 15
Seafloor features	Shelf Slope Terrace

5.5 Proposed Gascoyne Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Gascoyne Commonwealth marine reserve covers approximately 81 762 square kilometres, from just north of Cape Cuvier to the waters offshore of Exmouth and into deep waters of the region out to the limit of the exclusive economic zone. The proposed reserve abuts the existing Ningaloo Commonwealth Marine Park and, at the southern boundary, the Western Australian Ningaloo Marine Park. The deep waters of the proposed reserve are over the Cuvier Abyssal Plain which has an average depth of 5,070 metres.

The proposed marine reserve includes some of the most diverse slope habitat in the whole of Australia, specifically the continental slope between North West Cape and the Montebello Trough; which is home to more than 500 fish species, 76 of which are endemic. The canyons linking the Cuvier Abyssal Plain with the Cape Range Peninsula are incorporated within the proposed reserve and are unusual because their heads are so close to the coast.

The canyons, Exmouth Plateau and Commonwealth waters adjacent to Ningaloo Reef are believed to form a system that creates conditions for enhanced productivity resulting in seasonal aggregations of marine species including whale sharks, manta rays, humpback whales, sharks and other large predatory fish and seabirds. The canyons are also believed to support the productivity and species richness of Ningaloo Reef, which is the only extensive coral reef that fringes the west coast of a continent in the world.

Flatback and green turtles occur within the proposed marine reserve as do wedge tailed shearwaters. The proposed marine reserve is adjacent to Exmouth Gulf, which is considered to be a significant foraging and nursing area for dugong, an important nesting and internesting area for hawksbill and loggerhead turtles, a breeding area for roseate and fairy terns and a resting area for humpback whales.

Conservation values

- Five key ecological features:
  - Ancient coastline (localised enhanced productivity)
  - Canyons linking the Cuvier Abyssal Plain with the Cape Range Peninsula
  - Commonwealth waters adjacent to Ningaloo Reef
  - Continental slope demersal fish communities
  - Exmouth Plateau
- Seafloor habitats and communities of the Central Western Shelf Province, Central Western Shelf Transition, Central Western Transition, Northwest Province, Northwest Shelf Province and the Ningaloo, Zuytdorp and Pilbara (offshore) meso-scale bioregions.
- Important foraging area for migratory seabirds
- Adjacent to high intensity foraging areas for dugongs and whale sharks
- Important foraging area for hawksbill and flatback turtles, and adjacent to resting areas for humpback whales.

Existing uses

Recreational fishing and tourism are important, particularly around Ningaloo Reef. The area supports a number of commercial fisheries, including the Western Australian-managed North Coast Shark, West Coast Deep Sea Crab, Shark Bay Snapper (Gascoyne Demersal Scalefish), Pilbara Trap (North Coast Demersal) fisheries and the Commonwealth-managed Western Tuna and Billfish, North West Slope Trawl and Western Deepwater Trawl fisheries.

The proposed marine reserve overlaps with the Northern Carnarvon Basin which is an area of extensive petroleum exploration and production activity. Petroleum prospectivity in the area is considered low – medium with some areas of high prospectivity in the north of the proposed reserve.

The Gnulli Native Title claim extends into Commonwealth waters in this area.

Proposed zoning arrangements and management principles

The proposed Gascoyne Commonwealth marine reserve contains two zones. The activities permitted in these zones under the proposed management arrangements are shown in Table 3.5:

- A large Marine National Park Zone offshore in deeper waters which would be managed consistent with the management principles for IUCN Category II. This is approximately 42 395 square kilometres.
- A multiple use zone (approximately 39 367 square kilometres) over the continental shelf and adjacent to the existing Commonwealth Ningaloo Marine Park and, along the southern boundary, adjacent to the existing Western Australian Ningaloo Marine Park. A number of petroleum exploration leases overlap with this zone. Multiple use zoning would allow for petroleum exploration and development, subject to assessment and approval under the EPBC Act. This zone would be managed in accordance with the management principles for IUCN Category VI.

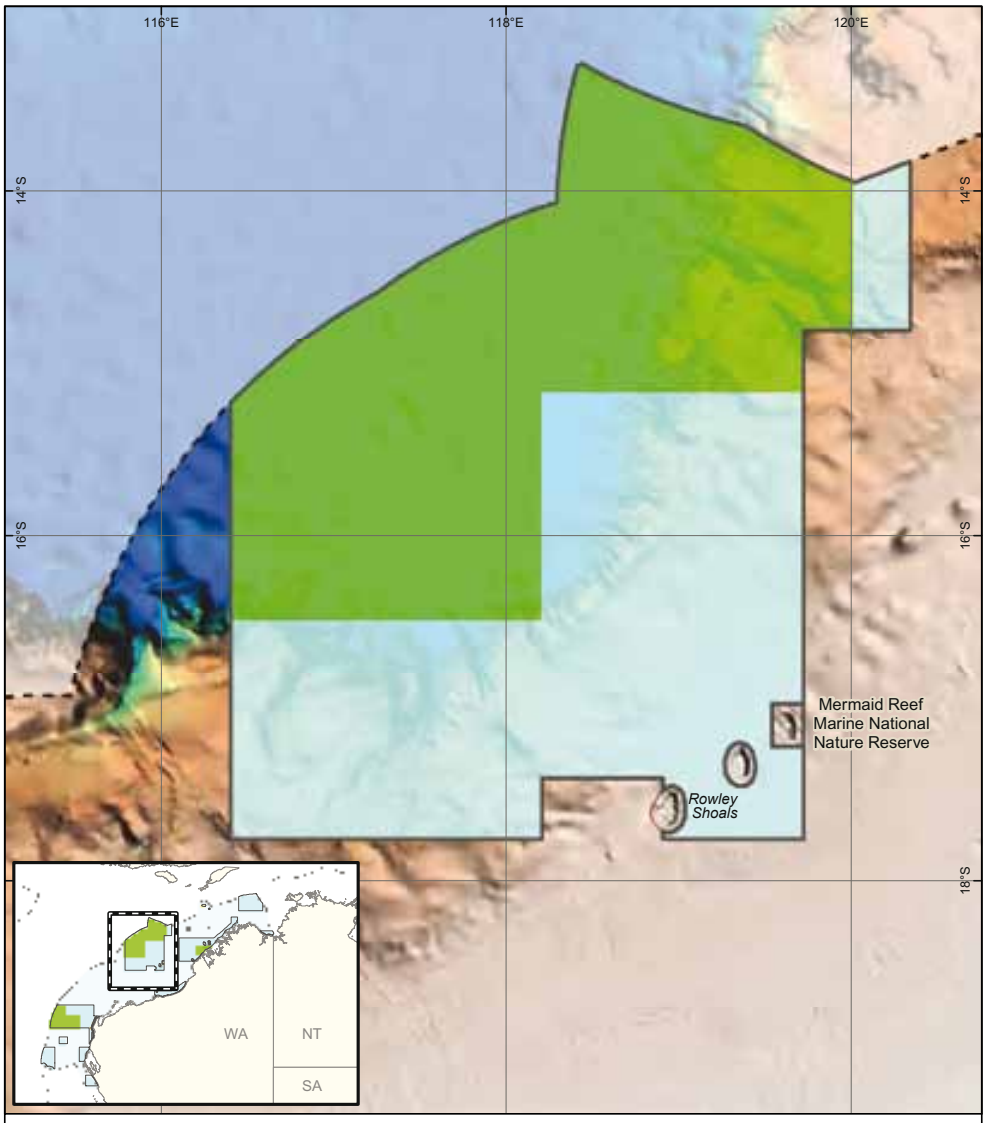
Table 5.5: Conservation features represented in the draft proposed Gascoyne Commonwealth marine reserve

