Kimberly Supply Chain Cluster EIA

Marine Flora and Fauna

Crestlink Pty Ltd

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Executive summary

In 2016, Crestlink Pty Ltd (formerly Kimberley Technology Solutions Pty Ltd) proposed the construction and operation of the Cockatoo Island Multi-User Supply Base in Western Australia. The project aims to upgrade and develop infrastructure on Cockatoo Island, including an airfield, a wharf, an aftermarket subsea workshop, and other related support facilities.

After a period of inactivity, the project is now progressing. This report, Revision 2 of the initial 2017 technical study, has been updated to support the State and Commonwealth approvals processes. It includes an updated desktop assessment of marine fauna and a likelihood of occurrence assessment within the Development Envelope (DE) and a 5 km buffer study area. The report also incorporates findings from 2017 field surveys.

Desktop Assessment

The desktop assessment identified potentially occurring significant fauna species using publicly available databases, including the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) and the Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Fauna databases. The assessment focused specifically on species listed under the Environmental Protection Biodiversity Conservation Act (EPBC Act) and the states Biodiversity Conservation Act (BC Act).

The likelihood of occurrence assessment was based on information gathered from the desktop assessment, the known species' biology, an assessment of the habitat requirements, and the quality and availability of suitable habitat that were observed during field surveys.

Six listed species were assessed as likely to occur within the study area including:

- Australian humpback dolphin (listed Cetacean, Migratory under the EPBC Act and Priority 4 Migratory under the BC act)
- Indian ocean bottlenose dolphin (listed Cetacean under the EPBC Act and Migratory under the BC act)
- Flatback turtle (Vulnerable, Marine Migratory under the EPBC Act and Migratory under the BC Act)
- Green turtle (Vulnerable, Marine Migratory under the EPBC Act and Migratory under the BC Act)
- Hawksbill turtle (Vulnerable, Marine Migratory under the EPBC Act and Migratory under the BC Act)
- Saltwater crocodile (Marine Migratory under the EPBC Act and Migratory under the BC Act)

Twelve additional species were assessed as possibly occurring within the study area, including the dugong, freshwater sawfish, green sawfish, narrow sawfish, northern river shark, oceanic whitetip shark, scalloped hammerhead, giant manta ray, reef manta ray, southern bluefin tuna, loggerhead turtle and Mertens water monitor, as well as fourteen sea snake species and twenty-four Syngnathid species,.

Field Survey

Field surveys conducted in 2017 characterised the benthic communities and habitat (BCH) in the proposed wharf development area (Bay 1) and two adjacent bays (Bay 2 and Bay 3). The surveys revealed that Bay 1, impacted by nearby mining activities, had a higher percentage of bare substrate (67.3%) compared to Bay 2 (47.2%) and Bay 3 (37.6%).

Soft coral and hydroids were minor contributors to the BCH, with a greater proportion in Bay 1. Density observations for hard coral and macroalgae were used to estimate total coverage areas within each bay and the entire survey area. The estimated hard coral area in Bay 1 was 0.2 ha, approximately 3% of the bay's surveyed area, while the total estimated hard coral area across the three bays was 4.92 ha. The estimated macroalgal area in Bay 1 was 0.19 ha, representing 3% of the bay's surveyed area, similar to Bay 2 (5%) and Bay 3 (6%).

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1. Introduction

1.1 Background

In 2016, Crestlink Pty Ltd (formerly Kimberley Technology Solutions Pty Ltd) proposed the construction and operation of the Kimberley Supply Chain Cluster (the 'Project') (formerly the Cockatoo Island Multi-User Supply Base) in Western Australia (WA). The project aimed to upgrade and develop infrastructure on Cockatoo Island, including an airfield, a wharf, an aftermarket subsea workshop, and other related support facilities.

After a period of inactivity, the project is now progressing. To ensure thoroughness, this report provides an updated desktop assessment of marine fauna within the Development Envelope (DE) and incorporates the findings from the field surveys conducted in 2017 for a comprehensive evaluation of the marine habitat and fauna within the project's DE.

1.2 Study Objective and Scope

To support State and Commonwealth approval processes, a technical study was conducted to describe the benthic communities and habitats (BCH) and marine fauna in the vicinity of the proposed wharf. This study included a desktop assessment of marine fauna and BCH, as well as field data from BCH surveys detailed in the 2017 report, "Cockatoo Island Multi-User Supply Base: Technical Study Marine Flora and Fauna".

This report provides and updated assessment of the previous GHD (2017) technical report on marine flora and fauna including:

- Updated desktop assessment of marine fauna
- Summary of 2017 BCH assessment

1.3 Scope and limitations

This report: has been prepared by GHD for Crestlink Pty Ltd and may only be used and relied on by Crestlink Pty Ltd for the purpose agreed between GHD and Crestlink Pty Ltd as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Crestlink Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

2. Methods

2.1 Desktop Assessment

To identify the presence of marine fauna within the DE and its vicinity (5 km buffer) (referred to as study area) a desktop assessment was conducted. This included a literature review and searches of the following publicly available databases:

– Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) (DCCEEW 2025) to identify potentially occurring Significant fauna species listed under the Environmental Protection Biodiversity Conservation Act (EPBC Act)
– Department of Biodiversity, Conservation and Attractions (DBCA) *Dandjoo* database search for previous Significant flora records (DBCA 2025).
– The DBCA Threatened and Priority Fauna database to identify potentially occurring Significant fauna (DBCA 2025a) based on a 50 km buffer[1].
– DCCEEW Biologically Important Areas (BIAs) spatial data (DCCEEW 2025a)
– Publicly available spatial data for turtles such as TurtleNet (2025) and TurtleViewR (2025)

2.1.1 Likelihood of occurrence assessment

An assessment was undertaken of the 'likelihood of occurrence' for listed species identified through the database search and desktop review. The assessment was based on information gathered from the desktop assessment, the known species' biology, an assessment of the habitat requirements, and the quality and availability of suitable habitat that were observed during field surveys. The species were assigned to the following likelihood ranking outlined in Table 1.

Table 1 Fauna likelihood of occurrence assessment description

Likelihood of occurrence	Description
Known	Species recorded during the field survey or from recent, reliable records from within or close proximity to the study area. The species has been recorded in close proximity to the study area and is expected to occur in the study area.
Likely	Species likely to occur in the study area where there is suitable habitat and recent records of occurrence in close proximity. The species' known distribution overlaps with the study area, and suitable habitat is present.
Possible	The local area is within the known distribution of the species, marginal habitat may be present, and/or the species has been recorded in close proximity to the study area.
Unlikely	Species previously recorded within the study area but with limited habitat (poor or restricted type, quality, and quantity). The suitable habitat is isolated from other areas, preventing species migration.

For the purposes of this report, exclusively marine species (marine mammals, fish, marine reptiles) were included in the likelihood of occurrence assessment as the focus of this technical report is on marine habitat and species within the DE.

2.2 Field Survey

In 2016 a three day marine environment survey during 11-13 November was undertaken in the locale of the proposed wharf development. A digital underwater drop camera video system and a GPS-enabled tablet application were used.

[1] DBCA assigned a 50 km buffer for the DE as this is the typical buffer size used for this region, however impact magnitude not expected to extend beyond 5 km.

2.2.1 Site Selection

Aerial imagery was used to select the survey area and to understand the level of similarity between the bay with the proposed wharf footprint and other proximal bays of Cockatoo Island. Aerial imagery could not be used to delineate habitat types because of poor water clarity.

2.2.2 Data Collection

During the survey the following data was collected at each site:

– Time and date of observation;
– Visual recording;
– Coordinates of observation;
– Dominant substrate (e.g. sand, silt etc.); and
– Benthic community type and coverage.

2.2.3 Data Analysis

Marine substrate and benthic community data were spatially mapped onto aerial imagery and recently acquired bathymetry. Contours from the marine habitat data were derived between sites through a natural neighbour interpolation. The coverage of benthic communities for interpolation was classed as per Table 2 with the mid-value (i.e. assigned value) of the coverage range intervals allocated to each site as per Table 2.

Table 2 Benthic coverage percentage bins

Coverage (Qualitative description)	Coverage Range (%)	Assigned Value (%)
None	0	0
Very Sparse	0 – 5	2.5
Sparse	5 – 25	15
Moderate	25 – 50	37.5
Dense	50 – 100	75

3. Results

3.1 Desktop Review

3.1.1 Overview of Cockatoo Island

Cockatoo Island is located approximately 7 km off the Western Australian coast within the Buccaneer Archipelago, approximately 130 km north-west of Derby (Figure 1). As described in MScience (2011), the Cockatoo Island climate is a dry sub-tropical environment, in an area of low wave energy with a large tidal range of 10 m. The large tidal range, steep cliffs and beach profile, and high ultraviolet radiation are the dominant factors that drive habitat distributions.

3.1.2 Marine Habitats

Bay 1, the location of the proposed wharf development (Bay 1 in Figure 1), has not been previously surveyed. This review is based on marine environment surveys primarily undertaken of the nearshore regions of Cockatoo Island to the northwest of Bay 1.

As described by the EPA (2016), benthic communities and habitats (BCH) are defined as “Functional ecological communities that inhabit the seabed and the areas of seabed that support these communities (e.g. high relief reef, platform reef, sand, silt and the depth they occur at). The communities may include light dependent taxa (e.g. algae, seagrass, corals, some sponges, mangroves) or animals that obtain their energy by consuming live or dead organisms (e.g. ascidians, sponges, soft corals)”.

Marine Substrates

In a 2013 survey (MScience, 2013) around the existing ship loader (approximately 400 m to the northwest of the proposed wharf development), the marine environment was characterised as a shallow nearshore flat of 10 to 30 m width that drops off at the seaward edge to 10-15 m below lowest astronomical tide (LAT). Uncolonised rocky substrates were common at the edges of the headland. Sand with some patches of mud was the dominant habitat. Areas of gravel and coral rubble were also noted on the outer flat and the slope.

Hard Coral

In a 2007 survey (MScience, 2007), two types of hard coral communities were noted; coral habitats of crests and upper reef slopes, and coral on reef flats (see Figure 2).

Hard coral colonised some areas of the coral rubble. Coral genera typically included *Acropora* and *Montipora* across a depth range of 1-5 m below LAT (MScience, 2013).

Macroalgae

MScience (2007) found substantial areas of moderately abundant macroalgae including *Sargassum* interspersed with *Padina*, and other brown, red and green algae around the perimeter of Cockatoo Island (see Figure 2).

Non Benthic Primary Producer Habitats

Filter feeding invertebrates such as gorgonian soft coral sea whips, sponges and crinoids colonise some areas of the coral rubble (MScience, 2013).

3.1.3 Marine Water Quality

The large tidal regime has a large effect on the turbidity of in the region. Currents entrain and transport large amounts of suspended sediment (MScience, 2011) that may generate considerable turbidity in some regions of the archipelago (Wilson, 2014). Refer to GHD (2025a) and GHD (2025b) for overview of past and recent marine water and sediment quality surveys of the Proposal area.

Paper Size ISO A4

0 100 200 300 400

Metres

N

Map Projection: Mercator Auxillary Sphere
Horizontal Datum: GDA 1994
Grid: MGA Zone 51

GHD

Kimberley Technology Solutions

Cockatoo Island Multi-User Supply Base

Site location

Project No. **12526793**
Revision No. **A**
Date. **28/03/2025**

FIGURE 1

Document Path:
Print Date: 28 March 2025

Data Source:WANow
Created By: Tristan Sleigh

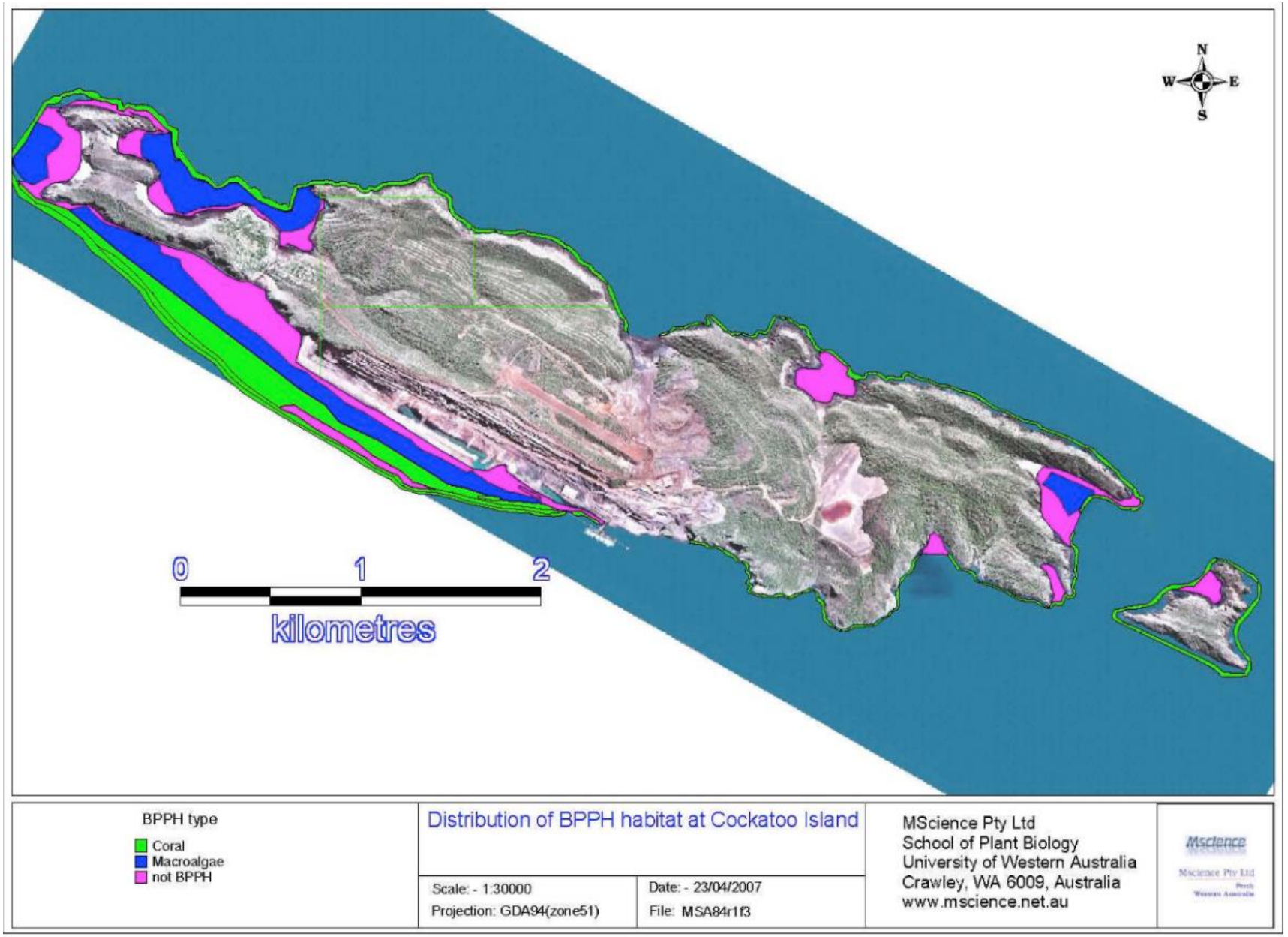


Figure 2 ***BCH mapping of Cockatoo Island in 2007 (MScience, 2007)***

3.1.4 Marine Mammals

Table 3 summarises the likelihood of occurrence of conservation significant marine mammals that have been identified within the study area.

Table 3 Likelihood of occurrence of conservation significant marine mammals that have been identified within the study area

Common name	Scientific name	National listing	State listing	Likelihood of occurrence
		EPBC Act listing	**BC Act listing/ DBCA**	
Whales				
Bryde's whale	*Balaenoptera edeni*	Cetacean Migratory	Migratory	**Unlikely** This species appears to be limited to the 200 m depth contour, moving along the coast in response to the availability of suitable prey, while the offshore form is found in deeper waters (500 to 1,000 m) (Best 1977). Because of its small population, lack of sightings and preference for deeper water, it is unlikely to be encountered in the study area.
Humpback whale	*Megaptera novaeangliae*	Cetacean Migratory	Conservation Dependent Migratory	**Unlikely** Humpback whales occur throughout Australian waters with their distribution influenced by their migratory pathways and aggregation areas for resting, breeding and calving. The study area intersects with four humpback whale BIAs, for resting, nursing, calving and migration purposes. Humpbacks arrive in the coastal waters of the Kimberley after summer to breed and calve. These breeding activities are known to occur within waters surrounding the study area, however after the winter season has passed, Humpback whales are likely be in deeper waters outside of the study area as they return to the Antarctic. It is highly unlikely that the species would occur in close proximity to the DE, but it is likely that the species occur in deeper waters in vicinity of the study area.
Killer whale, Orca	*Orcinus orca*	Cetacean Migratory	Migratory	**Unlikely** Killer whales are thought to be the most cosmopolitan of all cetaceans and may be seen in any marine region and the species have been sighted along the Kimberley coast (Kimberley Society 2010). Although not common, the killer whale may occur in waters surrounding the study area. This species is not anticipated to occur within the study area given its inshore location.
Dolphins				
Australian humpback dolphin	*Sousa sahulensis*	Cetacean Migratory	Priority 4 Migratory	**Likely** The Australian humpback dolphin is a Migratory species known to inhabit the tropical and subtropical waters of Northern Australia. Although studies are limited, it is reported that the Australian humpback dolphins occur within 20 km from land in sheltered offshore waters near reefs and islands. The species is known to undertake breeding activities in waters surrounding Cockatoo Island and the entire Buccaneer Archipelago and as such is likely to occur within the study area.
Australian snubfin dolphin	*Orcaella heinsohni*	Cetacean Migratory	Priority 4 Migratory	**Unlikely** This dolphin is primarily found in nearshore habitats, but has been recorded up to 23 km offshore. Beagle Bay and Pender Bay are important areas for the Australian snubfin dolphin (DoE 2016a). The Australian snubfin dolphin is known to use the waters surrounding Cockatoo Island and the entire Buccaneer Archipelago for breeding. However, this species is not anticipated to occur within the study area given its inshore location.
Bottlenose dolphin	*Tursiops truncatus s. str*	Cetacean	-	**Unlikely**

Common name	Scientific name	National listing	State listing	Likelihood of occurrence
		EPBC Act listing	BC Act listing/ DBCA	
				Bottlenose dolphins are primarily known from coastal waters around the world, in the Indian Ocean, and in Australia in general, they tend to inhabit offshore waters. Therefore, the species is not anticipated to occur within the study area given its inshore location.
Common dolphin	*Delphinus delphis*	Cetacean	-	**Unlikely** Common Dolphins are found in offshore waters. They have been recorded in waters off all Australian states and territories, but are rarely seen in northern Australian waters (Jefferson & Waerebeek; Ross 2006). Common Dolphins appear to occur in two main locations around Australia, with one cluster in the southern south-eastern Indian Ocean and another in the Tasman Sea. Therefore, it is unlikely that the species occur within the study area.
Indian ocean bottlenose dolphin	*Tursiops aduncus*	Cetacean	Migratory	**Likely** In Australia, the Indian ocean bottlenose dolphin is restricted to inshore areas such as bays and estuaries, nearshore waters, open coast environments, and shallow offshore waters including coastal areas around oceanic islands. The species has been observed during surveys by Jenner and Jenner (2009) between Cape Leveque (north of Broome) and Scott Reef in June, July, October and November 2008. It is likely that the species occurs within the study area.
Risso's dolphin	*Grampus griseus*	Cetacean	-	**Unlikely** Risso's Dolphin have been recorded throughout most Australian waters (except Tasmania and Northern Territory (NT)) with no migratory patterns identified. The limited data available displays depth sightings of 180 m to 1500 m, with the only suspected resident population located near Fraser Island. The Risso's Dolphin may occur within the study area, however it is unlikely given their depth preferences.
Pantropical spotted dolphin	*Stenella attenuata*	Cetacean Migratory	Migratory	**Unlikely** Little is known about the distribution of the spotted dolphin in the Kimberley region, although they have been recorded at the shelf edge and shelf slope area of the Browse Basin in large, high energy, mixed schools in association with tuna, seabirds and other pelagic cetaceans. Small groups of *Stenella* species have also been observed resting in nearshore areas of coast on the lee side of bays (DSEWPaC 2012a). It is possible that the spotted dolphin may occur in vicinity of study area, but due to depth preferences it is unlikely that the species occurs within the study area.
Sirenians				
Dugong	*Dugong dugon*	Migratory Marine	-	**Possible** The dugong occurs in coastal and island waters from Shark Bay in WA (25° S) across the northern coastline to Moreton Bay in Queensland (27° S) (DCCEEW, 2025). Regional sightings from 1996 to 2008 indicate some Dugong sightings around Cockatoo and Irvine Islands, but notably fewer than around the Dampier Peninsula, Derby, and Walcott Inlet (Holley and Prince, 2011). Given that Dugongs are largely associated with seagrass beds, they are unlikely to be found within the study area, but are likely to be present in the wider coastal region.

