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Research Program

TROPICAL ECOSYSTEMS *hub*

Technical Report

Conservation goals and objectives for the Great Barrier Reef coastal zone

Report from a workshop to identify goals, define assets and
formulate methods to articulate quantitative objectives



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Australian Government
Department of the Environment

 Reef &
Rainforest
RESEARCH CENTRE

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Report from a workshop to identify goals, define assets and formulate methods to articulate quantitative objectives

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Australian Government

Department of the Environment

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Contents

List of Figures.....	ii
List of Tables.....	ii
Acronyms Used In This Report.....	iii
Acknowledgements.....	iv
Introduction.....	1
Presentation of concepts of goals and objectives in the context of conservation planning by Prof. Bob Pressey.....	1
Summary of project NERP TE 9.4 and how goals and objectives fit in it	2
Methodology.....	3
Outputs.....	4
Conservation goals.....	4
Conservation assets	6
<i>Criteria to choose assets</i>	6
<i>Preliminary list of assets</i>	6
<i>Preliminary method to articulate objectives</i>	7
Next steps.....	9
Appendix 1	10

List of Figures

Figure 1:	Theoretical examples of possible benefit functions dependent of extent or abundance of a “feature” set in conservation objectives.....	2
Figure 2:	Framework for project NERP TE 9.4 “Conservation planning for a changing coastal zone”	3
Figure 3:	White board #1 with preliminary ideas on conservation goals in the GBR coast	5
Figure 4:	White board #2 on conservation goals in the GBR coast, after some refinement from board #1	5

List of Tables

Table 1:	List of participants of the one-day workshop on conservation goals and objectives for the GBR coastal zone as part of project NERP TE 9.4.....	2
Table 2:	Summary of the themes found in conservation goals in NRM plans along the GBR coastal zone.....	4
Table 3:	List of potential assets related to conservation goals for the GBRWHA coastal zone.....	6
Table 4:	List of some potential coastal assets for project NERP TE 9.4 as identified in the EPBC list found in Burdekin-Dry Tropics NRM Plan.....	7

Acronyms Used In This Report

ARC CoE	..... Australian Research Council Centre of Excellence
DSEWPaC	.....Department of Sustainability, Environment, Water, Population and Community
EPBC	.....Environment Protection and Biodiversity Conservation
GBR	.....Great Barrier Reef
GBRMPA	.....Great Barrier Reef Marine Park Authority
GBRWHA	.....Great Barrier Reef World Heritage Area
IUCN	.....International Union for Conservation of Nature
MNES	.....Matter of National Ecological Significance
NERP	.....National Environmental Research Program
NQ	.....North Queensland
NRM	.....Natural Resource Management
RE	.....Regional ecosystems
RRRC	.....Reef and Rainforest Research Centre Limited
TE	.....Tropical Ecosystems

Acknowledgements

I would like to acknowledge all the participants for their great inputs during this workshop. Their attendance and enthusiasm for the topic was invaluable. This research is funded by the National Environmental Research Program (NERP) Tropical Ecosystems Hub, in collaboration with the ARC Centre of Excellence for Coral Reef Studies (<http://www.coralcoe.org.au/>) and the Great Barrier Reef Marine Park Authority.

Introduction

A workshop was organised to elicit conservation goals and objectives for the Great Barrier Reef World Heritage Area (GBRWHA) coastal zone for NERP TE project 9.4 "Conservation planning for a changing coastal zone". In this project, spatially-explicit scenarios and impact assessments are used to produce spatial prioritisations for conservation. Following introductions to the concept of goals in conservation planning and to project 9.4, participants discussed goals, assets that relate to these goals and how they can be formulated into quantitative or spatial objectives. This report summarises the discussions and the main outputs of this workshop. The aims of this workshop were to articulate conservation goals for the GBRWHA coastal zone, to define criteria for choosing assets for the GBR coastal zone, to draw a preliminary list of potential assets and to describe a preliminary method to formulate objectives. Eleven scientists and managers (Table 1) gathered for this one-day workshop on 24 May 2013 in Townsville.