Feature	Name
Provincial bioregions	Central Western Shelf Transition Central Western Transition Northwest Province
Meso-scale bioregions	Ningaloo Zuytdorp

Feature	Name
Depth ranges within bioregions	**Central Western Shelf Transition**
	Shallow waters to Shallow Shelf Transition
	Deep Shelf
	Deep Shelf to Shelf Edge Transition
	Shallow Shelf
	Shallow Shelf to Deep Shelf Transition
	Shelf Edge
	Central Western Transition
	Shelf Edge to Shallow Upper Slope Transition
	Shallow Upper Slope
	Shallow Upper Slope to Deep Upper Slope Transition
	Shallow Upper Slope
	Deep Upper Slope to Shallow Mid-Slope Transition
	Shallow Mid-Slope
	Deep Upper Slope
	Deep Mid-Slope
	Deep Continental Slope
	Continental Rise
	Abyssal Plain below Calcite Compensation Depth
	Abyssal Plain above Calcite Compensation Depth
	Northwest province
	Shelf Edge to Shallow Upper Slope Transition
	Shallow Upper Slope to Deep Upper Slope Transition
	Shallow Upper Slope
	Shallow Mid-Slope
	Deep Upper Slope to Shallow Mid-Slope Transition
	Deep Upper Slope
	Deep Mid-Slope
	Deep Continental Slope
	Continental Rise
	Abyssal Plain below Calcite Compensation Depth
	Abyssal Plain above Calcite Compensation Depth

Feature	Name
Key ecological features	Ancient coastline at 125m depth contour Commonwealth waters adjacent to Ningaloo Reef Canyons linking the Cuvier Abyssal Plain with the Cape Range Peninsula Continental slope demersal fish communities Exmouth Plateau
Biological seascapes	Cluster 1 Cluster 4 Cluster 5 Cluster 7 Cluster 10 Cluster 16 Cluster 17
Seafloor features	Abyssal-plain/deep ocean floor Canyon Continental rise Deep/hole/valley Knoll/abyssal hills Plateau Ridge Shelf Slope Terrace Trench/trough

5.6 Proposed Pilbara Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Pilbara Commonwealth marine reserve covers approximately 145 833 square kilometres and is the largest reserve proposed in the region. The proposed reserve incorporates the existing Mermaid Reef Marine National Nature Reserve and Commonwealth waters surrounding Rowley Shoals (a key ecological feature) as well as parts of the Rowley Terrace, Scott Plateau and Argo Abyssal Plain. The Rowley Shoals and the waters surrounding them are a hotspot for biodiversity. The coral reefs of the Rowley Shoals support a diverse marine fauna and may play a role in the maintenance of gene flow among the north-west Australian coral reefs. The steep changes in slope around the reefs attract a range of migratory pelagic species including cetaceans, tunas, billfish and sharks. Mermaid Reef supports a number of shark species particularly large deep water sharks such as grey reef sharks and silvertip whaler sharks.

The proposed reserve boundaries include examples of key seafloor features such as aprons/fans and the canyons on the slope between the Argo Abyssal Plain, Rowley Terrace and Scott Plateau. Scott Plateau may be a breeding site for sperm and beaked whales and is a significant seafloor feature in this area. It is fringed by numerous spurs and valleys and is separated from the Rowley Terrace by a number of major canyons including the Bowers and Oates canyons. These canyons are believed to support fish aggregations that, in turn, attract larger predatory fish, sharks and cetaceans.

Conservation values

- Two key ecological features:
  - Mermaid Reef and Commonwealth waters surrounding Rowley Shoals (enhanced productivity, feeding and breeding aggregations, high biodiversity)
  - The canyons linking the Argo Abyssal Plain with the Scott Plateau (enhanced productivity, feeding aggregations, unique seafloor feature)
- Seafloor and pelagic environments associated with the Northwest Transition and the Timor Province provincial bioregions
- Important foraging areas for migratory seabirds
- Important foraging areas for loggerhead turtles
- Important areas for sharks which are found in abundance around the Rowley Shoals compared to elsewhere in the region.

Existing uses

The Western Australian-managed North Coast Shark fishery and the Commonwealth-managed North West Slope Trawl fishery both operate in the area.

The area around Rowley Shoals is of importance to recreational and charter fishing and tourism; it is well-known as a premium diving location.

The petroleum prospectivity is rated as low to medium or medium with a number of acreage releases overlapping.