Bryde’s Whale

Balaenoptera edeni (Bryde’s whale) is listed as Migratory under the EPBC Act and the BC Act. The body colour of Bryde's whales is principally dark smoky grey above and white below, and the species is identifiable by the presence of three rostral ridges. Bryde's whales occur in temperate to tropical waters, both oceanic and inshore, bounded by latitudes 40° N and 40° S, or the 20 °C isotherm.

This species appears to be limited to the 200 m depth contour, moving along the coast in response to the availability of suitable prey, while the offshore form is found in deeper waters (500 to 1,000 m) (Best 1977). Because of its small population, lack of sightings and preference for deeper water, it is unlikely to be encountered in the study area.

Humpback Whale

Megaptera novaeangliae (humpback whale) is listed as Migratory under the EPBC Act and Conservation Dependant under the BC Act. It can be identified by its long pectoral fins, which can reach lengths of up to 5 m, as well as by its distinctive tail fluke shape and pigmentation patterns. These patterns are unique to each whale and serve as reliable markers for researchers studying their population distribution, migratory patterns, and population structure. Mature humpback whales typically measure between 15 to 18 meters in length and can weigh up to 40 tonnes (t) (DCCEEW, 2025a).

Humpback whales are distributed in all ocean basins worldwide. Within Australian waters there are two such subpopulations: one that migrates from the Southern Ocean northwards along the West Australian coast in winter to breed in the region between North West Cape (Exmouth) and the Kimberley, and one that migrates along the east of Australia to breed in the Great Barrier Reef region (DCCEEW, 2025a).

Humpback whales occur throughout Australian waters with their distribution influenced by their migratory pathways and aggregation areas for resting, breeding and calving. The study area intersects with four humpback whale BIAs for resting, nursing, calving and migration purposes. Humpbacks arrive in the coastal waters of the Kimberley after summer to breed and calve. These breeding activities are known to occur within waters surrounding the study area, however after the winter season has passed, Humpback whales are likely be in deeper waters outside of the study area as they return to the Antarctic. However, it is unlikely that the species would occur in close proximity to the study area.

Killer Whale

Orcinus orca (killer whale, orca) are not listed as threatened under the EPBC Act or BC Act but are listed as a Migratory species. The species are the largest member of the dolphin family and are recognisable by their distinctive black, white, and grey coloration. The killer whale is thought to be the most cosmopolitan of all cetaceans and may be seen in any marine region. The species has been sighted along the Kimberley coast (Kimberley Society 2010) and although not common, the killer whale may occur in waters surrounding the wider coastal area. However, this species is not anticipated to occur within the study area given its inshore location.

Dolphins

Eight species of dolphin listed as Cetaceans under the EPBC Act were identified as potentially occurring in the study area, with four species listed as Migratory species.

The species that are deemed as likely to occur in the study area are the Australian humpback dolphin, the bottlenose dolphin, the Indian ocean bottlenose dolphin and the spotted bottlenose dolphin. These species are likely to occur within the study area as their have potential records in vicinity of the DE.

Sousa sahulensis (Australian humpback dolphin) is a Migratory species known to inhabit the tropical and subtropical waters of Northern Australia. Although studies are limited, it is reported that the Australian humpback dolphins occur within 20 km from land in sheltered offshore waters near reefs and islands.

Tursiops truncatus s. str (bottlenose dolphin) is a cosmopolitan species found in all Australian waters in coastal, estuarine and pelagic settings. Bottlenose dolphins have been observed during surveys by Jenner and Jenner (2009) between Cape Leveque (north of Broome) and Scott Reef in June, July, October and November 2008.

Tursiops aduncus (Indian ocean bottlenose dolphin) resemble common bottlenose dolphins in their general colour pattern. They have a dark grey dorsal cape with a paler grey overlay extending onto the flanks and an off-white ventral area. In the Indian and Western Pacific Oceans, Indian Ocean bottlenose dolphins have a shorter body and skull length than common bottlenose dolphins.

The other dolphin species identified in the desktop assessment are considered unlikely to occur within the study area due to their preference for offshore locations and deeper waters.

Dugong

Dugong dugon (dugong) is listed as Marine Migratory under the EPBC Act and is not listed under the BC Act.

The dugong occurs in coastal and island waters from Shark Bay in WA (25° S) across the northern coastline to Moreton Bay in Queensland (27° S) (DCCEEW, 2025) (see Figure 3).

The species is a large herbivorous marine mammal with paddle-like forelimbs and no hind limbs or dorsal fin. Its tail is broad, triangular in shape, and horizontally flattened, which it moves up and down to swim. Dugong feeding aggregations tend to occur in large seagrass meadows within wide, shallow protected bays (e.g. Hervey and Moreton Bays); wide, shallow mangrove channels (e.g. Hinchinbrook Channel); and in the lee of large inshore islands (DCCEEW, 2025). Regional sightings from 1996 to 2008 indicate some dugong sightings around Cockatoo and Irvine Islands, but notably fewer than around the Dampier Peninsula, Derby, and Walcott Inlet (Holley and Prince, 2011).

Spatial analysis identified foraging BIAs for the dugong south of the study area. Given that dugongs are largely associated with seagrass beds, they are unlikely to be found within the study area but are likely to be present in the wider coastal region.

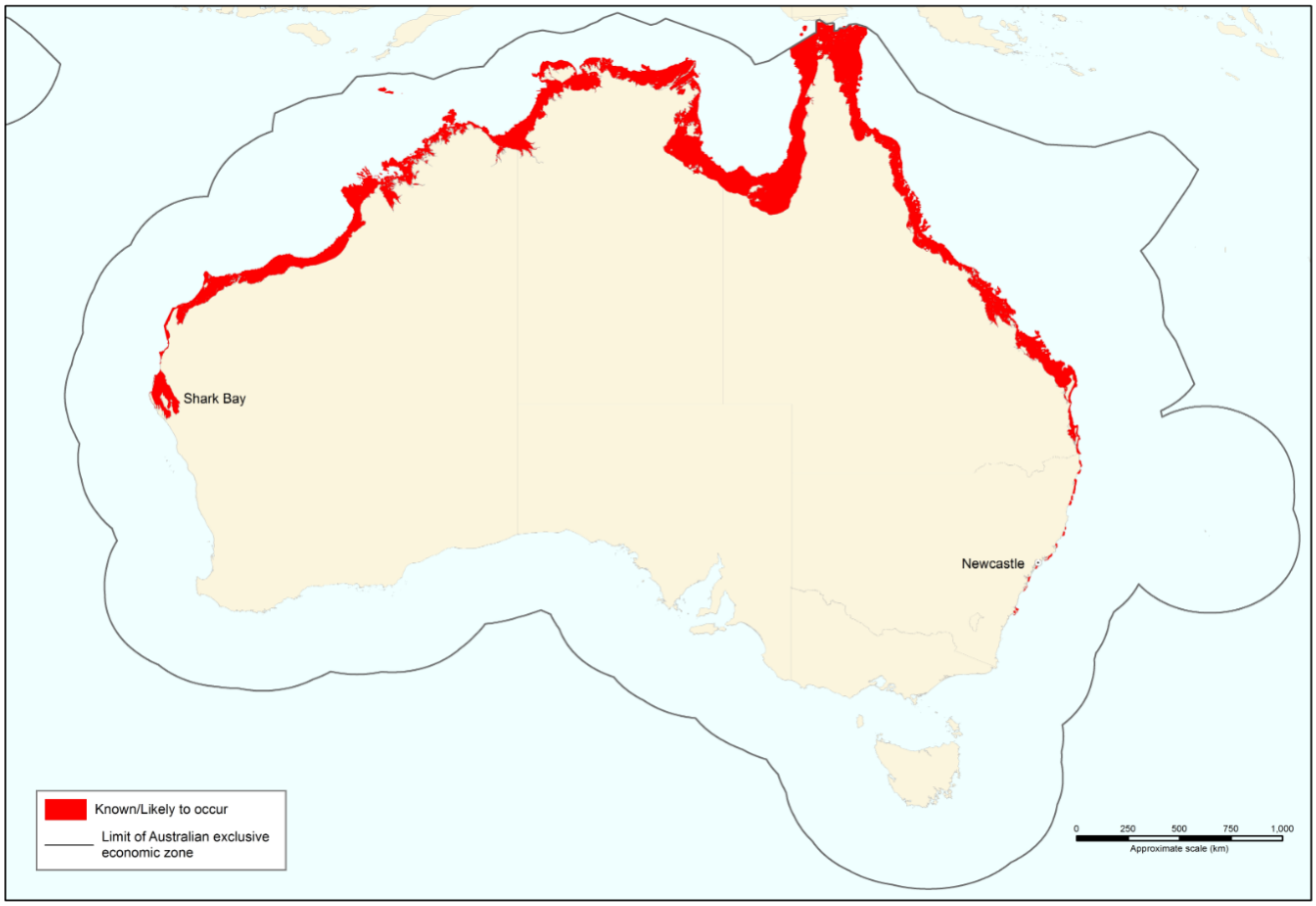


Figure 3 Distribution of dugongs in Australia (DCCEEW 2025)

3.1.5 Fish

Table 4 summarises the likelihood of occurrence of conservation significant fish species identified within the study area.

Table 4 Likelihood of occurrence of conservation significant fish species identified within the study area

Common name	Scientific name	EPBC listing	State listing	Presence
		Listed threatened	BC Act/DBCA	
Sawfish				
Dwarf sawfish	*Pristis clavata*	Vulnerable Migratory Marine	Priority 1 Migratory	**Unlikely** The Australian distribution of the dwarf sawfish extends from the Pilbara coast in WA across Northern Australia to the Gulf of Carpentaria, inhabiting shallow coastal waters (2–3 m) and estuarine habitats. The study area does not overlap with any BIAs for the dwarf sawfish. However, there is a foraging area to the north and a reproduction area to the south of the study area. Given that adults are believed to occupy a small range within the coastal fringe, showing site fidelity within just a few square kilometres (Stevens et al., 2008), it is unlikely that this species occurs within the study area.
Freshwater sawfish, largetooth sawfish	*Pristis pristis*	Vulnerable Migratory Marine	Priority 3 Migratory	**Possible** The Indo-West Pacific subpopulation of the largetooth sawfish was formerly wide ranging from parts of the Western Indian Ocean through India and southeast Asia to New Guinea and Northern Australia. Its current distribution is now patchy across its range. In Australia, the species is distributed across freshwater rivers in the west and northern parts of Australia and can be found in coastal waters along the west and north coast. There is a BIA for reproduction south of the study area. Due to the study area's close proximity to key reproduction areas, the species may potentially occur in the study area.
Green sawfish	*Pristis zijsron*	Vulnerable Migratory Marine	Vulnerable	**Possible** The green sawfish is distributed from about Mackay (Harry et al., 2011) in Queensland across Northern Australian waters to Shark Bay in WA. Individuals have been recorded in inshore coastal environments and estuaries but the species does not penetrate into freshwater. There are also records of green sawfish hundreds of kilometres offshore in relatively deep water (Stevens et al., 2005). There is a BIA for reproduction south of the study area and for foraging north of the study area. Due to the study area's close proximity to key reproduction and foraging areas suggests that the species may potentially occur in the study area.
Narrow sawfish	*Anoxypristis cuspidata*	Migratory Marine	Migratory	**Possible** The Narrow Sawfish is now restricted to tropical eastern Arabian Seas, parts of Southeast Asia, Papua New Guinea and Australia. In Australia, it has a wide range and is found from Rockhampton (Queensland) to the Pilbara coast, commonly found in sheltered bays, river deltas, estuaries and sandy inshore waters (Kyne et al, 2021). Although there is limited information on this species distribution, there is a possibility that the species may occur within the study area given its broad known distribution and preferred habitat.
Sharks				
Grey nurse shark	*Carcharias taurus*	Vulnerable Migratory Marine	Vulnerable	**Unlikely** The grey nurse shark is found globally in subtropical and temperate waters. In Australia, its distribution spans the coastal waters of New South Wales, southern Queensland, WA, and southwestern Australia, extending to the northwest shelf (DCCEEW, 2021a). Given that their range is south of the northwest shelf, it is unlikely that this species is present within the study area.

Common name	Scientific name	EPBC listing	State listing	Presence
		Listed threatened	BC Act/DBCA	
Northern River Shark	*Glyphis garricki*	Endangered	Priority 1	**Possible** The Northern river shark is known only from a small number of locations in WA, the NT and Papua New Guinea, utilising rivers, tidal sections of large tropical estuarine systems and macrotidal embayments, as well as inshore and offshore marine habitats. Given its known distribution and preferred habitats, it is possible that the species may occur within the study area.
Oceanic whitetip shark	*Carcharhinus longimanus*	Migratory Marine	-	**Possible** The oceanic whitetip sharks is a large carcharhinid shark that occurs globally in all of the world's tropical and sub-tropical oceans (Forese and Pauly 2013). The species spends most of its time in the upper layer of the ocean, to a depth of 150 m and prefers off-shore, deep-ocean areas (Koopman and Knuckey 2014) Considering this species' preference for deeper ocean waters, it is unlikely that they would be found in the study area. However, they might be present in the broader study region or occasionally venture into shallower waters.
Scalloped hammerhead	*Sphyrna lewini*	Conservation Dependant	-	**Possible** The scalloped hammerhead is a coastal and semi-oceanic species with a circumglobal distribution in coastal warm-temperate and tropical seas. In Australia, the species is recorded around the northern coastline to approximately 34°S on both east and west coasts (Sydney, New South Wales (NSW) to Geographe Bay, WA (Threatened species scientific committee 2024). In Northern Australia, juveniles inhabit shallow inshore environments whereas adults generally occur in deeper waters near the edge of the continental shelf (Threatened species scientific committee 2024). Based on the known distribution and habitat preferences of the species, there is a possibility that juvenile and occasional adult individuals may be found in inshore waters within the study area. Additionally, the species might also be present in the broader coastal region.
Whale shark	*Rhincodon typus*	Vulnerable Migratory Marine	Migratory	**Unlikely** Whale sharks are found in tropical and warm temperate seas between latitudes 30°N and 35°S, inhabiting both deep and shallow coastal waters, as well as lagoons of coral atolls and reefs. In Australia, they are prevalent at Ningaloo Marine Park, with sightings at Christmas Island, the Coral Sea, and as far south as Kalbarri and Eden. A recent study (D'Antonio et al., 2024) analysed satellite tracking data from 78 whale sharks tagged over 14 years, revealing that their distribution is far offshore from the study area, with canyons and pinnacles along the continental shelf edge being the most utilised features for the species.
White shark	*Carcharodon carcharias*	Vulnerable Migratory Marine	Vulnerable	**Unlikely** The white shark is a large apex predator found in temperate and sub-tropical regions globally. In Australia, their range extends from southern Queensland to the North West Cape in WA. A study by Bradford et al. (2020) using satellite tags over 15 years revealed that white sharks prefer southern waters and use off-shelf habitats more than previously thought. Therefore, it is unlikely that white sharks are present in or near the study area.
Rays				
Giant manta ray	*Mobula birostris*	Migratory Marine	Migratory	**Possible** The giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and in productive coastal areas. In Australia it is recorded from south-western WA, around the tropical north of the country and south to the southern coast of New South Wales (NOAA Fisheries, 2024).