Table 1: List of participants of the one-day workshop on conservation goals and objectives for the GBR coastal zone as part of project NERP TE 9.4.

Name	Organisation
Amélie Augé	ARC CoE Coral Reef Studies (JCU)
Jon Brodie	TropWater (JCU)
Alastair Buchan	NQ Dry Tropics
Allan Dale	The Cairns Institute (JCU)
Peter Gibson	NQ Dry Tropics
Tricia Gowdie	NQ Dry Tropics
Chris Manning	Townsville City Council
Neil Mattocks	Queensland Department of National Parks, Recreation, Sport and Racing
Bob Pressey	ARC CoE Coral Reef Studies (JCU)
Malcolm Turner	GBRMPA
Hugh Yorkston	GBRMPA

Presentation of concepts of goals and objectives in the context of conservation planning by Prof. Bob Pressey

Conservation objectives are quantitative statements about conservation requirements of "features". Planners and managers have to state explicitly what they intend to achieve through conservation objectives.

Objectives must be "feature"-specific, and where possible, framed in terms of initial conditions (for instance, pre-European extent). They also need to reflect the level of perceived conservation requirements based on potential threats.

Setting conservation objectives is based on multiple measures combined in quantitative equations. An example of such equation can be Objective = baseline% + x% measure1+ y% measure2. Measures can be official listing (IUCN Red list or National threat classifications), natural rarity, proportion of distribution within the study area, life history traits (related to inherent vulnerability), spatial overlap with abatable threats, refugia, genetic diversity etc (Figure 1).

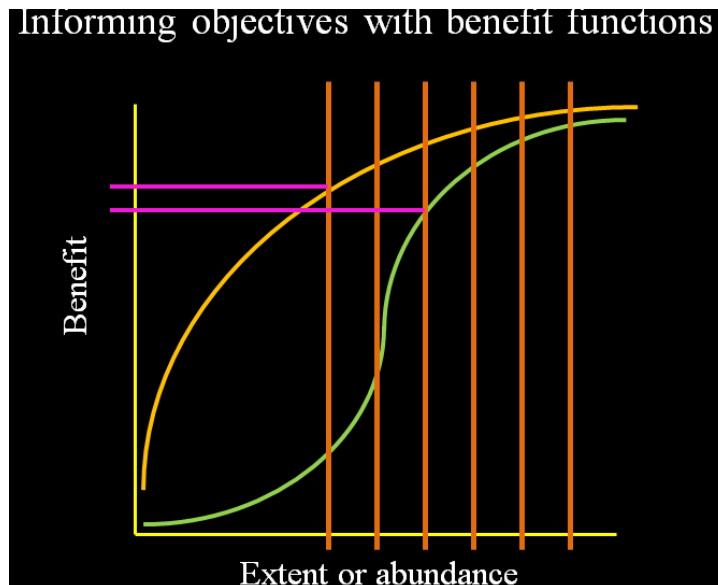


Figure 1: Theoretical examples of possible benefit functions dependent of extent or abundance of a “feature” set in conservation objectives

In the context of scenario planning, goals are common across scenarios while objectives have to vary amongst scenarios as threats vary. Consequently, conservation objectives are set based on potential threats as differing land use change patterns lead to various threats on features.

Summary of project NERP TE 9.4 and how goals and objectives fit in it

Project NERP TE 9.4 or “Conservation planning for a changing coastal zone” is part of the Program 9 “Decision support systems for GBR manager”. The overall aim of this project is to identify strategic priorities for protection and restoration of coastal ecosystem that support the health and resilience of the GBRWHA. The main method used includes spatially-explicit scenario planning to 2035 and land-use change modelling. This means that land use maps of plausible futures are produced for the GBRWHA coastal zone.

The framework of project 9.4, as shown in Figure 2, is made of several elements that are brought together to reach mainstreaming of spatial prioritisations. Conservation goals fit in the framework as the start point to bring in the assets, identified from these goals, with the scenarios and assess the impacts in each scenario for these assets. The combination of these impacts, depicting the threats to the assets in each scenario, and the current state and trends of these assets allow formulating conservation objectives.