Proposed zoning arrangements and management principles

The proposed Pilbara Commonwealth marine reserve contains two zones. The activities permitted in these zones under the proposed management arrangements are shown in Table 3.5.

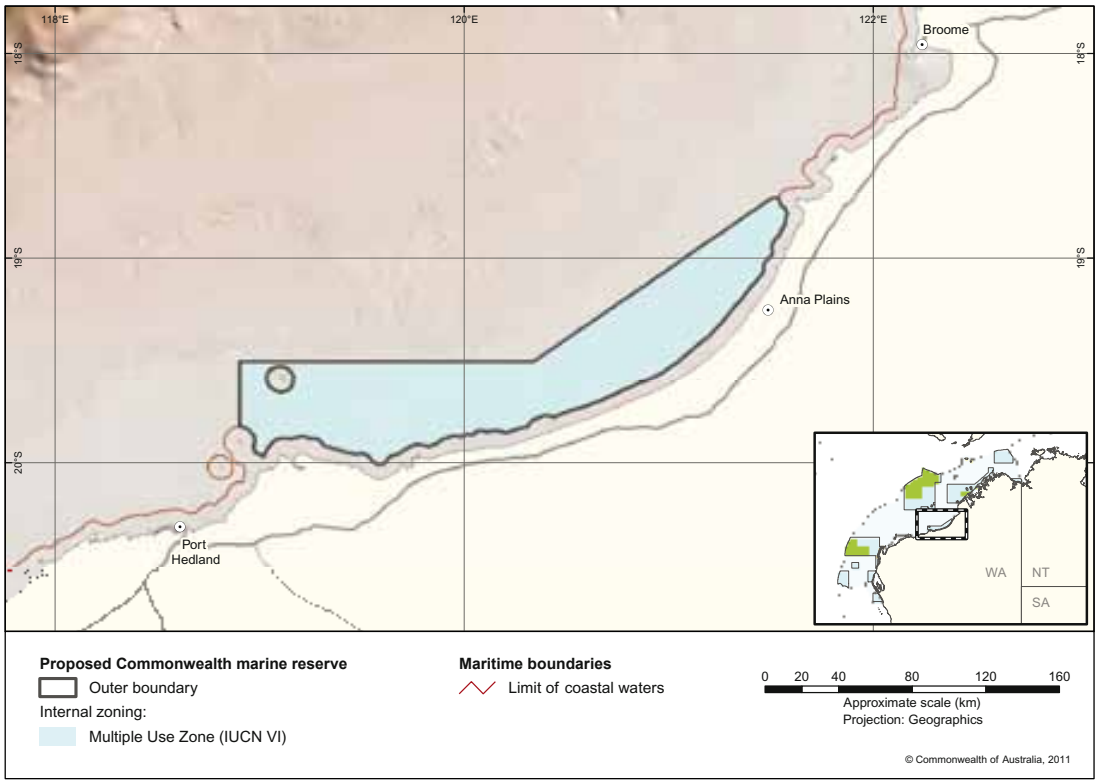
- A Marine National Park Zone is proposed for the outer area of the reserve. This is the largest area of high protection in the proposed marine reserve network at approximately 73 228 square kilometres. This provides protection for the canyons linking the Argo Abyssal Plain with the Scott Plateau – a key ecological feature for the region. No commercial activities or extractive recreational activities would be permitted in this area. This zone would be managed consistent with the management principles for IUCN Category II.
- The remainder of the reserve, predominantly on the slope, has been zoned multiple use (approximately 72 605 square kilometres). A number of commercial and recreational activities would be allowed in this zone subject to environmental approvals and relevant existing regulations. Some activities would not be permitted because of the risk they pose to its biological diversity. This zone provides protection to the ecosystems of the Northwest Transition, including an extensive amount of terrace and a canyon system which links this terrace with a continental rise. A number of acreage releases overlap with this zone. The use of multiple use zoning would allow for petroleum exploration and development, subject to assessment and approval under the EPBC Act. This zone would be managed consistent with the management principles for IUCN Category VI.

Table 5.6: Conservation features represented in the draft proposed Pilbara Commonwealth marine reserve

Feature	Name
Provincial bioregions	Northwest Transition
	Timor Province
Meso-scale bioregions	Not applicable
Depth ranges within bioregions	**Northwest Transition**
	Shelf Edge to Shallow Upper Slope Transition
	Shallow Upper Slope to Deep Upper Slope Transition
	Shallow Upper Slope
	Shallow Mid-Slope
	Deep Upper Slope to Shallow Mid-slope Transition
	Deep Upper Slope
	Deep Mid-Slope
	Deep Continental Slope
	Continental Rise
	Abyssal Plain below Calcite Compensation Depth
	Abyssal Plain above Calcite Compensation Depth
	Timor Province
	Deep Mid-Slope
	Deep Continental Slope
	Continental Rise
	Abyssal Plain below Calcite Compensation Depth
	Abyssal Plain above Calcite Compensation Depth
Key ecological features	Canyons linking the Argo Abyssal Plain with the Scott Plateau
	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals

Feature	Name
Biological seascapes	Cluster 1
	Cluster 2
	Cluster 3
	Cluster 4
	Cluster 5
	Cluster 6
	Cluster 7
	Cluster 8
	Cluster 9
	Cluster 10
	Cluster 14
	Cluster 15
	Cluster 16
	Cluster 17
	Cluster 18
Seafloor features	Abyssal-plain/deep ocean floor
	Canyon
	Apron/fan
	Continental rise
	Deep hole/valley
	Knoll/abyssal-hills
	Plateau
	Slope
	Terrace

5.7 Proposed Eighty Mile Beach Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Eighty Mile Beach Comonwealth marine reserve covers approximately 12 105 square kilometres of the Commonwealth marine environment. It covers part of the continental shelf, adjacent to the entire length of Eighty Mile Beach, from Cape Bossut in the north to Commonwealth waters adjacent to Bedout Island. The waters off Eighty Mile Beach are important for a number of species including dugongs, humpback whales, sawfish and migratory seabirds. Eighty Mile Beach is a Ramsar wetland and is recognised as one of the three most important areas for migratory shorebirds in Australia. It is estimated that more than 500,000 shorebirds use Eighty Mile Beach as a migration terminus each year, while another 150,000-200,000 use the site as a migration stop-over site on their way to south-western, southern and south-eastern Australian coasts. In terms of total numbers, the site is one of the most important non-breeding and migratory stop-over areas in the East Asian – Australasian Flyway for use by migrant shorebirds (WA DEC, 2003). The waters of the proposed marine reserve provide a vital food source for many of these species.