Common name	Scientific name	EPBC listing	State listing	Presence
		Listed threatened	BC Act/DBCA	
				Considering the limited data available on these species and their broad presence across all coastal waters in Australia, the species may be present in the study area.
Reef manta ray	*Mobula alfredi*	Migratory Marine	Migratory	**Possible** The reef manta ray is a large filter-feeding elasmobranch that is circumglobally distributed in tropical and subtropical waters. Although the knowledge on the movement patterns of reef manta rays is still sparse, the species is known to migrate relatively long distances, moving between productive areas, and aggregating at specific sites (Department of the Environment, 2012). Considering the limited data available on these species and their broad presence across all coastal waters in Australia, the species may be present in the study area.
Other fish				
20 pipefish and four seahorse species		Marine	-	**Possible** Twenty-four species of Syngnathids have been identified as potentially occurring in the study area. While their preferred habitat, seagrass, is likely to be sparse, these species are expected to inhabit shallow coastal areas. Therefore, it is possible for Syngnathids to be present in the study area, albeit uncommonly.
Southern Bluefin Tuna	*Thunnus maccoyii*	-	-	**Possible** The Southern bluefin tuna is a highly migratory species, and occur across the globe between 30-50°S. In Australia, the Southern Bluefin Tuna occurs from northern WA, across the southern region including Tasmania, and up into northern NSW. Juveniles are also known to inhabit nearshore waters in WA. Therefore, it is possible that they could occur in the study area (DCCEEW, 2025b).

Sawfish

The four following species of listed sawfish have been identified in the desktop search:

– *Pristis clavata* (dwarf sawfish) is listed as Vulnerable and Migratory Marine under the EPBC Act and Priority 1, Migratory under the BC Act.
– *Pristis pristis (*largetooth sawfish) is listed as Vulnerable and Migratory Marine under the EPBC Act and Priority 3, Migratory under the BC Act.
– *Pristis zijsron* (green sawfish) is listed as Vulnerable and Migratory Marine under the EPBC Act and Vulnerable under the BC Act.
– *Anoxypristis cuspidate* (narrow sawfish) is listed as Migratory Marine under the EPBC Act and Migratory under the BC Act.

The known and likely ranges of the three listed vulnerable species were mapped in the Sawfish and River Sharks Multispecies Recovery Plan (Department of Environment (DoE) 2015) (see Figure 4).

The Australian distribution of the dwarf sawfish extends from the Pilbara coast in WA across northern Australia to the Gulf of Carpentaria. This species typically inhabits shallow coastal waters (2–3 m) and estuarine habitats. Similar to the green sawfish, the dwarf sawfish does not utilise purely freshwater areas (Thorburn et al., 2007).

The study area does not overlap with any BIAs for the dwarf sawfish. However, there is a foraging area to the north and a reproduction area to the south of the study area. Given that adults are believed to occupy a small range within the coastal fringe, showing site fidelity within just a few square kilometres (Stevens et al., 2008), it is unlikely that this species occurs within the study area.

The Indo-West Pacific subpopulation of the largetooth sawfish was formerly wide ranging from parts of the Western Indian Ocean through India and southeast Asia to New Guinea and northern Australia. Its current distribution is now patchy across its range. In Australia, the species is distributed across freshwater rivers in the west and northern parts of Australia and can be found in coastal waters along the west and north coast. There is a BIA for reproduction south of the study area.

The green sawfish is distributed from about Mackay in Queensland across northern Australian waters to Shark Bay in WA. Individuals have been recorded in inshore coastal environments and estuaries but the species does not penetrate into freshwater. There are also records of green sawfish hundreds of kilometres offshore in relatively deep water (DCCEEW, 2025c). There is a BIA for reproduction south of the study area and for foraging north of the study area.

The study area's close proximity to key foraging and reproduction zones suggests that the largetooth sawfish and green sawfish may potentially occur in the study area.

The Narrow Sawfish is now restricted to tropical eastern Arabian Seas, parts of Southeast Asia, Papua New Guinea and Australia. In Australia, it has a wide range and is found from Rockhampton (Queensland) to the Pilbara coast, commonly found in sheltered bays, river deltas, estuaries and sandy inshore waters (Kyne et al, 2021). Although there is limited information on this species distribution there is a possibility that the species may occur within the study area given its broad distribution and preferred habitat.

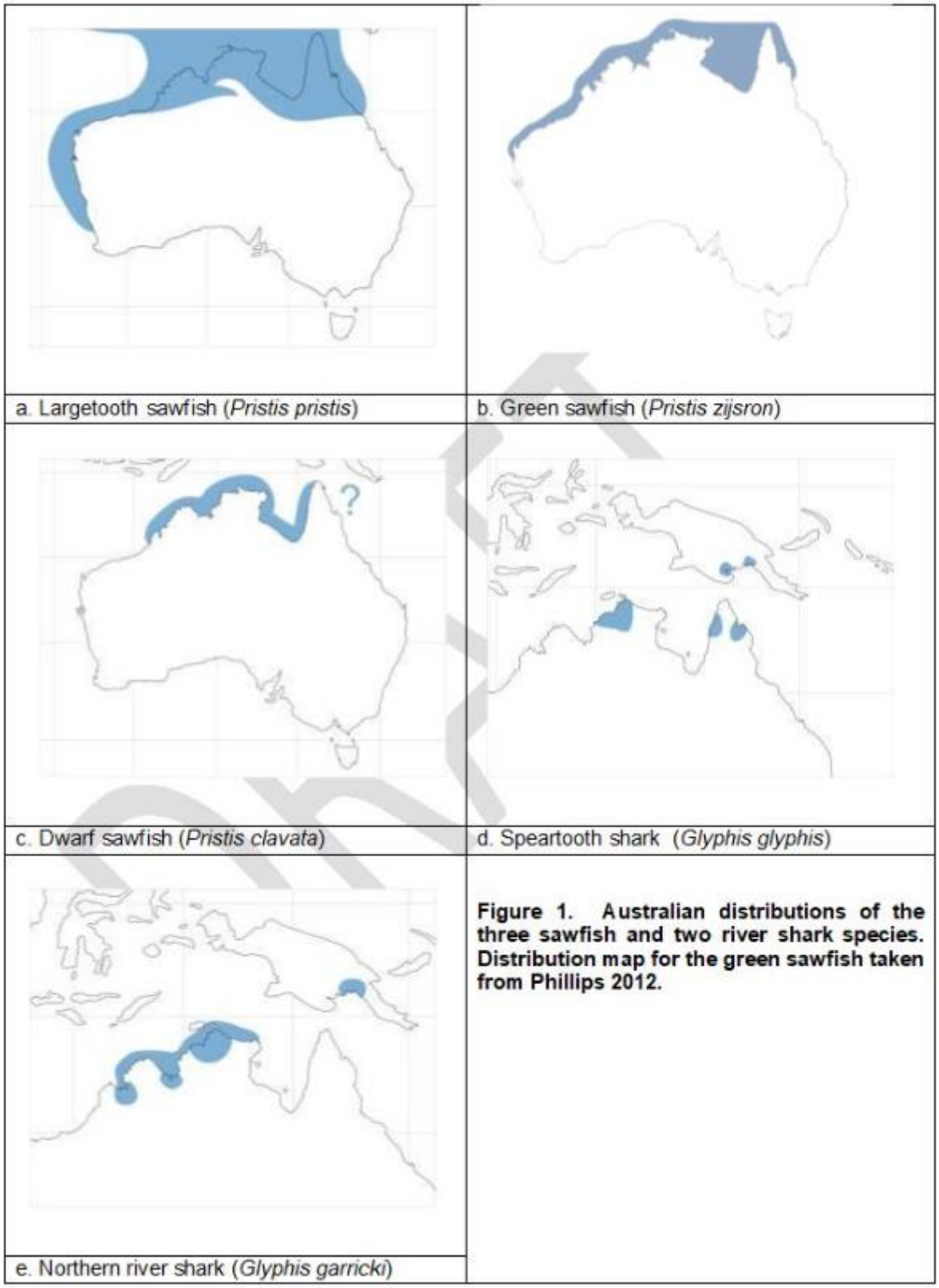


Figure 1. Australian distributions of the three sawfish and two river shark species. Distribution map for the green sawfish taken from Phillips 2012.

Figure 4 Sawfish and Northern river shark distributions (DoE 2015)

Grey nurse shark

Carcharias taurus (grey nurse shark) is listed as Vulnerable and Migratory Marine under the EPBC Act and Vulnerable under the BC Act. The species are identifiable through their large, stout like bodies, with a pointed snout with many rows of visible teeth and small eyes that can grow up to 3.6 metres in length (DCCEEW, 2021a).

The grey nurse shark is found globally in subtropical and temperate waters. In Australia, its distribution spans the coastal waters of New South Wales, southern Queensland, WA, and southwestern Australia, extending to the northwest shelf (DCCEEW, 2021a). Given that their range is south of the northwest shelf, it is unlikely that this species is present within the study area.

Northern river shark

Glyphis garricki (Northern river shark) is listed as Endangered under the EPBC Act and Priority 1 under the BC Act. The species is known only from a small number of locations in WA, the NT and Papua New Guinea (see Figure 4). Utilising rivers, tidal sections of large tropical estuarine systems and macrotidal embayments, as well as inshore and offshore marine habitats (DoE, 2015). Given its known distribution and preferred habitats, it is possible that the species may occur within the study area.

Oceanic whitetip shark

Carcharhinus longimanus (oceanic whitetip shark) is not listed as threatened under the EPBC or BC Act, however is listed as Migratory species by the EPBC Act.

The oceanic whitetip sharks is a large carcharhinid shark that occurs globally in all of the world's tropical and sub-tropical oceans (Forese and Pauly 2013).

The species spends most of its time in the upper layer of the ocean, to a depth of 150 m and prefers off-shore, deep-ocean areas (Koopman and Knuckey 2014). Considering this species' preference for deeper ocean waters, it is unlikely they would be found in the study area. However, they might be present in the broader study region or occasionally venture into shallower waters.

Scalloped hammerhead

Sphyrna lewini (scalloped hammerhead) is listed as Conservation Dependent under the EPBC Act. The species can be identified by its large, flattened 'hammer-like' head, featuring wide-set eyes and a prominent central scallop-like indentation in the front margin. It has a tapered body shape and is typically light brown, bronze, or olive on its dorsal surfaces, transitioning to a white underside. The tips of its pectoral fins have a dusky coloration.

The scalloped hammerhead is a coastal and semi-oceanic species with a circumglobal distribution in coastal warm-temperate and tropical seas. In Australia, the species is recorded around the northern coastline to approximately 34°S on both east and west coasts (Sydney, New South Wales (NSW) to Geographe Bay, WA (Threatened species scientific committee 2024) (see Figure 5).

In northern Australia, juveniles inhabit shallow inshore environments whereas adults generally occur in deeper waters near the edge of the continental shelf (Threatened species scientific committee 2024).

Based on the known distribution and habitat preferences of the species, there is a possibility that juvenile and occasional adult individuals may be found in inshore waters within the study area. Additionally, the species might also be present in the broader coastal region.

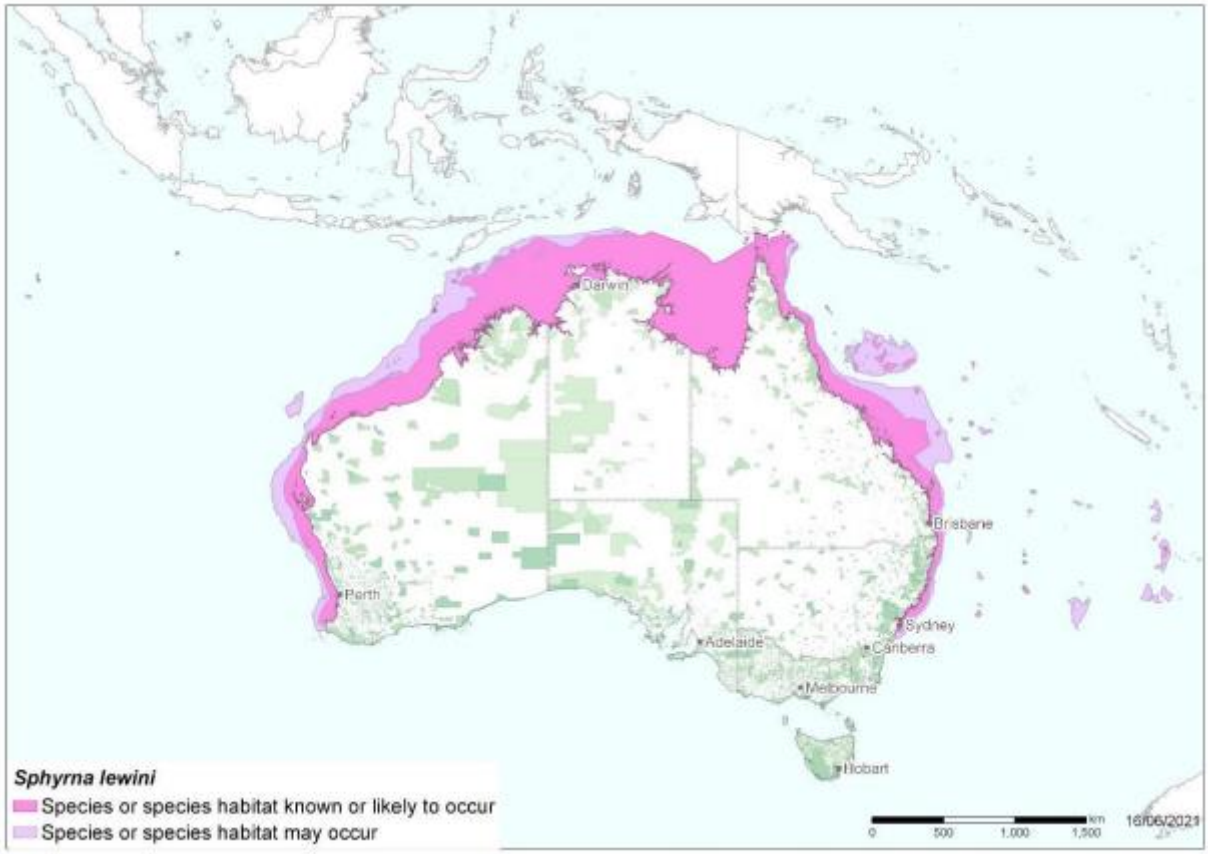


Figure 5 ***Modelled distribution of the scalloped hammerhead in Australian waters (Threatened species scientific committee, 2024)***

Whale shark

Rhincodon typus (whale shark), listed as Vulnerable and Migratory under the EPBC Act and Migratory under the BC Act, belongs to the same group as bottom-dwelling sharks (*Orectolobiformes*), which includes the wobbegong. The sharks are recognisable through their unique pattern of lines and spots on their skin, providing a form of "camouflage" that helps them blend into their surroundings and remain less conspicuous in the oceanic environment. This distinctive patterning is consistent and can be used for individual identification (Department of Fisheries, 2011).

Whale sharks are widely distributed in tropical and warm temperate seas, typically found between latitudes 30°N and 35°S. They inhabit both deep and shallow coastal waters, as well as the lagoons of coral atolls and reefs. In Australian waters, whale sharks are prevalent at Ningaloo Marine Park, with sightings also reported at Christmas Island, in the Coral Sea, and as far south as Kalbarri on the mid-west coast of WA, and Eden on the New South Wales south coast. Records also show sightings in Commonwealth waters between Australia and Indonesia (Department of Fisheries, 2011).

A more recent study titled 'Natural and Artificial Structures Influence the Movement and Habitat Connectivity of Whale Sharks' (D'Antonio et al., 2024) analysed satellite tracking data from 78 whale sharks tagged over 14 years at Ningaloo Reef and Shark Bay, two well-known aggregation sites off the Western Australian coast. The tracking data results revealed that the distribution of whale sharks appears to be far offshore from the study area (see Figure 5) emphasising that canyons and pinnacles situated along the edge of the continental shelf were the features most utilised by whale sharks in the East-Indian Ocean. Additionally, foraging BIAs for whale sharks are located further offshore from the study area.

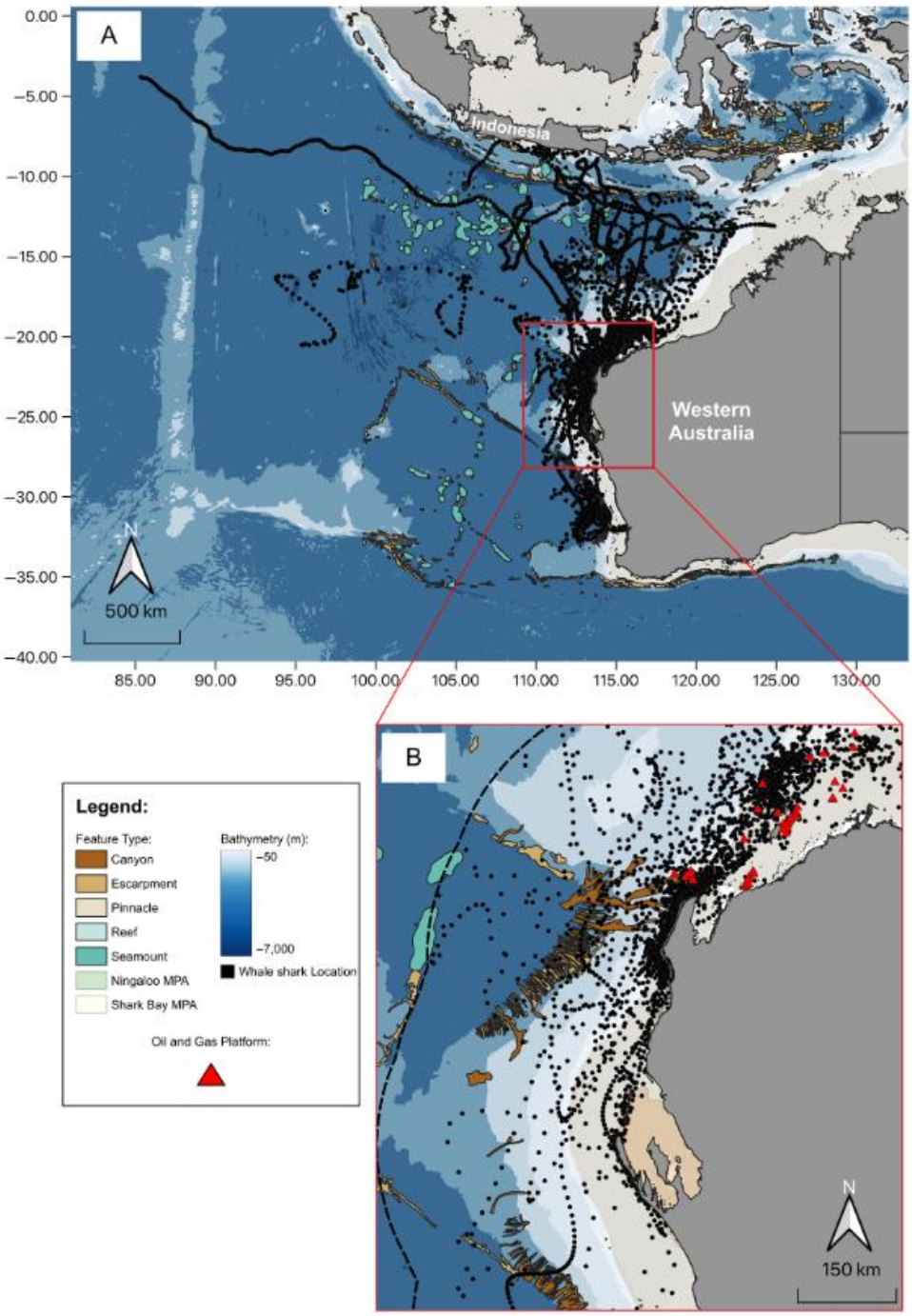


FIGURE 2 | State-space modeled location estimates of whale sharks in the East-Indian Ocean (A) and North-West Australia (B). The map coordinates are projected in WGS'84. Note that the Ningaloo MPA is obscured by whale shark locations.