The term “assets” is used in project NERP 9.4 to define something that is of ecological significance and that is deemed as reflecting the conservation goals. It relates to the terms used in other documents of “features”, “values” or “matters of significance”.

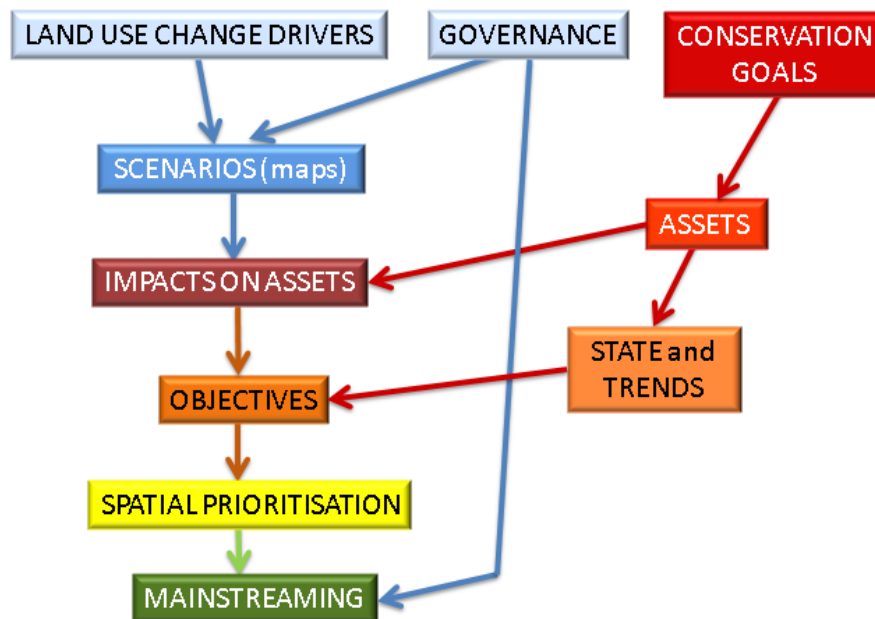


Figure 2: Framework for project NERP TE 9.4 “Conservation planning for a changing coastal zone”

Methodology

A review of goals in NRM plans and GBRMPA strategies was completed prior to the workshop and presented to the participants for discussion. Goals related to invasive species and private conservation land were excluded from this summary as they are outside of the scope of this project. The main themes for goals in these documents are summarized in Table 2. Deconstructing these goals also produced a list of characteristics that need to be included in a goal. These are a “category” (biodiversity, significant species, threatened species, populations, ecological communities, water quality, ecosystem functions, evolutionary adaptation), a “type” (extent, number, condition, viability, sustainability, diversity), an “extent” (local, regional, global, marine, freshwater, terrestrial, across realms), a “direction” (increase, decrease, maintain, rehabilitate, avoid, minimize, in an ecological manner, protect, reverse) and a “timeframe”. This last characteristic was strongly agreed upon during the workshop.

A goal was summarised during the workshop as “what you agree and accept”. Two general types of goals can be articulated and their use was discussed: aspirational goals versus operational goals. Aspirational goals are what is needed to preserve fully the natural values of an area. However, development is most often always associated with a loss of natural values and, hence, operational goals take this into consideration. Overall during the workshop, it clearly appeared that conservation goals should be aspirational. NRM biodiversity goals also seem aspirational and hence the goals formulated for project 9.4 were aspirational. Objectives are formulated with a more operational approach as they include threats (in the case of 9.4 due to coastal development). In project 9.4, both the extent and the timeframe are set due to the nature of the scenarios, respectively as the coastal zone and by 2035.

Table 2: Summary of the themes found in conservation goals in NRM plans along the GBR coastal zone.