The proposed reserve is adjacent to the proposed Western Australian Eighty Mile Beach Marine Park.

Conservation values

- Seafloor habitats and communities of the Canning, Eighty Mile Beach, Northwest Shelf and Pilbara (nearshore and offshore) meso-scale bioregions of the Northwest Shelf Province
- Important migration route for the humpback whale
- Important foraging areas for dugong
- Important foraging areas for sawfish
- Important foraging areas for migratory seabirds
- Important nesting areas for flatback turtles.

Existing uses

This area is important for recreational and charter fishing but this is generally confined to state waters. The area is critical for the pearling industry and provides about two-thirds of the pearl shell feed stock to the industry. A number of commercial fisheries are also active in the area: the Western Australian-managed Pilbara Trap (North Coast Demersal Fishery), the Northern Demersal Scalefish Fishery and the North Coast Shark (Northern Shark Fishery) as well as the Commonwealth-managed North West Slope Trawl Fishery.

Petroleum prospectivity within the proposed boundaries is considered to be low to medium. The proposed reserve abuts a number of petroleum leases but overlaps with none.

The Ngarla and Ngarla 2 (Determination Area A) Native Title determination extends into Commonwealth waters in this area.

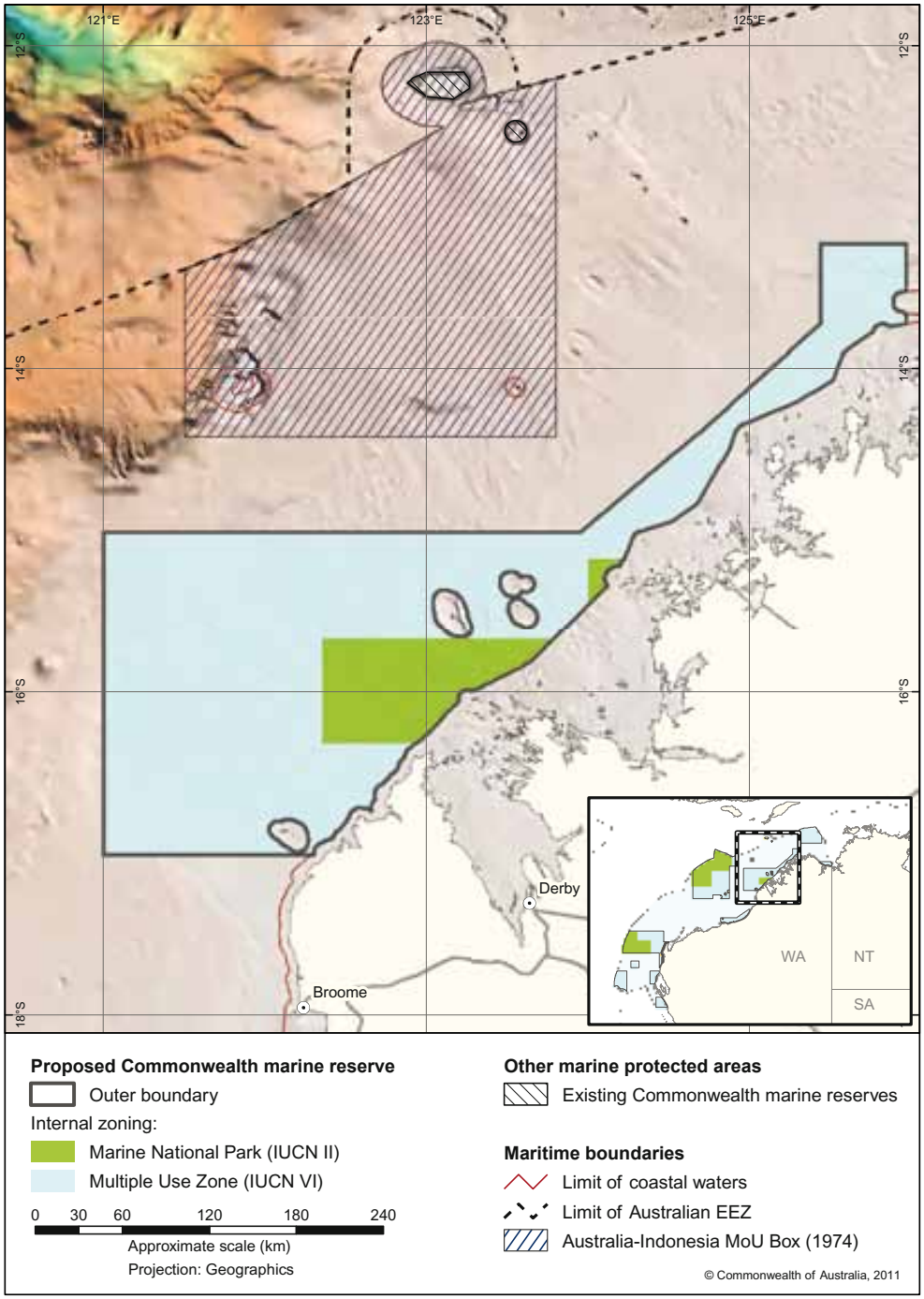
Proposed zoning arrangements and management principles

The proposed Eighty Mile Beach Commonwealth marine reserve is a multiple use zone reflecting the existing level of activities. The activities permitted in this zone under the proposed management arrangements are shown in Table 3.5. The proposed reserve is not expected to affect the activities of the pearling industry. This zone would be managed in accordance with the management principles for IUCN Category VI.