Figure 6 ***Whale shark distribution tracking data in the WA (D'antonio et al 2024)***

White shark

Carcharodon carcharias (white shark) is listed as Vulnerable and Migratory Marine under the EPBC Act and Vulnerable under the BC Act. The white shark is a large apex marine predator widely distributed throughout temperate and sub-tropical regions in both the northern and southern hemispheres. In Australian waters, the white shark's range primarily extends from southern Queensland, around the southern coastline, to the North West Cape in WA (DCCEEW, 2021).

A more recent study from Bradford et al (2020) examined the movement behaviours, spatial distribution patterns, and vertical habitat use of juvenile, sub-adult, and adult white sharks using 43 satellite tags over 15 years, the results revealed white sharks use off-shelf habitat to a greater extent than previously identified and tagging data identified the species preferring southern waters (see Figure 7).

Considering that white sharks are primarily distributed south of Australia, it is unlikely that this species occurs within or near the study area.

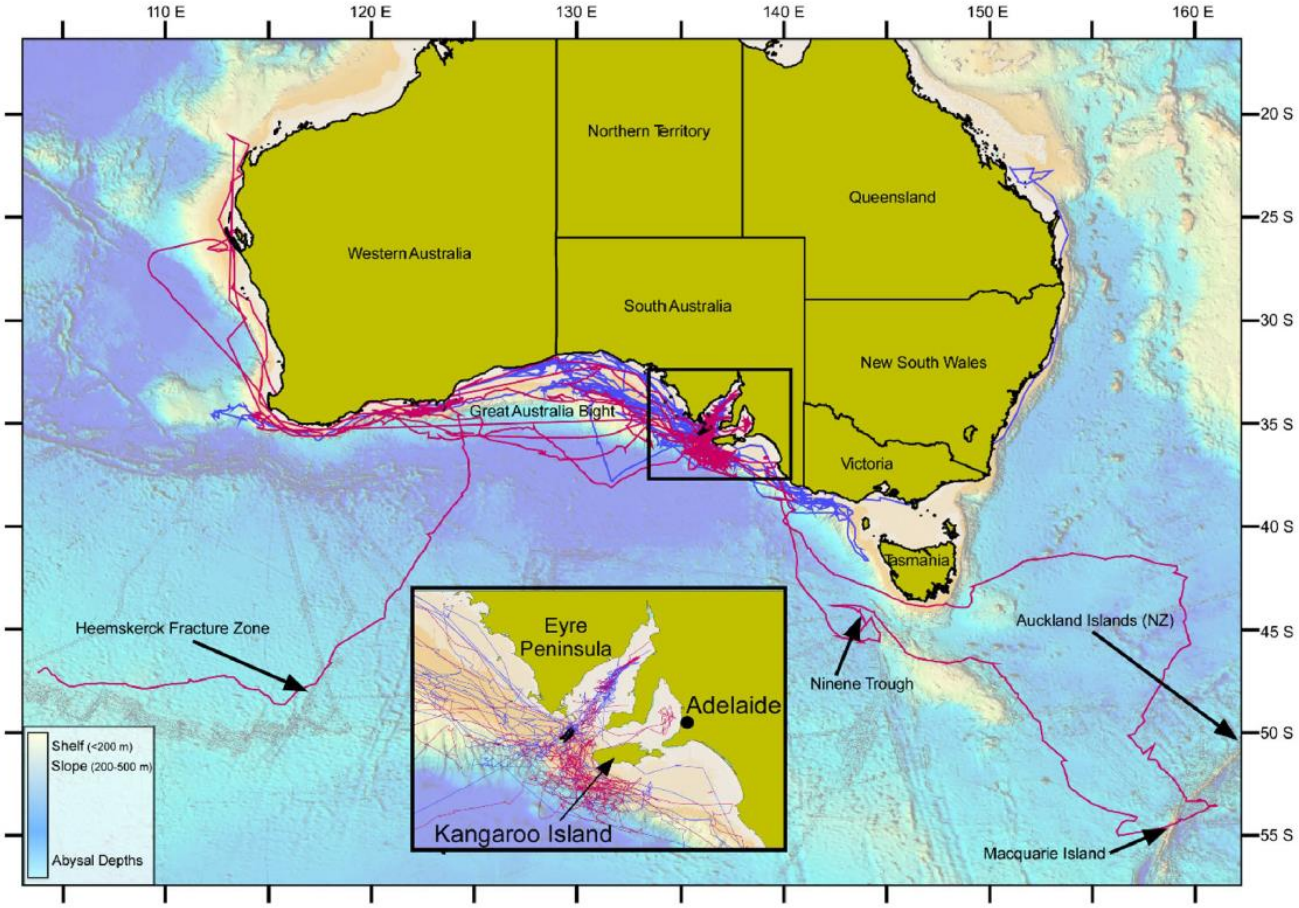


Figure 7 *White shark distribution in Australia (Bradford et al 2020)*

Reef and giant manta ray

Manta alfredi (coastal or reef manta ray), listed as Migratory under the EPBC and BC Act is a large filter-feeding elasmobranch that is circumglobally distributed in tropical and subtropical waters. Although the knowledge on the movement patterns of reef manta rays is still sparse, the species is known to migrate relatively long distances, moving between productive areas, and aggregating at specific sites (Department of the Environment, 2012).

Mobula birostris (giant manta ray), listed as Migratory under the EPBC and BC Act are the world's largest rays, with a wingspan of up to 8 m and are identifiable through their large diamond-shaped body with elongated wing-like pectoral fins, ventrally placed gill slits, laterally placed eyes, and wide, terminal mouths. In front of the mouth, they have two structures called cephalic lobes which extend and help to channel water into the mouth for feeding activities (DCCEEW, 2024).

The giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and in productive coastal areas. In Australia it is recorded from south-western WA, around the tropical north of the country and south to the southern coast of New South Wales (NOAA Fisheries, 2024).

Considering the limited data available on these species and their broad presence across all coastal waters in Australia, both species may be present in the study area.

Syngnathids

Twenty-four species of Syngnathids (twenty pipefish and four seahorse species) listed as Marine under the EPBC Act, have been identified as potentially occurring in the study area. While their preferred habitat, seagrass, is likely to be sparse, these species are expected to inhabit shallow coastal areas. Therefore, it is possible for Syngnathids to be present in the study area, albeit uncommonly.

Southern blue fin tuna

Thunnus maccoyii (southern bluefin tuna) is no longer listed as Conservation Dependent (effective from 11 July 2024) and is not listed under the BC Act. The species is a highly migratory species, and occur across the globe between 30-50°S. In Australia, the southern bluefin tuna occurs from northern WA, across the southern region including Tasmania, and up into northern NSW. Juveniles are also known to inhabit nearshore waters in WA. Therefore, it is possible that they may occur in the study area (DCCEEW, 2025b).

3.1.6 Marine Reptiles

Table 5 outlines the likelihood of occurrence of conservation significant reptile species identified within the study area.

Table 5 Likelihood of occurrence of conservation significant reptile species identified within the study area

Common name	Scientific name	National listing	State listing	Presence
		EPBC Act	BC Act/ DBCA	
Turtles				
Flatback turtle	*Natator depressus*	Vulnerable Migratory Marine	Vulnerable Migratory	**Likely** The species has the smallest geographic range among the seven sea turtle species, restricted to tropical regions of the continental shelf and coastal waters of Northern Australia, Southern Indonesia, and Southern Papua New Guinea. Suitable nesting and foraging BIAs for flatback turtles are located south of the study area, making it possible for the species to occur within the study area (Department of Environment and Energy (DoEE), 2017). The Kimberley region is a significant nesting area, particularly on the Lacepede Islands. Studies from the 2009-2010 nesting season tracked several flatback turtles via satellite tags, revealing that individuals remained within 50 km of the Islands during the inter-nesting period. During post-nesting migration, turtles travelled from 17 km to up to 1,005 km, primarily staying within Western Australian waters, including Adele Island, Lacepede Island, and the Maret Islands (north-east of Derby). Migration pathways of flatback turtles nesting in southern rookeries, such as Port Hedland, generally pass the Dampier Peninsula to probable foraging grounds in the Kimberley region (RPS 2010). Given their known migration routes, nearby nesting sites and use of shallow benthic habitats for foraging, it is likely that flatback turtles occur within the study area.
Green turtle	*Chelonia mydas*	Vulnerable Migratory Marine	Vulnerable Migratory	**Likely** Green turtles are the most widespread and abundant turtle species in WA waters, nesting from the Ningaloo coast to the Kimberley islands (Prince, 1994). In Australia, there are seven regional populations the species that nest in different areas: the southern Great Barrier Reef, the northern Great Barrier Reef, the Coral Sea, the Gulf of Carpentaria, WA's north-west shelf, the Ashmore and Cartier Reefs and Scott Reef (DoEE, 2017). Green turtles nesting along the WA coast migrate from feeding grounds in WA, Indonesia, NT and Queensland (DCCEEW, 2021). Desktop analysis of publicly available spatial data identified foraging BIAs for green turtles located south of the study area. Most green turtles that have been tracked from nesting beaches in the Ningaloo region by CSIRO to date have travelled to foraging grounds to the north (TurtleViewR, 2024). The study area is considered to be within the dispersal range of the North-West Shelf genetic stock (DoEE, 2017). Given their known migration routes, nearby nesting sites and use of shallow benthic habitats for foraging, it is likely that green turtles occur within the study area.
Hawksbill turtle	*Eretmochelys imbricata*	Vulnerable Migratory Marine	Vulnerable Migratory	**Likely** The species has a global distribution throughout tropical, sub-tropical and temperate waters, with nesting largely concentrated on sub-tropical beaches. Adults tend to forage in tropical tidal and sub-tidal coral and rock reef habitats where they primarily feed on sponges and algae (DoEE 2017). Key nesting and inter-nesting areas include the Dampier Archipelago, Barrow Island, Lowendal and Thevenard Islands, with areas of Ashmore Reef, Cartier Island and Sandy Island. Given this turtle's regional presence and use of reefs for foraging, it is likely that the Hawksbill turtle occurs in the study area.

Common name	Scientific name	National listing	State listing	Presence
		EPBC Act	BC Act/ DBCA	
Leatherback turtle	*Dermochelys coriacea*	Endangered Migratory Marine	Vulnerable Migratory	**Unlikely** The leatherback turtle has the broadest global distribution of any reptile, primarily nesting on tropical or subtropical beaches. Once found in every ocean except the Arctic and Antarctic, their population is now rapidly declining in many regions (NOAA Fisheries, 2024). In Australia, leatherback turtles inhabit tropical and temperate waters. They are most commonly reported feeding in coastal waters of central eastern Australia (from the Sunshine Coast in southern Queensland to central New South Wales), south-east Australia (including Tasmania, Victoria, and eastern South Australia), and south-western WA (DCCEEW, 2021). Although there are no major nesting areas recorded in Australia, there are scattered records in the NT, Queensland, and NSW (DoEE, 2017). No BIAs for foraging or reproduction have been identified within or near the study area, and their migration ranges seem to occur far offshore. Given the absence of significant feeding and nesting areas, it is unlikely that leatherback turtles are present in the study area.
Loggerhead turtle	*Caretta caretta*	Endangered Migratory Marine	Endangered Migratory	**Possible** The loggerhead turtle has a worldwide tropical and subtropical distribution. In Australia, they occur in tropical and warm temperate waters off the coast of Queensland, NT, WA, and New South Wales (DCCEEW, 2021). Nesting of loggerhead turtles is mainly concentrated on subtropical beaches, with major aggregations occurring to the north of the region, from Shark Bay to the Pilbara. Most loggerhead turtles that have been tracked from nesting beaches in the Ningaloo region by CSIRO to date have travelled to foraging grounds to the north (TurtleViewR; also see Pilcher et al 2021). Additionally, desktop analysis of publicly available information identified foraging BIAs of loggerhead turtles near the study area. Given the known migration route and use of nearby shallow benthic habitats for foraging, it is possible that loggerhead turtles may occur within and adjacent to the study area.
Olive Ridley turtle	*Lepidochelys olivacea*	Endangered Migratory Marine	Endangered Migratory	**Unlikely** The Olive Ridley turtle nests throughout the globe in tropical waters withy migratory circuits through tropical and subtropical regions (Pritchard, 1969). The Australian breeding population is recorded as the largest breeding population remaining in the south-east Asia-western Pacific region (Limpus, 2008). Nesting has only been recorded in the NT and QLD throughout the Gulf of Carpentaria (DoEE, 2017). Additionally, no reproduction or foraging BIAs have been identified within or near the study area. Given the absence of significant feeding and nesting areas, it is unlikely that Olive Ridley turtles are present in the study area.
Crocodiles				
Freshwater crocodile	*Crocodylus johnstoni*	Marine	Specially protected	**Unlikely** Freshwater crocodiles occur along all but the near coastal reaches of the rivers, streams and creeks that flow into the waters off Northern Australia between King Sound in the south-western Kimberley, WA and the northern part of Cape York Peninsula, Queensland (Australian Museum, 2025). Despite the common name, freshwater crocodiles may also occur in brackish waters up to 24% salinity (seawater is 35%) (Australian Museum, 2025). Given the salinity concentration in the study area, it is unlikely that the species is present there.

Common name	Scientific name	National listing	State listing	Presence
		EPBC Act	BC Act/ DBCA	
Saltwater crocodile	*Crocodylus porosus*	Migratory Marine	Specially protected Migratory	**Likely** Saltwater crocodiles are found in Australian coastal waters, estuaries, lakes, inland swamps and marshes. Despite the species' common name, the salt-water crocodile can persist in freshwater bodies. The species' distribution ranges from Rockhampton in Queensland throughout coastal NT to King Sound (near Broome) in WA. Anecdotal observations from Cockatoo Island confirm that saltwater crocodiles occur infrequently within and near the study area.
Monitors				
Mertens water monitor	*Varanus mertensi*	Endangered	-	**Possible** The Mertens water monitor occurs patchily across tropical northern Australia, from the west Kimberley in WA across the Top End of the NT, to the wet tropics in far north Queensland (Qld). The study by Woinarski and Palmer (2013) involved extensive island surveys, detecting Mertens' water monitor on 1 out of 24 islands off the Kimberley coast and on 10 out of more than 66 islands surveyed off the Kimberley and NT coastlines. These islands represented less than 1% of the modelled distribution of Mertens' water monitor. However, given the species' distribution and potential presence on islands, it is possible that the species occurs within the study area.
Mitchell's water monitor	*Varanus mitchelli*	Critically Endangered	-	**Unlikely** The Mitchell's water monitor occurring across the wet-dry tropics of northern Australia from Yampi Sound Training Area in the far west Kimberley of WA across the Kimberley and Top End of the NT to approximately the Boodjamulla National Park area of far northwest Queensland. However, Mitchell's water monitor is not known to occur on any offshore island: general fauna surveys of more than 66 islands across the Kimberley region and the Wessel, English and Tiwi Island groups in the NT have not detected it (DCCEEW, 2023). Therefore, the species is unlikely to occur within the study area.
Sea snakes				
15 sea snake species including **one** Critically Endangered species (Leaf scaled sea snake)	*Aipysurus foliosquama*	Critically Endangered Marine	-	**Unlikely** (leaf scaled sea snake) The species is known to inhabit shallow waters (less than 10 m deep), particularly in protected areas of the reef flat, adjacent to living coral, and on coral substrates. It is found exclusively on the reefs of the Sahul Shelf in WA, especially on Ashmore and Hibernia Reefs in the North-west Bioregion (DCCEEW, 2025d). Therefore, it is unlikely that the species occur in the study area. **Possible** (other species) There is a potential that other sea snake species occur within the study area (e.g. the widely distributed sea snakes).

Flatback turtle

Natator depressus (flatback turtle) is listed as Vulnerable and Marine Migratory under the EPBC Act and Vulnerable and Migratory under the BC Act. The species has the smallest geographic range among the seven sea turtle species, restricted to tropical regions of the continental shelf and coastal waters of Northern Australia, Southern Indonesia, and Southern Papua New Guinea. Suitable nesting (see Figure 8) and desktop analysis of publicly available spatial data identified foraging BIAs for flatback turtles are located south of the study area (DoEE, 2017).

The Kimberley region is a significant nesting area, particularly on the Lacepede Islands. Studies from the 2009-2010 nesting season tracked several flatback turtles via satellite tags, revealing that individuals remained within 50 km of the Islands during the inter-nesting period. During post-nesting migration, turtles travelled from 17 km to up to 1,005 km, primarily staying within Western Australian waters, including Adele Island, Lacepede Island, and the Maret Islands (north-east of Derby).

Migration pathways of flatback turtles nesting in southern rookeries, such as Port Hedland, generally pass the Dampier Peninsula to probable foraging grounds in the Kimberley region (RPS 2010).

Given their known migration routes, nearby nesting sites and use of shallow benthic habitats for foraging, it is likely that flatback turtles occur within the study area.