Table 5.7: Conservation features represented in the draft proposed Eighty Mile Beach Commonwealth marine reserve

Feature	Name
Provincial bioregions	Northwest Shelf
Meso-scale bioregions	Canning
	Eighty Mile Beach
	Northwest Shelf
	Pilbara (offshore)
	Pilbara (near-shore)
Depth ranges within bioregions	**Northwest Shelf Province**
	Shallow Waters
	Shallow Waters to Shallow Shelf Transition
Key ecological features	None
Biological seascapes	Cluster 3
	Cluster 8
	Cluster 14
	Cluster 15
	Cluster 19
Seafloor features	Banks/shoals
	Shelf
	Terrace

5.8 Proposed Kimberley Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Kimberley Commonwealth marine reserve covers approximately 62 791 square kilometres of the Commonwealth marine environment from the Lacepede Islands in the north to the Holothuria Banks offshore from Cape Bougainville. The waters offshore from the Kimberley coastline play host to a rich and diverse marine life and many protected marine species use these areas as nursery and feeding grounds. The Kimberley is particularly important for the Western Australian population of humpback whales and Australian snubfin dolphins. Thousands of humpback whales migrate through the region each year and give birth in the tropical waters off the Kimberley coast, especially around Camden Sound.

The rugged coastline, numerous islands, submerged cliffs and banks and coral reefs along with the surrounding Commonwealth waters support a high diversity of tropical species including marine turtles, dugongs and seabirds. For example, the waters around the Lacepede Islands are crucial for migrating marine turtles as they move between nesting and feeding areas. These Islands provide critical nesting habitat for marine turtles and are the site of the largest green turtle rookery in Western Australia. The Lacepede Islands also support the largest brown booby rookery in the state and the Commonwealth waters in this area play an important role for feeding seabirds. Many of the islands along the Kimberley coastline have extensive reef formations that support a high abundance and diversity of coral and associated species. The Kimberley meso-scale bioregion, in particular has been reported to be one of the most diverse coral areas in Western Australia (WA DEC, 2009). There is important connectivity between the biophysical and ecological processes occurring in state and Commonwealth waters in this area.

Conservation values

- Two key ecological features:
  - Ancient coastline (unique seafloor feature, enhanced productivity)
  - Continental slope demersal fish communities (high species diversity and endemism)
- Examples of the communities and ecosystems of the Northwest Shelf province, Northwest Shelf Transition and Timor Province provincial bioregions as well as the Kimberley, Canning, Northwest Shelf and Oceanic Shoals meso-scale bioregions
- Important foraging areas for:
  - Dugongs
  - Dolphins (Indo-Pacific humpback, Indo-Pacific bottlenose and Australian snubfin)
  - Migratory seabirds
  - Marine turtles (green, olive ridley, flatback)
- Important migration pathways for humpback whales
- Adjacent to important foraging and pupping areas for sawfish and important nesting sites for green turtles.

Existing uses

Recreational and charter fishing are important activities particularly in state waters and around the many islands along the Kimberley coastline. A number of fisheries operate within the boundaries of the proposed reserve: Western Australian-managed Northern Shark Fishery, and the Northern Demersal Scalefish Fishery as well as the Commonwealth-managed North West Slope Trawl Fishery. The Western Australian- managed Kimberley Prawn Fishery operates primarily in state waters and displacement as a result of the proposed reserve is expected to be minimal. The pearling industry is very significant in the Kimberley but the majority of its activities are in state waters.

Petroleum prospectivity is considered to be low to medium or low to high with a minor overlap with an area considered to have high prospectivity. Petroleum exploration, particularly in the Roebuck and Browse Basins, is a major activity in the area.

The Bardi Jawi, Dambimangari, and the Uunguu Native Title determinations extend into Commonwealth waters in the area. The Mayala and Nyul-Nyul Native Title claims also extend into Commonwealth waters in the area.

Proposed zoning arrangements and management principles

The proposed Kimberley Commonwealth marine reserve contains two types of zones. The activities permitted in these zones under the proposed management arrangements are shown in Table 3.5.

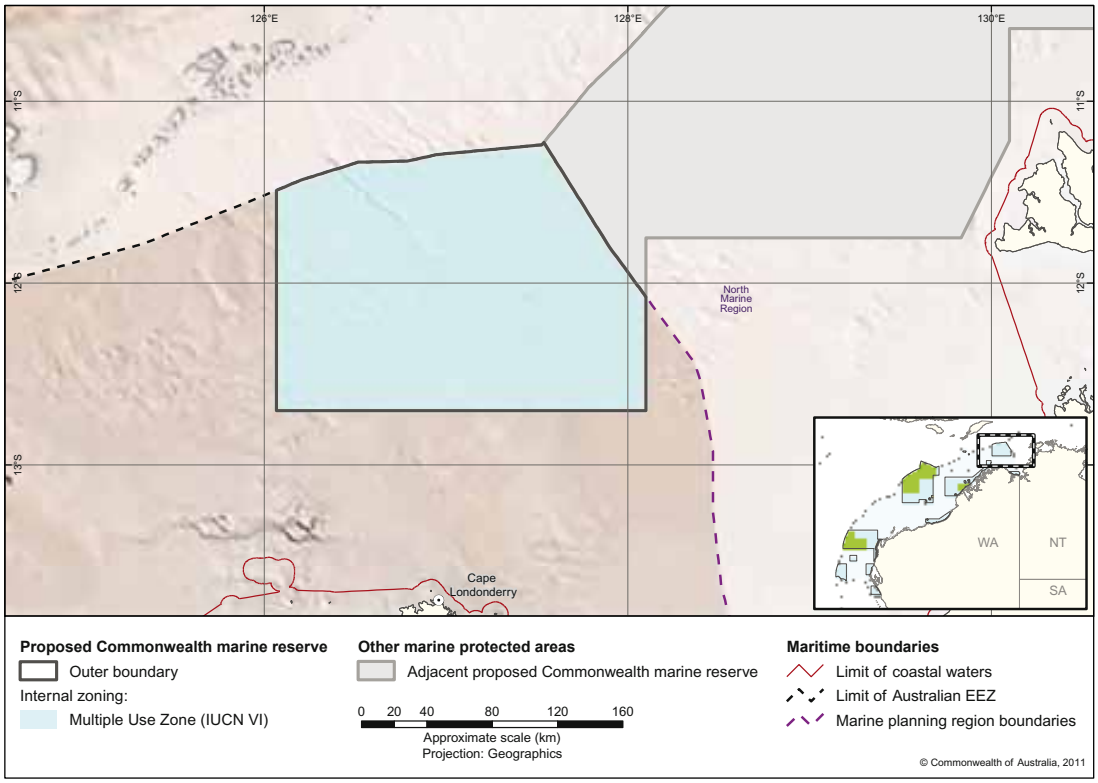
- A Marine National Park Zone is proposed for two areas within the reserve (total area is approximately 7905 square kilometres). The larger marine national park zone in the southern part of the proposed reserve is approximately 7 555 square kilometres in size and seeks to provide a high level of protection to areas on the shelf in the Kimberley, an area of importance to a number of species including green turtle, green sawfish, humpback whales and a number of dolphin species. It is predominantly an area of terrace that includes banks and shoals, deep holes and valleys and plateau along with the shelf. The second smaller Marine National Park Zone (approximately 350 square kilometres in size) is adjacent to the proposed Western Australian Camden Sound Marine Park. No commercial activities and no extractive recreational activities would be permitted in these areas. These zones would be managed consistent with the management principles for IUCN Category II.
- The rest of the reserve has been zoned for multiple use (approximately 54 886 square kilometres). A number of commercial and recreational activities would be allowed in this zone subject to environmental approvals and relevant existing regulations. A number of petroleum exploration leases overlap with this zone. The use of multiple use zoning allows for petroleum exploration and development, subject to assessment and approval under the EPBC Act. This zone would be managed consistent with the management principles for IUCN Category VI.

Table 5.8: Conservation features represented in the draft proposed Kimberley Commonwealth marine reserve

Feature	Name
Provincial bioregions	Northwest Shelf Province
	Northwest Shelf Transition
	Timor Province
Meso-scale bioregions	Kimberley
	Canning
	Northwest Shelf
	Oceanic Shoals
Depth ranges within bioregions	**Northwest Shelf Province**
	Shallow Waters
	Shallow Waters to Shallow Shelf Transition
	Deep Shelf
	Deep Shelf to Shelf Edge
	Northwest Shelf Transition
	Shallow Waters
	Shallow Waters to Shallow Shelf Transition
	Deep Shelf
	Deep Shelf to Shelf Edge Transition
	Shallow Shelf
	Shallow Shelf to Deep Shelf Transition
	Timor Province
	Shallow Upper Slope
	Shallow Upper Slope to Shallow Mid-Slope
	Shelf Edge to Shallow Upper Slope Transition
Key ecological features	Ancient coastline at 125m depth
	Continental slope demersal fish communities

Feature	Name
Biological seascapes	Cluster 1
	Cluster 2
	Cluster 3
	Cluster 4
	Cluster 5
	Cluster 6
	Cluster 7
	Cluster 9
	Cluster 10
	Cluster 11
	Cluster 12
	Cluster 15
	Cluster 16
	Cluster 17
	Cluster 18
	Cluster 20
Seafloor features	Banks/shoals
	Deep/hole/valley
	Pinnacle
	Plateau
	Shelf
	Slope
	Terrace

5.9 Proposed Oceanic Shoals Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Oceanic Shoals Commonwealth marine reserve covers approximately 31 362 square kilometres of the Commonwealth marine environment far offshore from Wyndham to the edge of the North-west Marine Region. The proposed marine reserve extends into the North Marine Region and represents a significant area of the Bonaparte Basin. It includes protection for the carbonate banks of the Joseph Bonaparte Gulf and the pinnacles of the Bonaparte Basin, both of which are key ecological features (that include hard and soft corals, sponges, aggregations of demersal fish) and important feeding sites for marine turtles. The carbonate banks and shoals are sites of enhanced biological productivity and support many tropical reef species. They consist of a hard substrate with flat tops and steep sides that rise from 150 -300 metres (Baker *et al*, 2008). The banks are separated from each other by narrow channels that generally occupy less than 10 square kilometres. These channels are known foraging grounds for flatback and loggerhead turtles. The Joseph Bonaparte Gulf supports a genetically distinct population of flatback turtles.

Conservation values

- Two key ecological features:
  - Carbonate banks in the Joseph Bonaparte Gulf (unique seafloor feature, enhanced productivity, high biodiversity)
  - Limestone pinnacles in the Bonaparte Basin (unique seafloor feature, enhanced productivity)
- Examples of the communities and ecosystems of the Northwest Shelf Transition provincial bioregion including the Oceanic Shoals meso-scale bioregion
- Important foraging areas for:
  - Marine turtles.

Existing uses

The area supports a number of commercial fisheries: the Western Australian-managed Northern Shark Fishery (Joint Authority Northern Shark), and the Northern Demersal Scalefish Fishery. Petroleum exploration and production is also a major activity in the area. Petroleum prospectivity is considered to be medium to high and high.