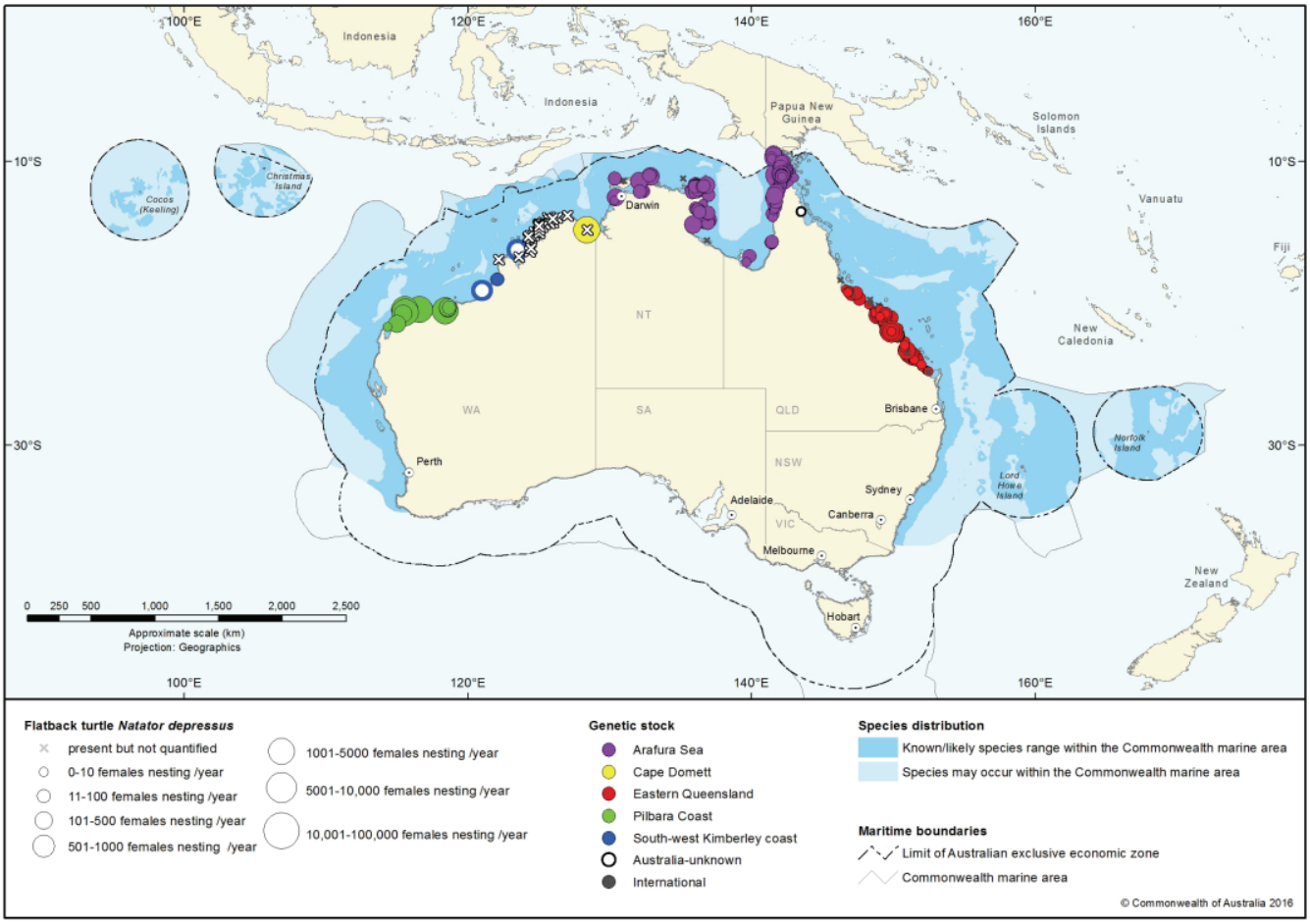


Figure 8 *Flatback turtle nesting sites in Australia and surrounding regions (DoEE, 2017)*

Green turtle

Chelodina mydas (green turtle) listed as Vulnerable and Marine Migratory under the EPBC Act and Vulnerable and Migratory under the BC Act, are the most widespread and abundant turtle species in WA waters, nesting from the Ningaloo coast to the Kimberley islands (Prince, 1994). In Australia, there are seven regional populations the species that nest in different areas: the southern Great Barrier Reef, the northern Great Barrier Reef, the Coral

Sea, the Gulf of Carpentaria, WA's north-west shelf, the Ashmore and Cartier Reefs and Scott Reef (DoEE, 2017) (see Figure 9). Green turtles nesting along the WA coast migrate from feeding grounds in WA, Indonesia, NT and Queensland (DCCEEW, 2021).

Desktop analysis of publicly available spatial data identified foraging BIAs for green turtles located south of the study area. Most green turtles that have been tracked from nesting beaches in the Ningaloo region by CSIRO to date have travelled to foraging grounds to the north (TurtleViewR, 2024). The study area is considered to be within the dispersal range of the North-West Shelf genetic stock (DoEE, 2017).

Given the known migration route, nearby nesting sites and use of shallow benthic habitats for foraging, it is likely that green turtles could occur within and adjacent to the study area.

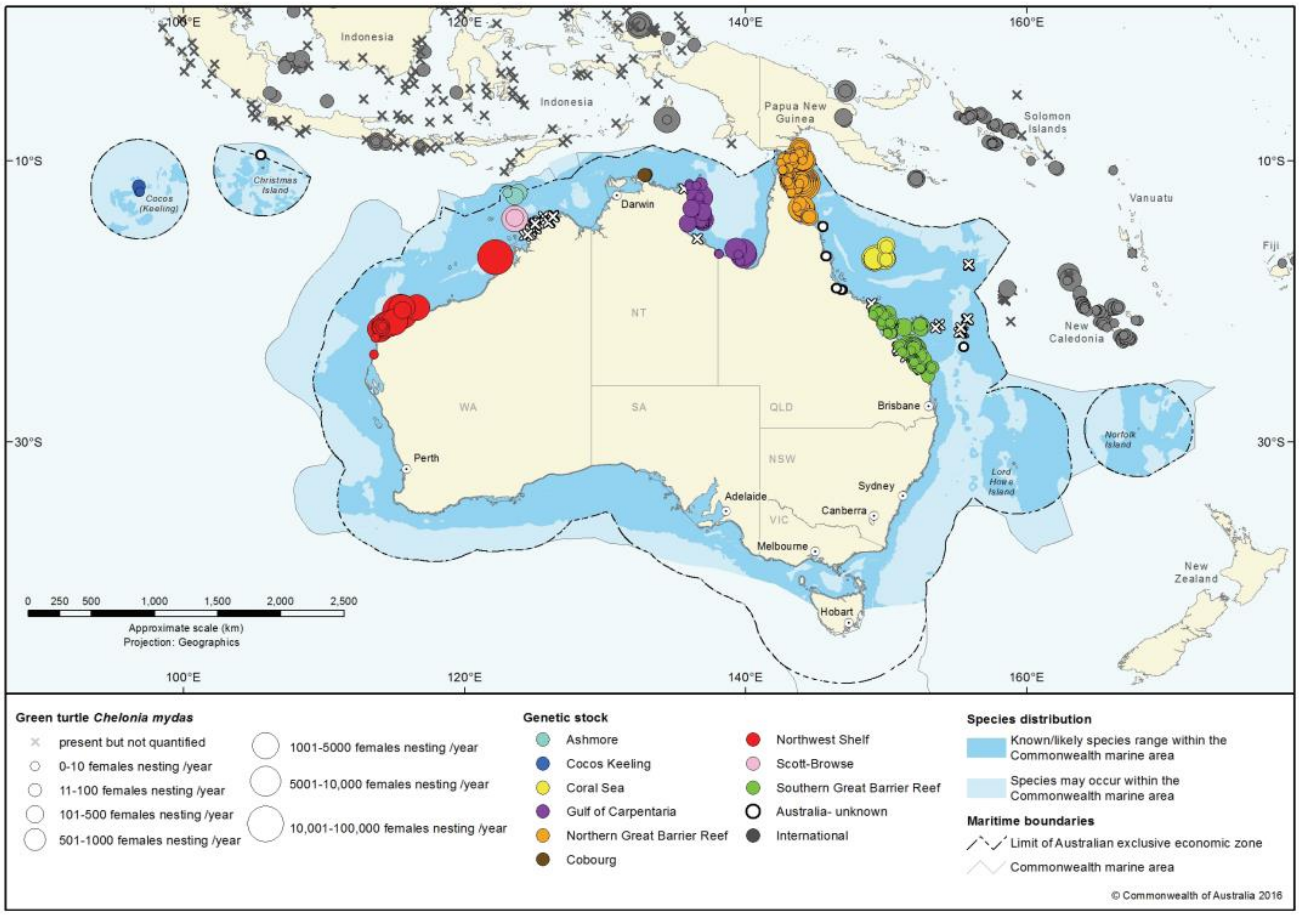


Figure 9 *Green turtle nesting sites in Australia and surrounding regions (DoEE, 2017)*

Hawksbill turtle

Eretmochelys imbricata (Hawksbill turtle) is listed as Vulnerable and Marine Migratory under the EPBC Act and Vulnerable and Migratory under the BC Act. The species has a global distribution throughout tropical, sub-tropical and temperate waters, with nesting largely concentrated on sub-tropical beaches (Marquex 1990). Adults tend to forage in tropical tidal and sub-tidal coral and rock reef habitats where they primarily feed on sponges and algae (DoEE 2017). Key nesting and inter-nesting areas include the Dampier Archipelago, Barrow Island, Lowendal and Thevenard Islands, with areas of Ashmore Reef, Cartier Island and Sandy Island (see Figure 10). Given this turtle's regional presence and use of reefs for foraging, it is likely that the Hawksbill turtle occur in the study area.

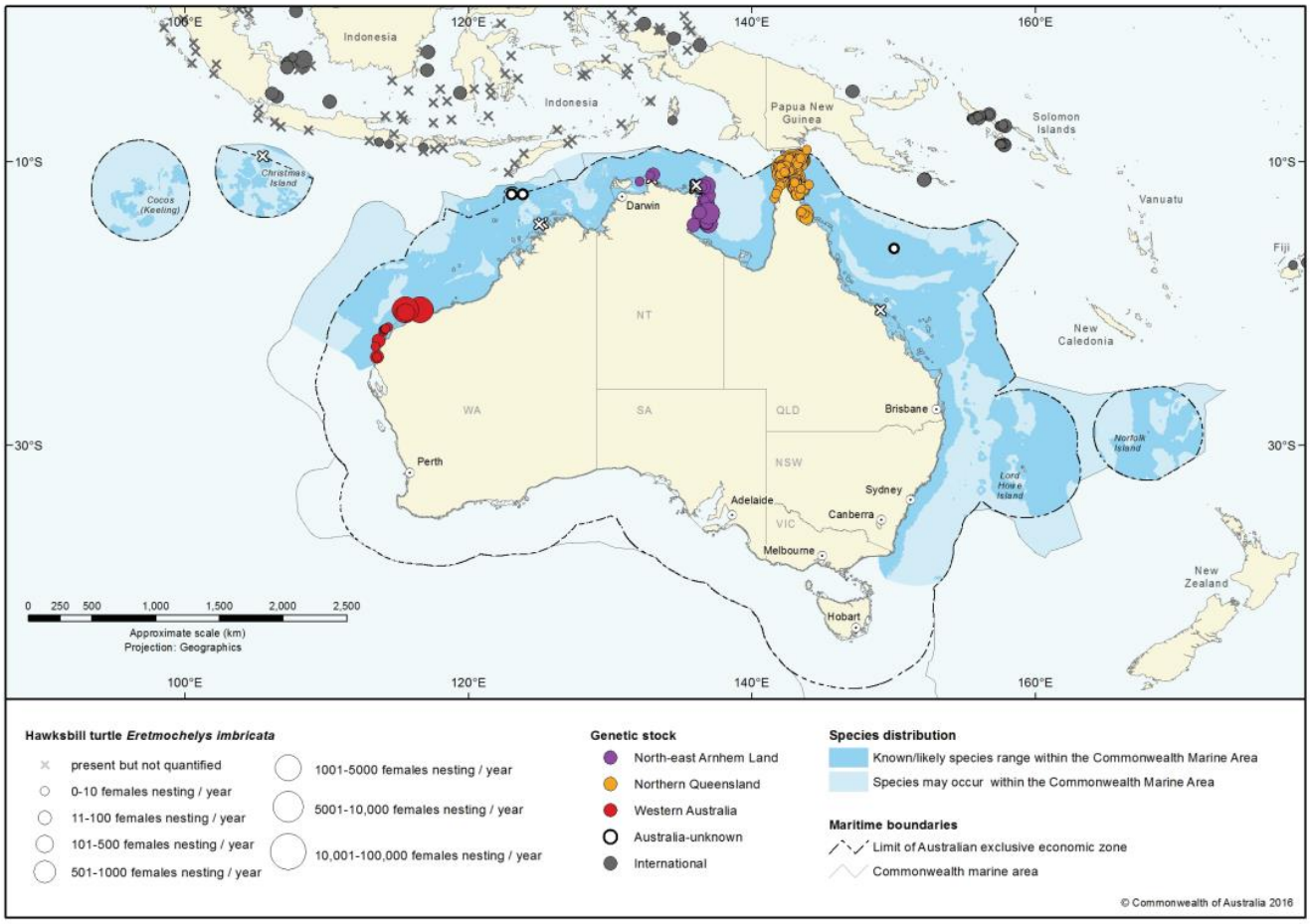


Figure 10 Hawksbill turtle nesting sites in Australia and surrounding regions (DoEE, 2017)

Leatherback turtle

Dermochelys coriacea (leatherback turtle) is listed as Endangered and Marine Migratory under the EPBC Act and Vulnerable and Migratory under the BC Act. The leatherback turtle has the broadest global distribution of any reptile, primarily nesting on tropical or subtropical beaches. Once found in every ocean except the Arctic and Antarctic, their population is now rapidly declining in many regions (NOAA Fisheries, 2024).

In Australia, leatherback turtles inhabit tropical and temperate waters. They are most commonly reported feeding in coastal waters of central eastern Australia (from the Sunshine Coast in southern Queensland to central New South Wales), south-east Australia (including Tasmania, Victoria, and eastern South Australia), and south-western WA (DCCEEW, 2021). Although there are no major nesting areas recorded in Australia, there are scattered records in the NT, Queensland, and NSW (DoEE, 2017). No BIAs for foraging or reproduction have been identified within or near the study area, and their migration ranges seem to occur far offshore (see Figure 11).

Given the absence of significant feeding and nesting areas, it is unlikely that leatherback turtles are present in the study area.

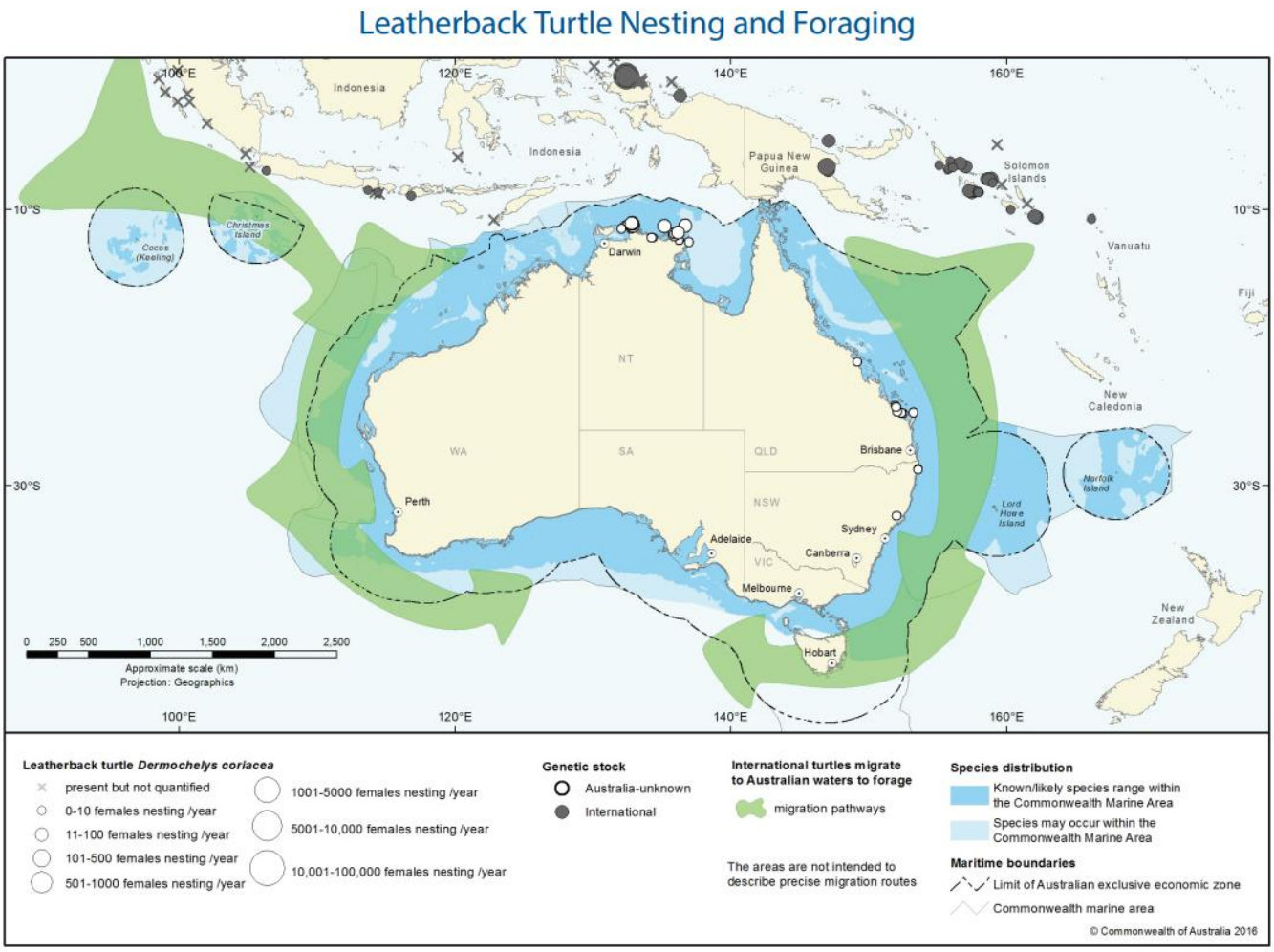


Figure 11 Leatherback turtle nesting and foraging distribution in Australia (DoEE, 2017)

Loggerhead turtle

Carretta carretta (loggerhead turtle), listed as Endangered and Migratory under the EPBC Act and Endangered and Migratory under the BC Act, has a worldwide tropical and subtropical distribution. In Australia, they occur in tropical and warm temperate waters off the coast of Queensland, NT, WA, and New South Wales (DCCEEW, 2021).