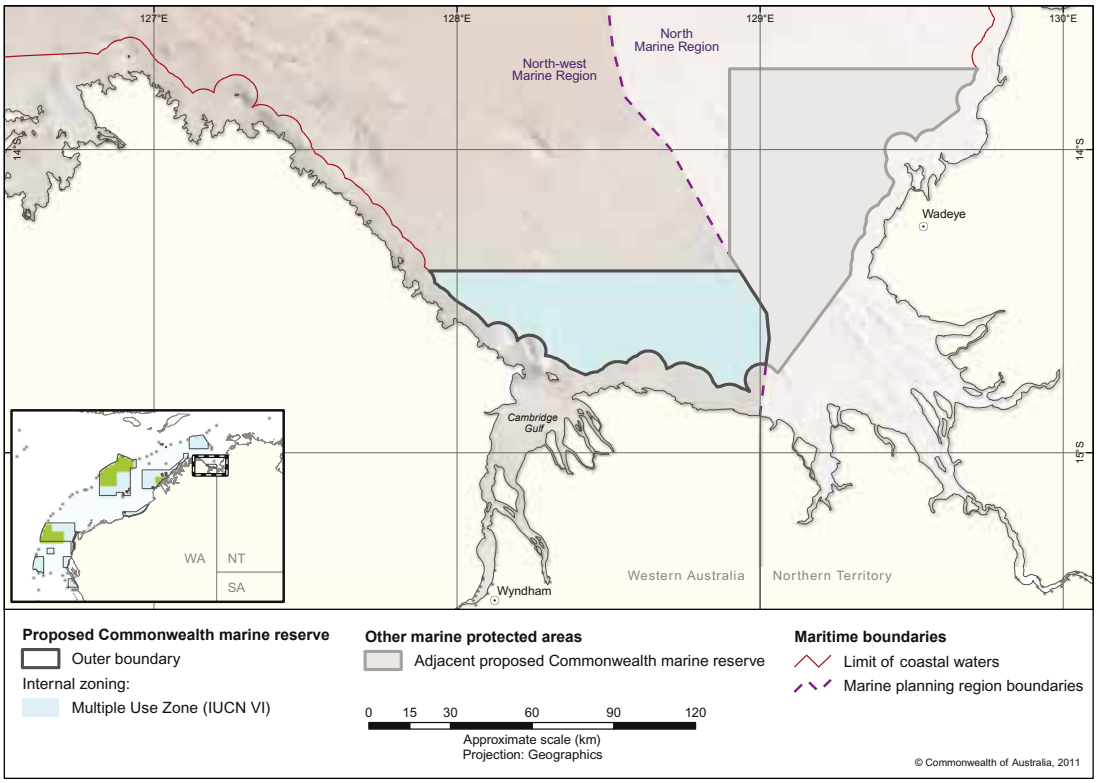
Proposed zoning arrangements and management principles

The proposed Oceanic Shoals Commonwealth marine reserve is a multiple use zone reflecting the existing level of activities. A number of commercial and recreational activities would be allowed in this zone subject to environmental approvals and relevant existing regulations. Some activities would not be permitted because of the risk they pose to its biological diversity. A number of petroleum exploration leases overlap with this zone. The use of multiple use zoning allows for petroleum exploration and development, subject to assessment and approval under the EPBC Act. This zone would be managed consistent with the management principles for IUCN Category VI.

Table 5.9: Conservation features represented in the draft proposed Oceanic Shoals Commonwealth marine reserve

Feature	Name
Provincial bioregions	Northwest Shelf Transition
Meso-scale bioregions	Oceanic Shoals
Depth ranges within bioregions	**Northwest Shelf Transition**
	Shallow Waters to Shallow Shelf Transition
	Deep Shelf
	Deep Shelf to Shelf Edge Transition
	Shallow Shelf
	Shallow Shelf to Deep Shelf Transition
	Shelf Edge
Key ecological features	Carbonate banks of the Joseph Bonaparte Gulf
	Pinnacles of the Bonaparte Basin
Biological seascapes	Cluster 2
	Cluster 4
	Cluster 7
	Cluster 12
	Cluster 15
	Cluster 18
Seafloor features	Banks/shoals
	Basin
	Deep/hole/valley
	Pinnacle
	Reef
	Sill
	Terrace

5.10 Proposed Joseph Bonaparte Gulf Commonwealth marine reserve



Biophysical, ecological and conservation values

The proposed Joseph Bonaparte Gulf Commonwealth marine reserve covers approximately 3385 square kilometres of the Commonwealth marine environment offshore and west of Cambridge Gulf to the edge of the North-west Marine Region. The reserve extends into the North Marine Region. The proposed reserve is in relatively shallow waters on the shelf and includes representation of tidal sandwaves and banks; the only tidal sandwaves and banks found in the North-west Marine Region. The different sediments on the shelf in this area indicate a seabed environment not found elsewhere in the region. These muddy substrates support gorgonians (sea fans), sponges, ascidians (sea squirts) and bryozoans, also known as sea mats or sea moss. These demersal (bottom-dwelling) communities are believed to have a relatively high biomass with reports of very large catches of some crab species (cornflake or swimming crabs), perhaps reflecting spawning aggregations in this area (Brewer *et al*, 2007). Dugongs feed on seagrass meadows in the coastal waters of this area.

Conservation values

- One key ecological feature:
  - Carbonate banks of the Joseph Bonaparte Gulf (enhanced productivity, high biodiversity, and unique seafloor feature)
- Examples of the communities and ecosystems of the Northwest Shelf Transition, provincial bioregion as well as the Bonaparte Gulf and Cambridge-Bonaparte meso-scale bioregions
- Important foraging areas for:
  - Marine turtles
  - Australian snubfin dolphins.

Existing uses

The area supports a number of commercial fisheries including: the Western Australian-managed Northern Shark Fishery (Joint Authority Northern Shark); and the Commonwealth-managed Northern Prawn Fishery. Petroleum exploration is a key activity in the area which is considered to be highly prospective. There is some recreational and charter fishing in the area, mostly within state waters.

The Balanggarra Native Title claim extends into Commonwealth waters in this area.

Proposed Zoning arrangements and management principles

The proposed Joseph Bonaparte Gulf Commonwealth marine reserve is a multiple use zone reflecting the existing level of activities. A number of commercial and recreational activities would be allowed in this zone subject to environmental approvals and relevant existing regulations. Some activities would not be permitted because of the risk they pose to its biological diversity. A number of petroleum exploration leases overlap with this zone. The use of multiple use zoning allows for petroleum exploration and development, subject to assessment and approval under the EPBC Act. This zone would be managed consistent with the management principles for IUCN Category VI.