Nesting of loggerhead turtles is mainly concentrated on subtropical beaches, with major aggregations occurring to the north of the region, from Shark Bay to the Pilbara (see Figure 12). Most loggerhead turtles that have been tracked from nesting beaches in the Ningaloo region by CSIRO to date have travelled to foraging grounds to the north (TurtleViewR; also see Pilcher et al 2021). Additionally, desktop analysis of publicly available information identified foraging BIAs of loggerhead turtles near the study area.

Given the known migration route and use of nearby shallow benthic habitats for foraging, it is possible that loggerhead turtles may occur within and adjacent to the study area.

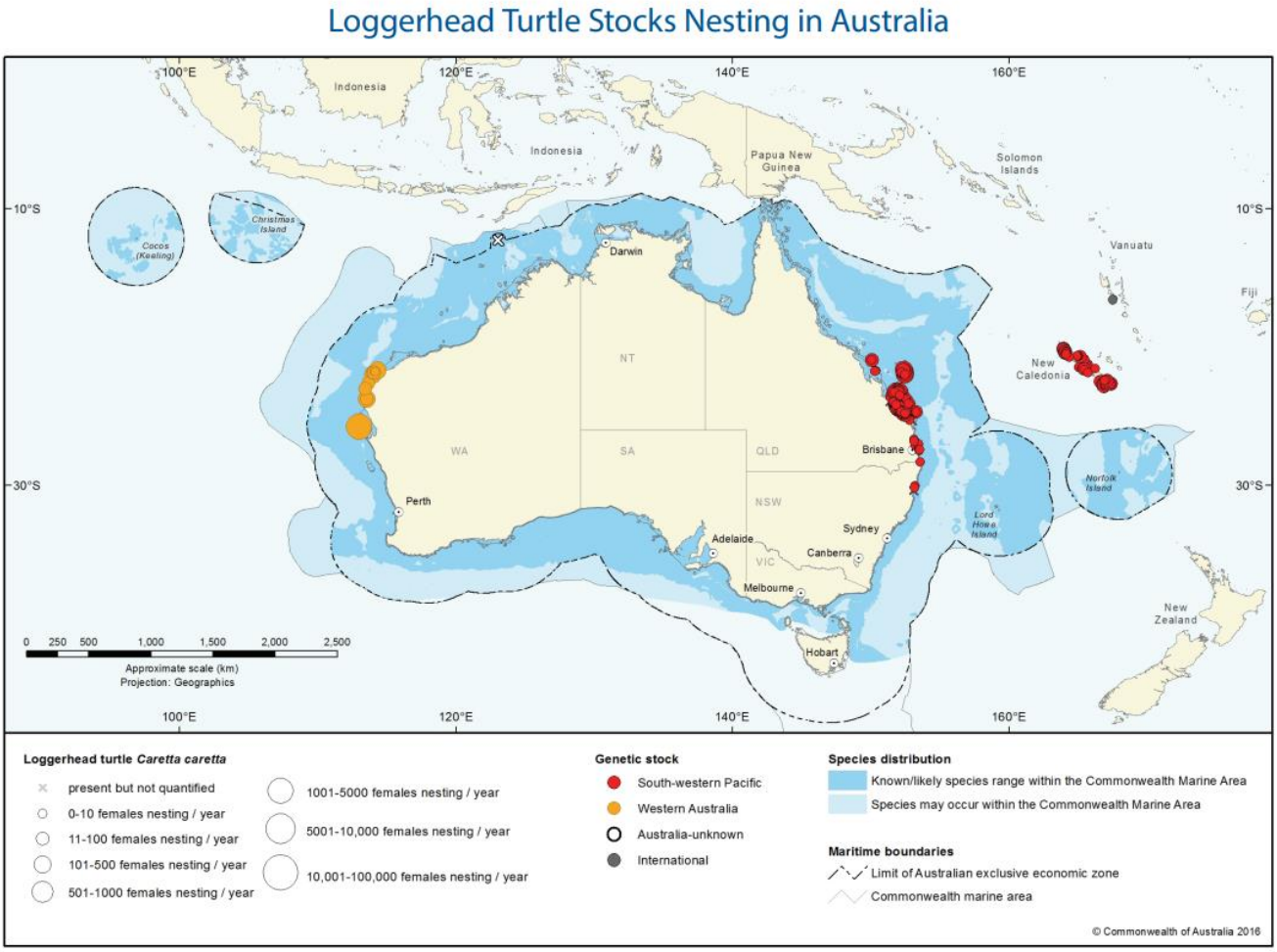


Figure 12 Loggerhead turtle distribution and nesting locations in Australia

Olive Ridley turtle

Lepidochelys olivacea (Olive Ridley turtle) is listed as Endangered and Marine Migratory under the EPBC Act and listed as Endangered under the BC Act. The species nests throughout the globe in tropical waters with migratory circuits through tropical and subtropical regions. The Australian breeding population is recorded as the largest breeding population remaining in the south-east Asia-western Pacific region (Limpus, 2008). Nesting has only been recorded in the NT and Queensland throughout the Gulf of Carpentaria (DoEE, 2017) (see Figure 12). Additionally, no reproduction or foraging BIAs have been identified near the study area.

Given the absence of significant feeding and nesting areas, it is unlikely that leatherback turtles are present in the study area.

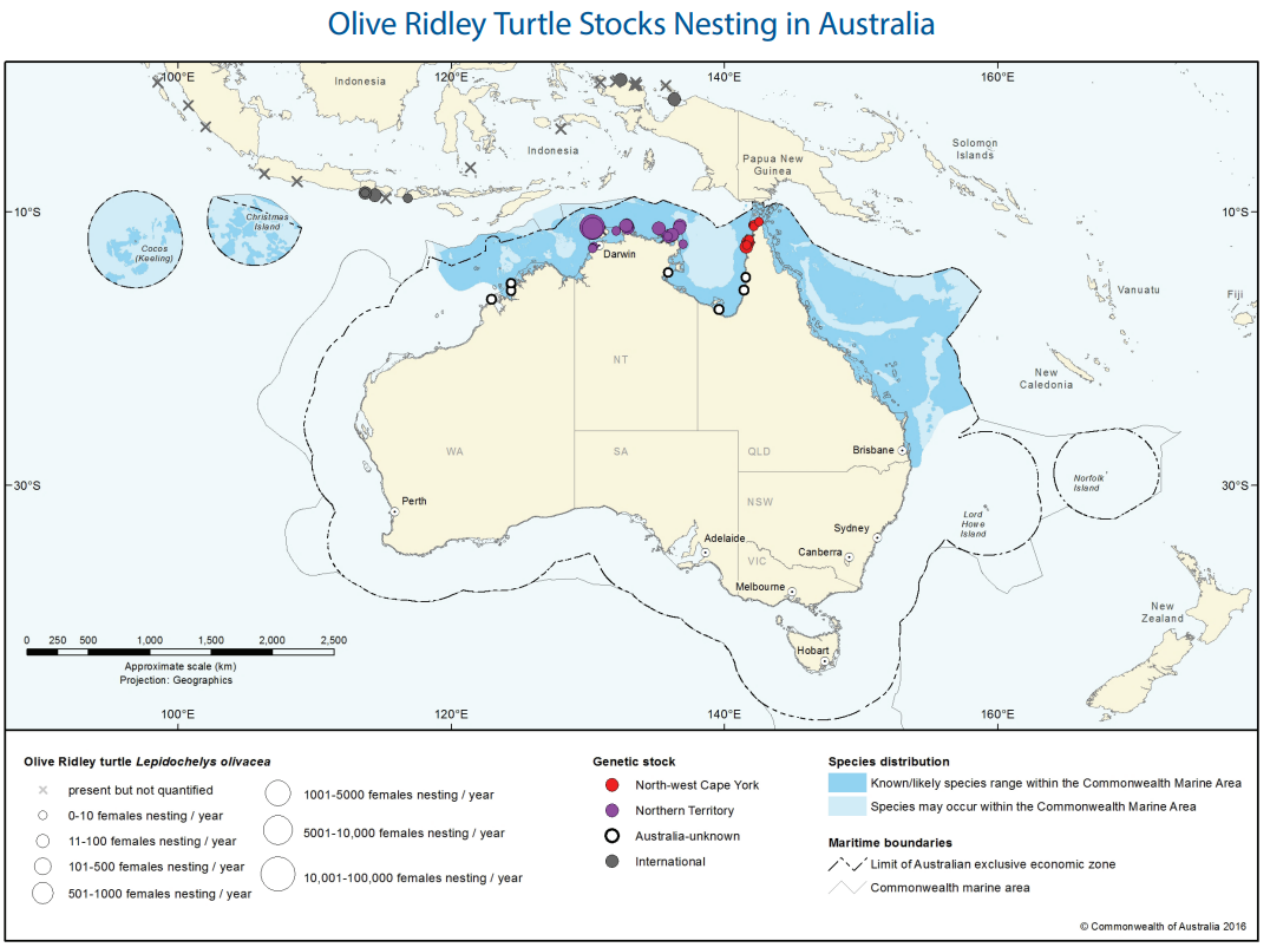


Figure 13 *Olive Ridley turtle distribution and nesting location in Australia*

Freshwater and Saltwater Crocodile

Crocodylus johnstoni (freshwater crocodile) listed as Marine under the EPBC Act, occur along all but the near coastal reaches of the rivers, streams and creeks that flow into the waters off northern Australia between King Sound in the south-western Kimberley, WA and the northern part of Cape York Peninsula, Queensland (Australian Museum, 2025).

Despite the common name, freshwater crocodiles may also occur in brackish waters up to 24% salinity (seawater is 35%) (Australian Museum, 2025). Given the salinity concentration in the study area, it is unlikely that the species is present there.

Crocodylus porosus (salt-water crocodile) listed as Marine Migratory under the EPBC Act and Migratory under the BC Act, is found in Australian coastal waters, estuaries, lakes, inland swamps and marshes. Despite the species' common name, the salt-water crocodile can persist in freshwater bodies. The species' distribution ranges from Rockhampton in Queensland throughout coastal NT to King Sound (near Broome) in WA).

Anecdotal observations from Cockatoo Island confirm that saltwater crocodiles occur infrequently near the study area.

Mitchells and Mertens water monitors

Varanus mitchelli (Mitchell's water monitor) is listed as Critically Endangered under the EPBC Act, occurring across the wet-dry tropics of northern Australia from Yampi Sound Training Area in the far west Kimberley of WA across the Kimberley and Top End of the NT, to approximately the Boodjamulla National Park area of far northwest Queensland (see Figure 14). However, Mitchell's water monitor is not known to occur on any offshore island: general fauna surveys of more than 66 islands across the Kimberley region and the Wessel, English and Tiwi Island groups in the NT have not detected it (Woinarski et al. 1999, 2003; Palmer et al. 2013; DAC unpublished data). Therefore, the species is unlikely to occur within the study area.

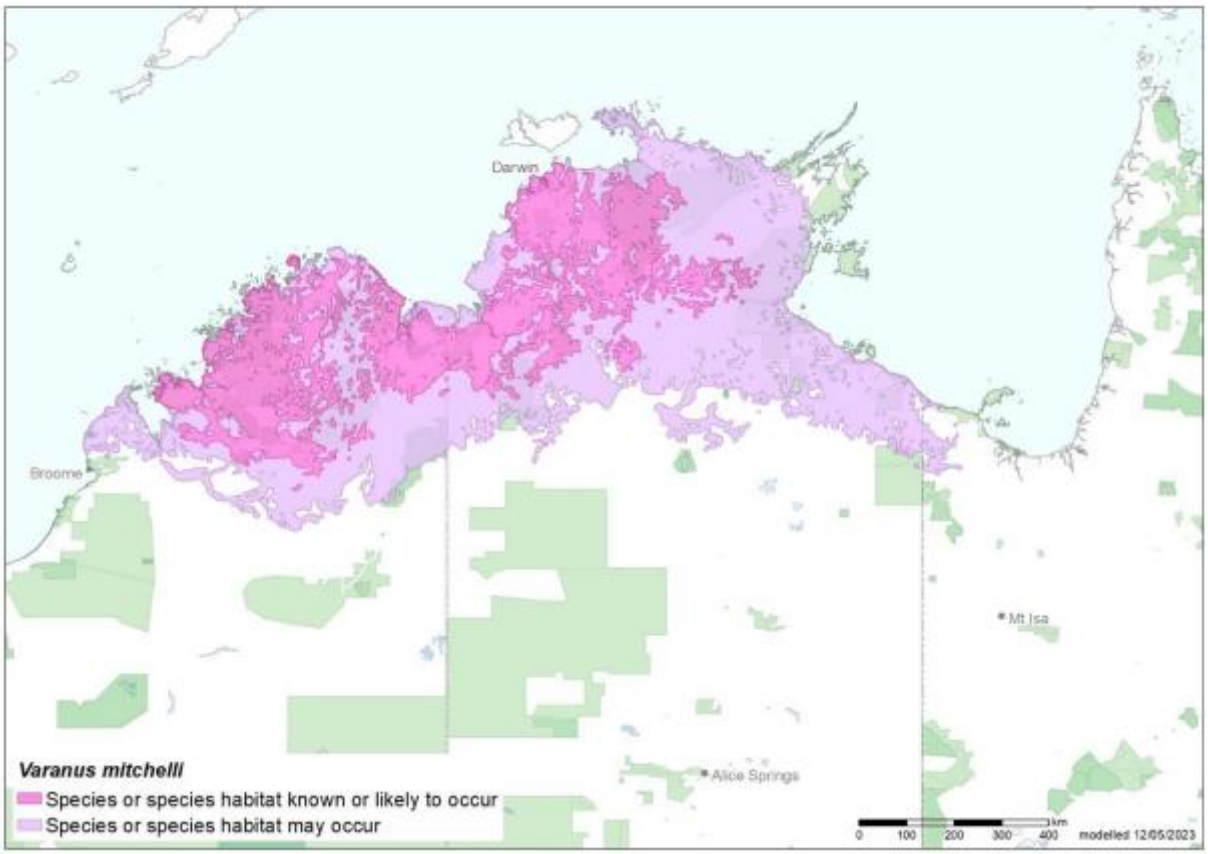


Figure 14 Modelled distribution of Mitchell's water monitor (DCCEEW, 2023)

Varanus mertensi (Mertens water monitor), listed as Endangered under the EPBC Act, occurs patchily across tropical northern Australia, from the west Kimberley in WA across the Top End of the NT, to the wet tropics in far north Queensland (Qld) (see Figure 15).

The study by Woinarski and Palmer (2013) involved extensive island surveys, detecting Mertens' water monitor on 1 out of 24 islands off the Kimberley coast and on 10 out of more than 66 islands surveyed off the Kimberley and NT coastlines. These islands represented less than 1% of the modelled distribution of Mertens' water monitor. However, given the species' distribution and potential presence on islands, it is possible that the species occurs within the study area

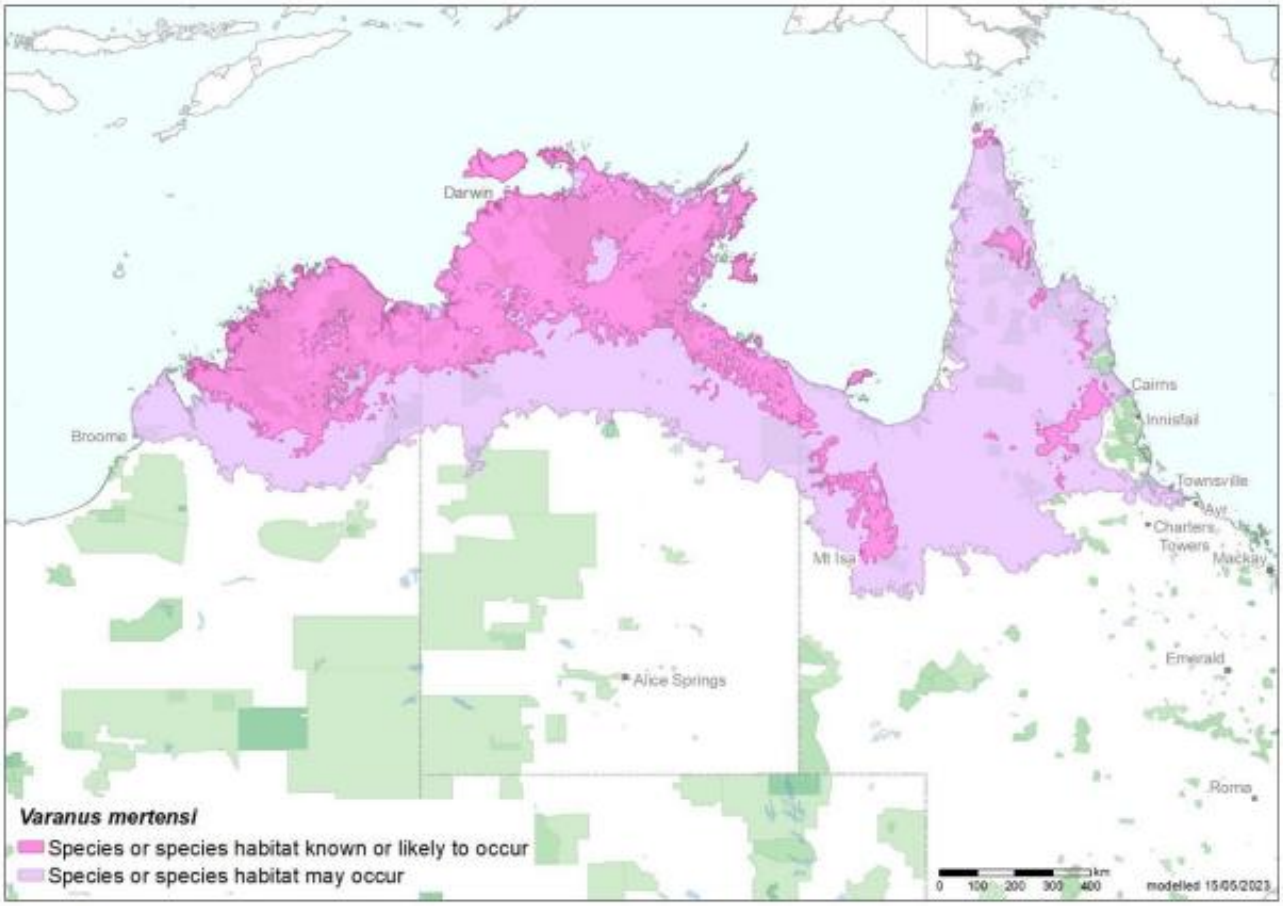


Figure 15 Modelled distribution of Mertens water monitor (DCCEEW, 2023a)

Sea snakes

Aipysurus foliosquama (leaf scaled sea snake) is listed as Critically Endangered and Marine under the EPBC Act. The leaf scale sea snake is a small viviparous, slender snake with an average length of 60 cm, although individuals have been recorded up to 90 cm in length. The species has a small head with large and usually symmetrical scales and pointed snout. The species is dark blackish-brown or purplish in colour with paler cross bands and scattered pale spots with smooth imbricate scales (Threatened Species Scientific Committee, 2011).