Table 5.10: Conservation features represented in the draft proposed Joseph Bonaparte Gulf Commonwealth marine reserve

Feature	Name
Provincial bioregions	Northwest Shelf Transition
Meso-scale bioregions	Cambridge-Bonaparte
	Bonaparte Gulf
Depth ranges within bioregions	**Northwest Shelf Transition**
	Shallow Waters
	Shallow Waters to Shallow Shelf Transition
Key ecological features	Carbonate banks of the Joseph Bonaparte Gulf
Biological seascapes	Cluster 8
	Cluster 11
	Cluster 20
Seafloor features	Deep/hole/valley
	Shelf
	Tidal-sandwave/sand-bank

ACRONYMS AND ABBREVIATIONS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ACMA	Australian Communications and Media Authority
AFAs	Areas for Further Assessment
AFMA	Australian Fisheries Management Authority
AMSA	Australian Maritime Safety Authority
CAR	Comprehensiveness, Adequacy and Representativeness
CERF	Commonwealth Environment Research Facilities
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DOF or WA DOF	Western Australian Department of Fisheries
DRET	Department of Resources, Energy and Tourism
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EEZ	Exclusive Economic Zone
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GVP	Gross Value of Production
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IUCN	International Union for the Conservation of Nature
KEF	Key Ecological Feature
MB	Meso-scale Bioregion
NRSMPA	National Representative System of Marine Protected Areas
PB	Provincial Bioregion
PPA	Pearl Producers Association
WA DEC	Western Australian Department of Environment and Conservation

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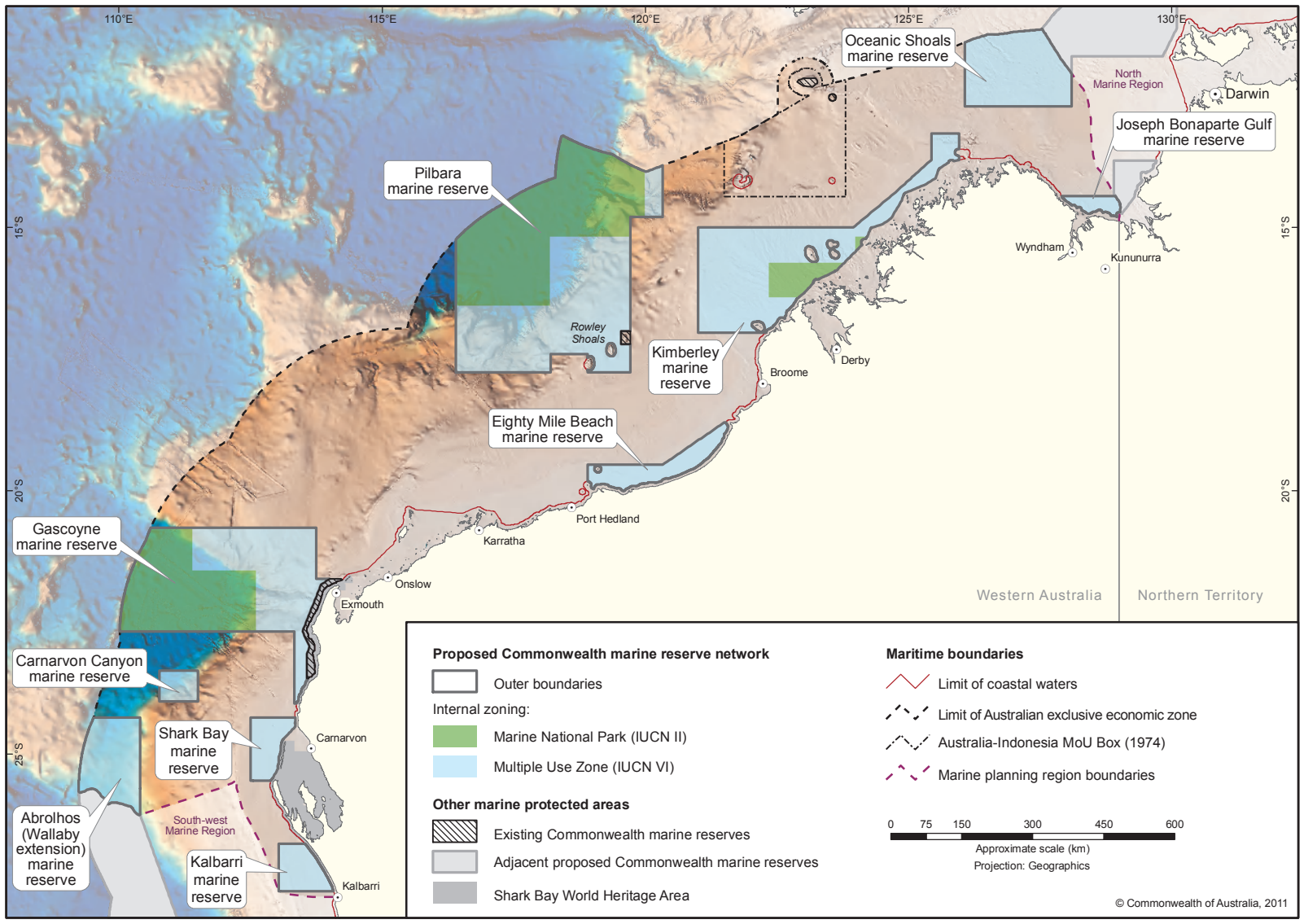
110°E
115°E
120°E
125°E
130°E
15°S
20°S
25°S
Oceanic Shoals marine reserve
North Marine Region
Darwin
Joseph Bonaparte Gulf marine reserve
Pilbara marine reserve
Wyndham
Kununurra
Rowley Shoals
Kimberley marine reserve
Broome
Derby
Eighty Mile Beach marine reserve
Port Hedland
Karratha
Gascoyne marine reserve
Onslow
Exmouth
Carnarvon Canyon marine reserve
Shark Bay marine reserve
Carnarvon
South-west Marine Region
Abrolhos (Wallaby extension) marine reserve
Kalbarri marine reserve
Kalbarri
Western Australia
Northern Territory
Proposed Commonwealth marine reserve network
Outer boundaries
Internal zoning:
Marine National Park (IUCN II)
Multiple Use Zone (IUCN VI)
Other marine protected areas
Existing Commonwealth marine reserves
Adjacent proposed Commonwealth marine reserves
Shark Bay World Heritage Area
Maritime boundaries
Limit of coastal waters
Limit of Australian exclusive economic zone
Australia-Indonesia MoU Box (1974)
Marine planning region boundaries
0 75 150 300 450 600
Approximate scale (km)
Projection: Geographics
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