The species is known to inhabit shallow waters (less than 10 m deep), particularly in protected areas of the reef flat, adjacent to living coral, and on coral substrates. It is found exclusively on the reefs of the Sahul Shelf in WA, especially on Ashmore and Hibernia Reefs in the North-west Bioregion (DCCEEW, 2025d). Therefore, it is unlikely that the species occur in the study area.

There is a potential that other sea snake species occur within the study area (e.g. the widely distributed yellow bellied sea snake).

3.2 Field Survey

This Section details field data results from BCH surveys taken from the 2017 report “Cockatoo Island Multi-User Supply Base: Technical Study Marine Flora and Fauna”.

Seven hundred and twenty-three sites were surveyed across the three bays. The location and distribution of these sites are shown in Figure 16. Opportunistic surveys of the ship loader piles were also undertaken to characterise marine life colonisation of these metal structures.

3.2.1 Marine Substrate

The dominant substrate across the three bays was sand with fewer sites comprised of silt, gravel/pebbles, coral rubble and rocks. All three bays had similar substrate patterns with rocky habitats around the shoreline and sandy bottoms in the centre, though Bay 2 had considerably greater proportion of rocky substrate (21%) than the other two bays (1-8%). A breakdown of the seabed substrate and its spatial distribution is shown in Table 6. Examples of substrate observations are illustrated in Plate 1.

Table 6 Substrate percentages within each of the three bays

Bay	Silt	Sand	Gravel/Pebbles	Coral Rubble	Rocky
Bay 1 (proposed wharf site)	0%	91%	1%	0%	8%
Bay 2	0%	71%	5%	3%	21%
Bay 3 (Copper Bay)	<1%	98%	0%	<1%	1%

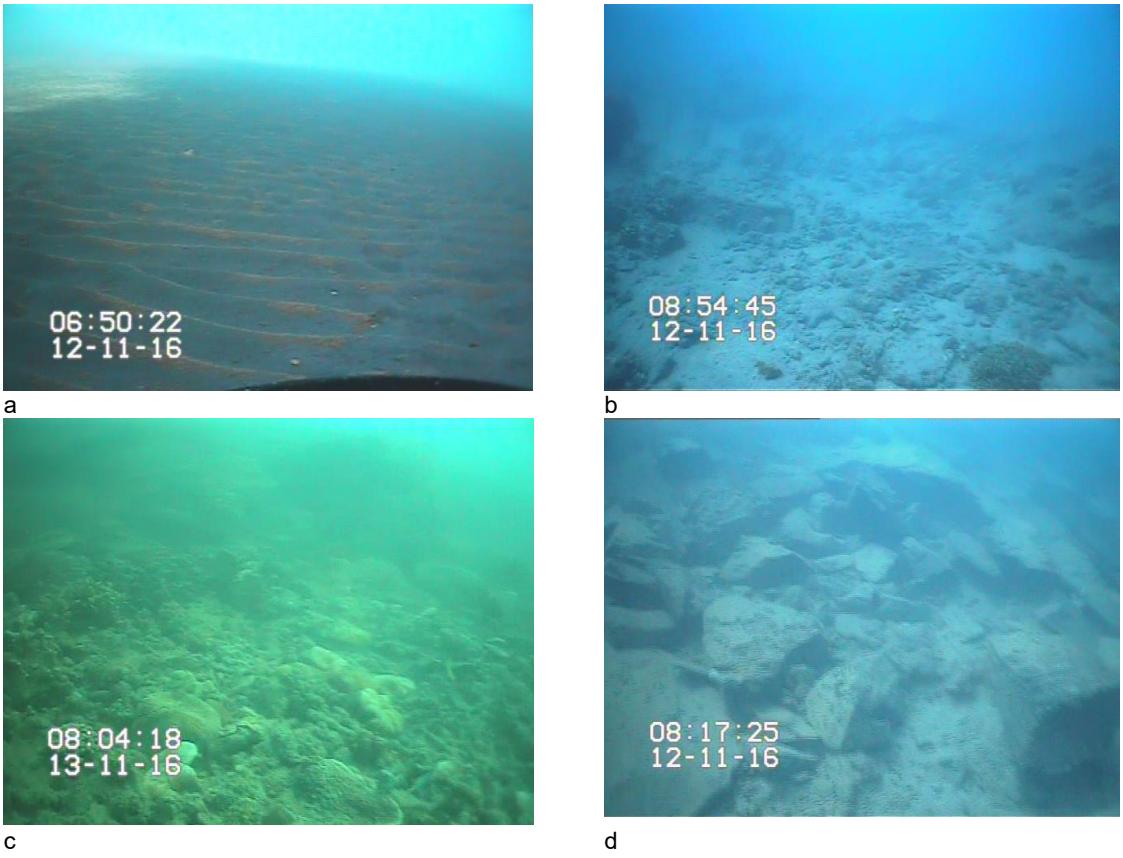
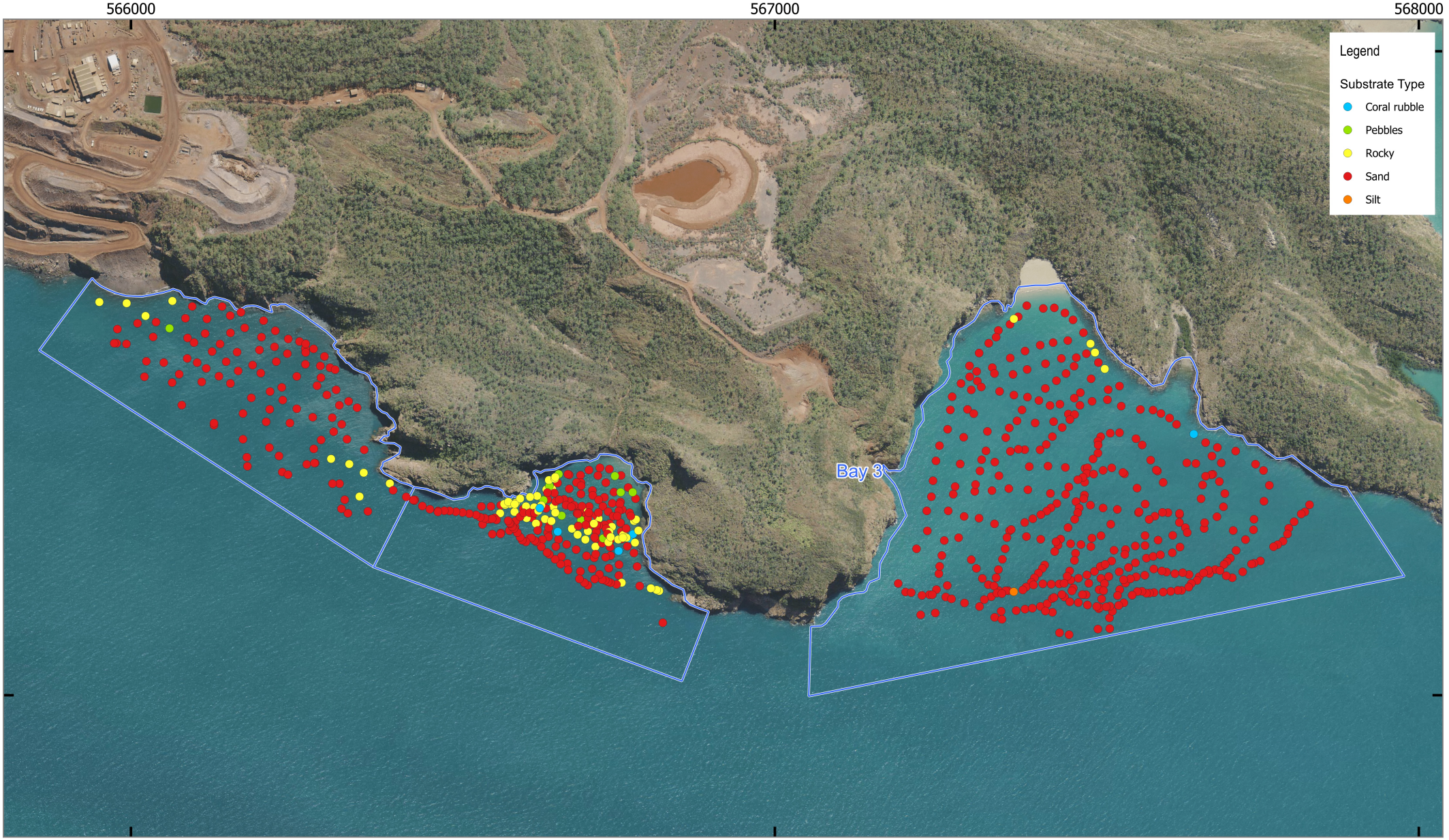


Plate 1 Observations of dominant substrate types including a) sand, b) pebbles, c) coral rubble and d) rocky



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Map Projection: Mercator Auxillary Sphere
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Kimberley Technology Solutions

Cockatoo Island Multi-User Supply Base

Substrate Type

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Date. **28/03/2025**

FIGURE 16

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3.2.2 Marine Habitats

Overview

All three bays had similar physical attributes with gently sloping sandy beaches from the shore to approximately 0 m LAT. Because of the large tidal range, much of this sandy area is likely to be exposed or very shallow at low spring tides. These areas were observed to be very sparsely colonised by hard coral and macroalgae (particularly *Chlorodesmis* spp "turtle weed"). Rocky environments were common in deeper waters around the headlands and were observed to be colonised only by turfing algae. As the depth increases, sandy habitats are more densely colonised by macroalgae and hard coral until approximately -5 m LAT. Thereafter, the slope profile steeply descends to -20 m LAT where generally only rippled sand was present with sparse hydroids and soft coral.

Bay 1 – Proposed Wharf Area

The survey area for Bay 1 was approximately 7.55 ha. Shallow (below 0 m LAT) sandy habitats extended from the shoreline for approximately 120 m and steeply descended thereafter to -20 m LAT. Of the 110 survey sites in this Bay, 67% were comprised of bare substrate (see Table 7).

Macroalgae was observed at 21% of all sites with the majority comprised of very sparse to sparse coverage, and limited to shallower than -15 m LAT (see Figure 17). While fine grain identification of algae was not possible through video analysis, macroalgae included *Caulerpa* spp. and *Chlorodesmis* spp.

Hard coral occurred at 15% of sites primarily at the south-eastern edge of the bay (see Figure 18). Hard coral coverage was moderate to dense. Several sites outside of this south-eastern edge of the bay had very sparse hard coral cover. Most sites with hard corals were shallower than -5 to -10 m LAT. While fine grain identification of hard corals was not possible through video analysis, corals included:

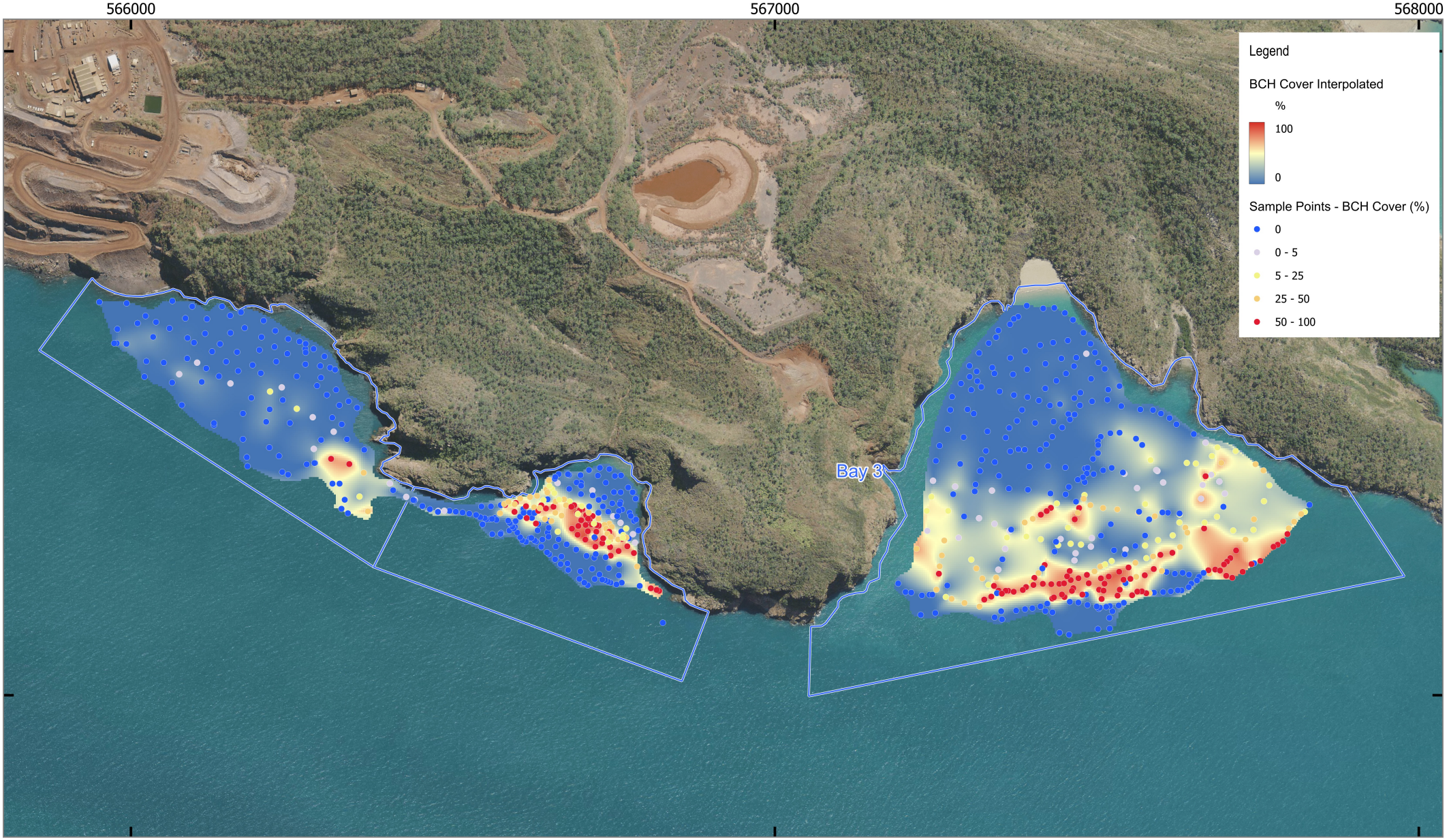
– Foliose forms of *Turbinaria*;
– Massive and sub-massive forms of *Porites*;
– Branching *Acropora*; and
– Other corals from the families Acroporidae, Faviidae and Pocilloporidae.

Soft coral and hydroids were observed at less than 10% of sites (Table 7) Video stills of sites at key areas throughout Bay 1 are shown in Figure 19.

Table 7 Marine habitat types within Bay 1

Marine Habitat Types	Observation %	Marine Habitat	Observation %
Bare	**67**	**Soft Coral**	**6**
Macroalgae	**21**		
Dense	0	Dense	0
Moderate	4	Moderate	0
Sparse	65	Sparse	89
Very Sparse	30	Very Sparse	0
Hard Coral	**15**	**Hydroids**	**8**
Dense	13	Dense	0
Moderate	13	Moderate	11
Sparse	19	Sparse	89
Very Sparse	56	Very Sparse	0

Note: Multiple marine habitat types were observed at some sites and therefore the cumulative percentages are >100%.



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Map Projection: Mercator Auxillary Sphere
Horizontal Datum: GDA 1994
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Cockatoo Island Multi-User Supply Base

Benthic communities and habitats

Project No. **12526793**
Revision No. **A**
Date. **28/03/2025**

FIGURE 17

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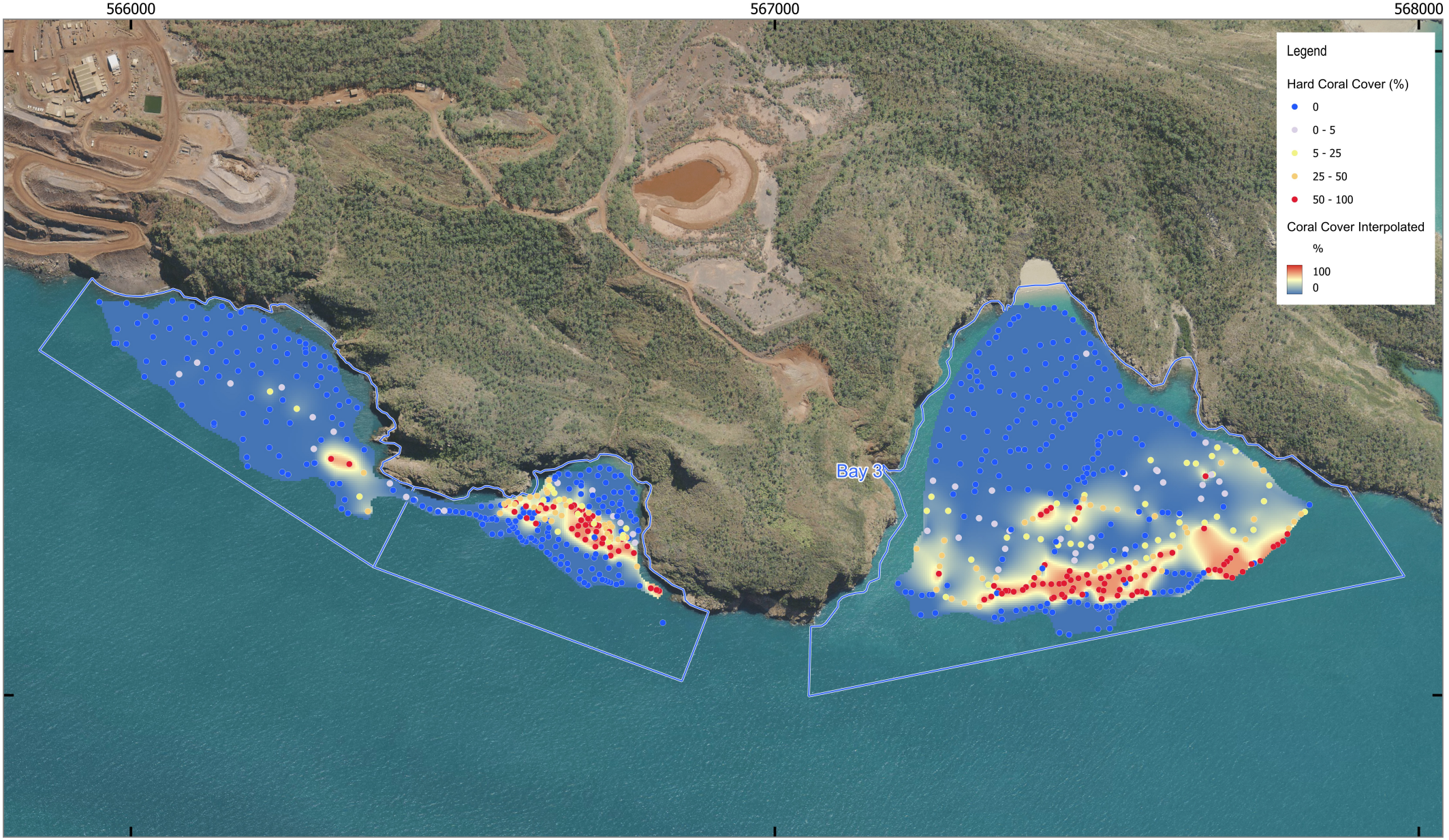

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Map Projection: Mercator Auxillary Sphere
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Hard Coral Coverage

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Date. **28/03/2025**

FIGURE 18

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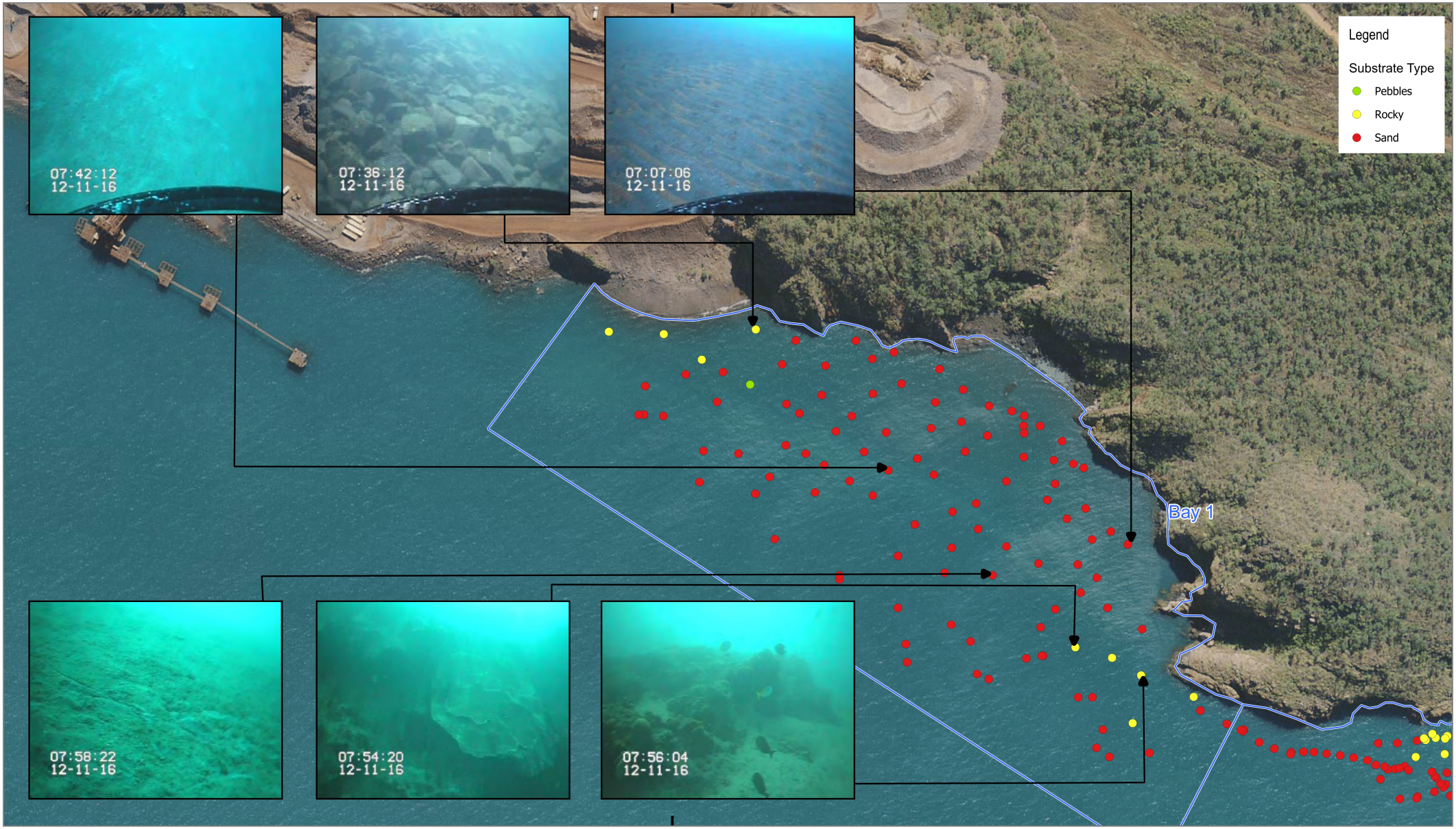

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Cockatoo Island Multi-User Supply Base

Marine Habitat and Substrate Observations in Bay 1

Project No. **12526793**
Revision No. **A**
Date. **28/03/2025**

FIGURE 19

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Bay 2

The survey area for Bay 2 was approximately 3.47 ha. Shallow sandy habitats extended from the shoreline to approximately 360 m with a band of hard coral prior to the steep drop-off. Of the 235 sites in Bay 2, 47% had bare substrate (see Table 8).

Macroalgae were observed at 30% of the Bay 2 sites. The majority of these sites had sparse coverage (Figure 17). While fine grain identification of macrolgae was not possible through video analysis, types included *Caulerpa* spp and *Chlorodesmis* spp.

Hard corals were observed at 43% of sites with the majority restricted to approximately a 50 m band width across the bay (Figure 18). Approximately 80% of all coral sites had moderate to dense coverage. While fine grain identification of hard corals was not possible through video analysis, corals included:

– Foliose forms of *Turbinaria*;
– Massive and sub-massive forms of *Porites*;
– *Fungia*;
– Branching *Acropora*; and
– Other corals from the families Acroporidae, Faviidae and Pocilloporidae.

Soft corals were observed at 1% of the Bay 2 sites (Table 8). Video stills of marine features of Bay 2 are shown in Plate 1.

Table 8 Marine habitat types within Bay 2

Marine Habitat Types	Observation %	Marine Habitat	Observation %
Bare	**47**	**Soft Coral**	**1**
Macroalgae	**30**		
Dense	3	Dense	0
Moderate	11	Moderate	0
Sparse	66	Sparse	50
Very Sparse	20	Very Sparse	50
Hard Coral	**43**	**Hydroids**	**0**
Dense	46	Dense	0
Moderate	32	Moderate	0
Sparse	14	Sparse	0
Very Sparse	9	Very Sparse	0

Note: Multiple marine habitat types were observed at some sites and therefore the cumulative percentages are >100%

Bay 3 (Copper Bay)

The survey area for Bay 3 (Copper Bay) was approximately 19.64 ha. Shallow sandy habitats extend from the shoreline for approximately 400 m, then transition into a deeper band of hard coral before steeply descending down the drop-off. Of the 378 sites in Bay 3, 38% had bare substrate (Table 9).

Macroalgae were observed at 36% of the Bay 3 sites (Figure 17). The majority of these sites had sparse coverage. While fine grain identification of macroalgae was not possible through video analysis, types included *Caulerpa* spp and *Chlorodesmis* spp.

a

b

Plate 1 Observations of marine habitats at Bay 2 where a) and b) are areas of dense hard coral, and c) is of the steep drop off with hard coral

Table 9 Marine habitat types within Bay 3 (Copper Bay)

Marine Habitat Types	Observation %	Marine Habitat	Observation %
Bare	**47**	**Soft Coral**	**1**
Macroalgae	**30**		
Dense	3	Dense	0
Moderate	11	Moderate	0
Sparse	66	Sparse	50
Very Sparse	20	Very Sparse	50
Hard Coral	**43**	**Hydroids**	**0**
Dense	46	Dense	0
Moderate	32	Moderate	0
Sparse	14	Sparse	0
Very Sparse	9	Very Sparse	0

Note: Multiple marine habitat types were observed at some sites and therefore the cumulative percentages are >100%

Hard corals were observed at 49% of the bay's sites with the majority of corals restricted to approximately a 50 m wide band across the bay (Figure 18). Approximately 60% of all coral observations were moderate to dense coverage. While fine grain identification of hard corals was not possible through video analysis, corals included:

– Foliose forms of *Turbinaria*;
– Massive and sub-massive forms of *Porites*;
– *Fungia*;
– Branching *Acropora*; and
– Other corals from the families Acroporidae, Faviidae and Pocilloporidae.

Soft corals and hydroids were observed at less than 2% the bay's sites (Table 9). Video stills of marine features of Bay 3 are shown in Plate 2.

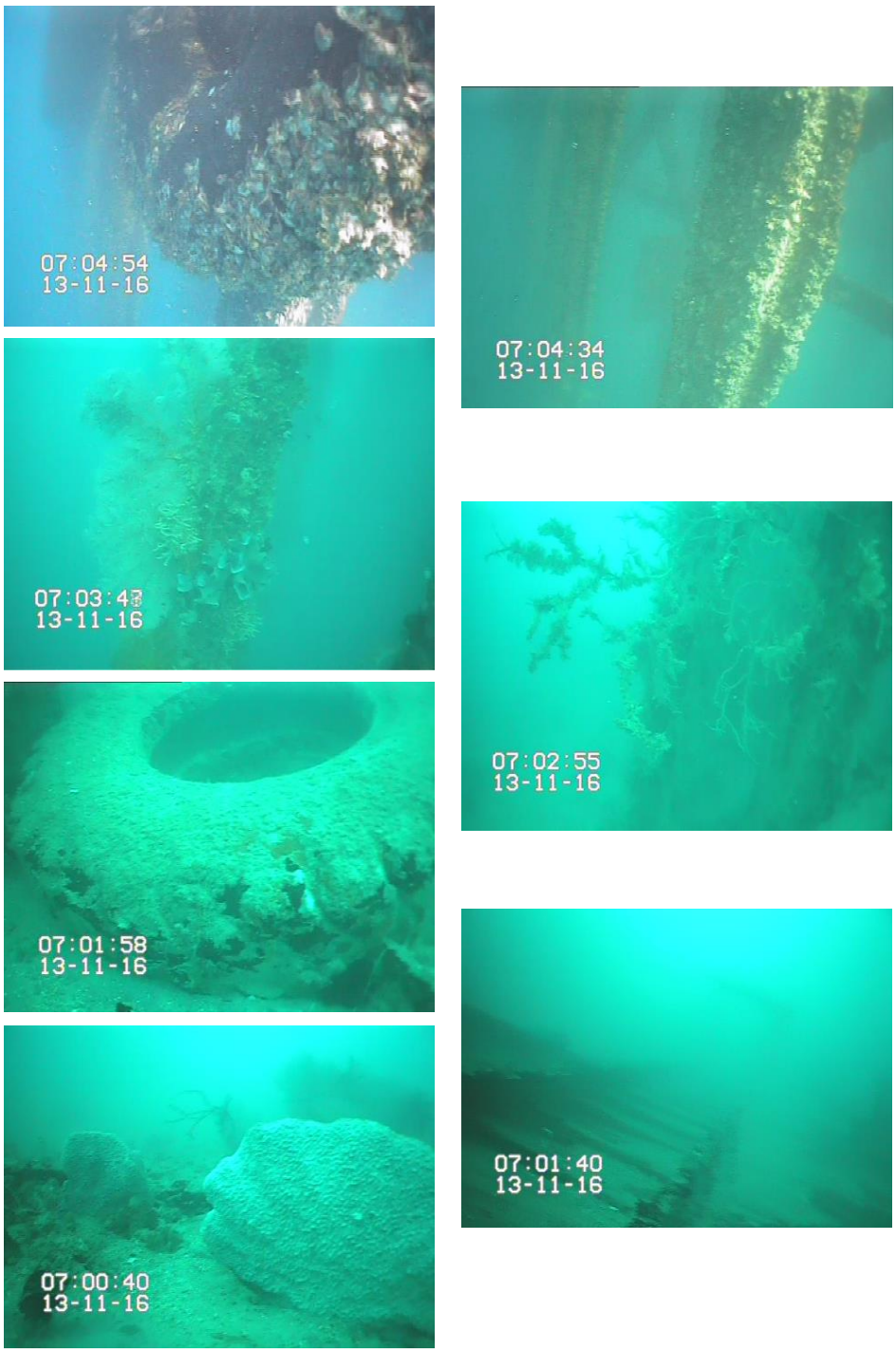
a b c d

Plate 2 Observations of marine habitats at Bay 3 where a) and b) are areas of dense hard coral, and c) and d0 are soft coral Gorgonians

Pile Survey

An opportunistic survey was undertaken to assess the marine environment near to and on the piles of the ship loader. Images of the ship loader pile environment are illustrated in Plate 3. At the seafloor, sparse soft corals, macroalgae and hydroids were noted. Deeper sections of the piles were colonised by hydroids and macroalgae, and shallower (and likely intertidal) portions were heavily encrusted by bivalves.

Shallow



Moderate Depth

Deep

Plate 3 Observations of the marine environment at the base of the ship loader piles and growth on the piles

4. Discussion

4.1 Marine Fauna

There is the potential for threatened and listed marine fauna to occur near to the proposed wharf development that may be indirectly impacted during construction and operation of the facility.

Six listed species were assessed as likely to occur within the study area including:

- Australian humpback dolphin (listed Cetacean, Migratory under the EPBC Act and Priority 4 Migratory under the BC act)
- Indian ocean bottlenose dolphin (listed Cetacean under the EPBC Act and Migratory under the BC act)
- Flatback turtle (Vulnerable, Marine Migratory under the EPBC Act and Migratory under the BC Act)
- Green turtle (Vulnerable, Marine Migratory under the EPBC Act and Migratory under the BC Act)
- Hawksbill turtle (Vulnerable, Marine Migratory under the EPBC Act and Migratory under the BC Act)
- Saltwater crocodile (Marine Migratory under the EPBC Act and Migratory under the BC Act)

Twelve additional species were assessed as possibly occurring within the study area, including the dugong, freshwater sawfish, green sawfish, narrow sawfish, northern river shark, oceanic whitetip shark, scalloped hammerhead, giant manta ray, reef manta ray, southern bluefin tuna, loggerhead turtle and Mertens water monitor, as well as twenty-four Syngnathid species and fourteen sea snake species.

4.2 Benthic Communities and Habitats

The focus of the field survey was to characterise the BCH in the bay proposed for wharf development (Bay 1) and the two adjacent bays to the southeast (Bay 2 and Bay 3).

The survey identified that the estimated percentage of bare substrate in Bay 1 (67.3%) is substantially higher than in Bay 2 (47.2%) and Bay 3 (37.6%), likely due to Bay 1 having been impacted by nearby mining-related activities to the northwest (Table 10, which summarises the percentage of each habitat category in Table 7,Table 8 and Table 9 accounting for sites with multiple habitat types).

Soft coral and hydroids are relatively minor contributors to the benthic community assemblage, although they represent a greater proportion of Bay 1 than the other two bays Table 10.

Table 10 Summary of field survey marine habitat observations

Habitat Category	Bay 1 – Observations %	Bay 2 – Observations %	Bay 3 – Observations %
Bare	67.3	47.2	37.6
Algae	10.9	9.4	13.8
Hard Coral	9.1	23.0	27.0
Hard Coral and Algae	3.6	19.1	20.6
Hard Coral and Hydroids	0.9	0.0	0.0
Hard Coral, Soft Coral and Algae	0.9	0.4	0.5
Hard Coral, Sponges and Algae	0.0	0.4	0.0
Hydroids	1.8	0.0	0.0
Soft Coral and Algae	0.0	0.4	0.3
Soft Coral, Algae and Hydroids	5.5	0.0	0.3

The habitat density observations (e.g. sparse, dense) for hard coral and macroalgae were used to estimate total coverage areas within each bay and over the entire survey area on the basis of the values in Table 2, which demonstrates that (Table 10):

– The estimated hard coral area in Bay 1 of 0.2 ha is approximately 3% of this bay's surveyed area. The total estimated hard coral area of the three bays is 4.92 ha. The hard coral area in Bay 1 (0.2 ha) comprises only 4% of the total hard coral area across the three bays. Presumably, the lower percentage of hard coral area in Bay 1 is because of its proximity to past mining-related activities (and associated impacts). Construction and operation of the wharf facility will pose elevated environmental risks and impacts to only ~4% of the existing hard coral cover across the three bays (i.e. those in Bay 1); and
– The estimated macroalgal area in Bay 1 is 0.19 ha, representing 3% of this bay's surveyed area. This is a similar proportion to Bay 2 (5%) and Bay 3 (6%). Furthermore, the estimated macroalgae area in Bay 1 comprises 13% of the total macroalgae area across the three bays. A relatively small proportion (13%) of the total macroalgae area across the three bays will be at risk of impact by construction and operational activities of the wharf facility.

Table 11 Summary of Hard Coral and Macroalgae coverage areas

Parameter	Bay 1	Bay 2	Bay 3	Total
Total Surveyed Area (ha)	7.55	3.47	19.64	30.66
Hard Coral Area Calculations				
Calculated Hard Coral Coverage (ha)	0.20	0.72	4.00	4.92
% Hard Coral Cover	3	21	2016	
Macroalgae Area Calculations				
Calculated Algae Coverage (ha)	0.19	0.16	1.15	1.5
% Algae Cover	3	5	6	5

4.3 Wharf Colonisation

On the basis of the benthic communities on the existing ship loader piles, it is anticipated that a similar community assemblage will colonise the proposed wharf infrastructure. Further, colonisation of the wharf structure by hard corals may occur, particularly along the eastern portion of Bay 1 where some hard corals currently occur.

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