Themes of conservation goals from NRM plans
Coastal ecosystems managed for biodiversity values
Decrease number of threatened ecological communities
Ecologically sustainable development
Improve functionality of ecosystems
Include biodiversity conservation in development
Maintain biodiversity
Maintain ecosystems
Maintain native ecosystems
Maintain populations of significant species
Maintain significant species
Maintain the functioning of natural systems
Maintain water quality
Maintain wetlands
Management is coordinated
Management to allow for best persistence with sea level rise and climate change
Management to minimise threatening processes to biodiversity
Reverse decline in water quality

Discussion during the workshop also included the need for conservation planning to be adaptive to changes, in particular conservation goals. In the context of project 9.4, the conservation goals are set but in the future there will be scope to adapt those goals to the new circumstances and threats. It was also agreed during the workshop that landscape values were not part of biodiversity conservation values as they are related to social factors (well-being) or economic factors (tourism).

Outputs

Conservation goals

Figures 3 and 4 show the formulation process that was used to articulate goals for project 9.4 during the workshop. A set of conservation goals were set for four main themes: water quality, organisms, habitats and ecosystem functions. These goals are that by 2035 in the GBRWHA coastal zone, there will be:

- Improved water quality in coastal waters from 2011
- Viable populations of native coastal-dependent species
- Viable populations of native coastal high value species
- Viable populations of endemic species to the coastal zone
- No net loss of representation of coastal ecosystems from 2009
- Enhanced or restored ecosystem functions and processes from 2009

All these goals fall under the overall conservation vision that by 2035 there will be functioning coastal ecosystems throughout the GBR coastal zone that ensure the health of the GBRWHA.

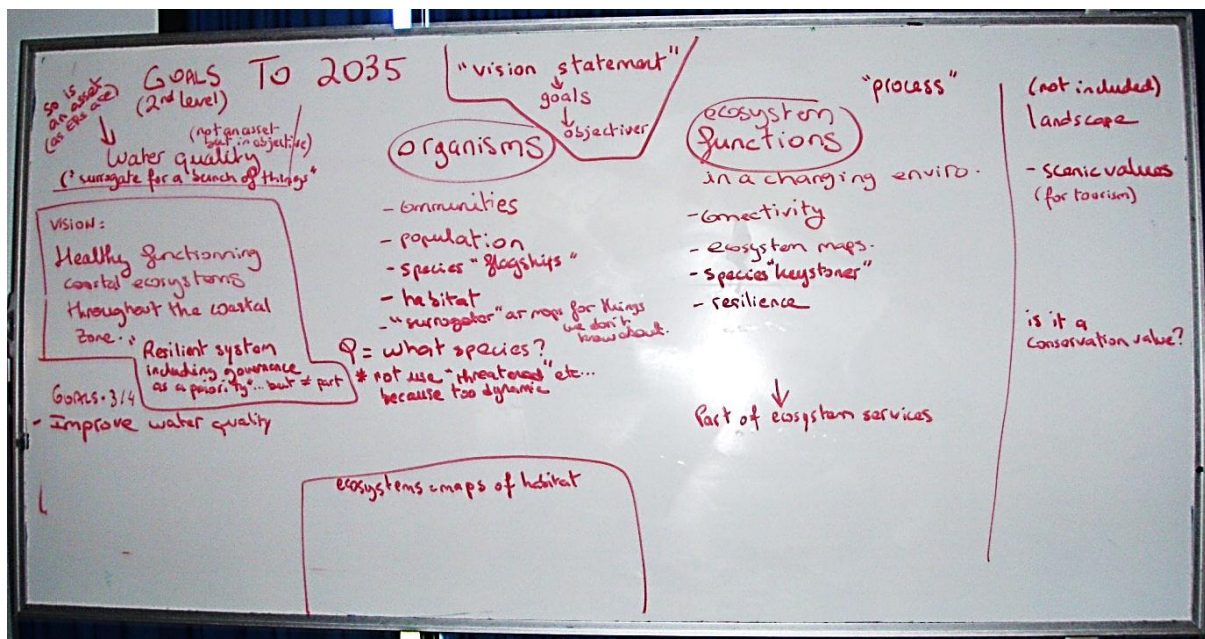


Figure 3: White board #1 with preliminary ideas on conservation goals in the GBR coast.

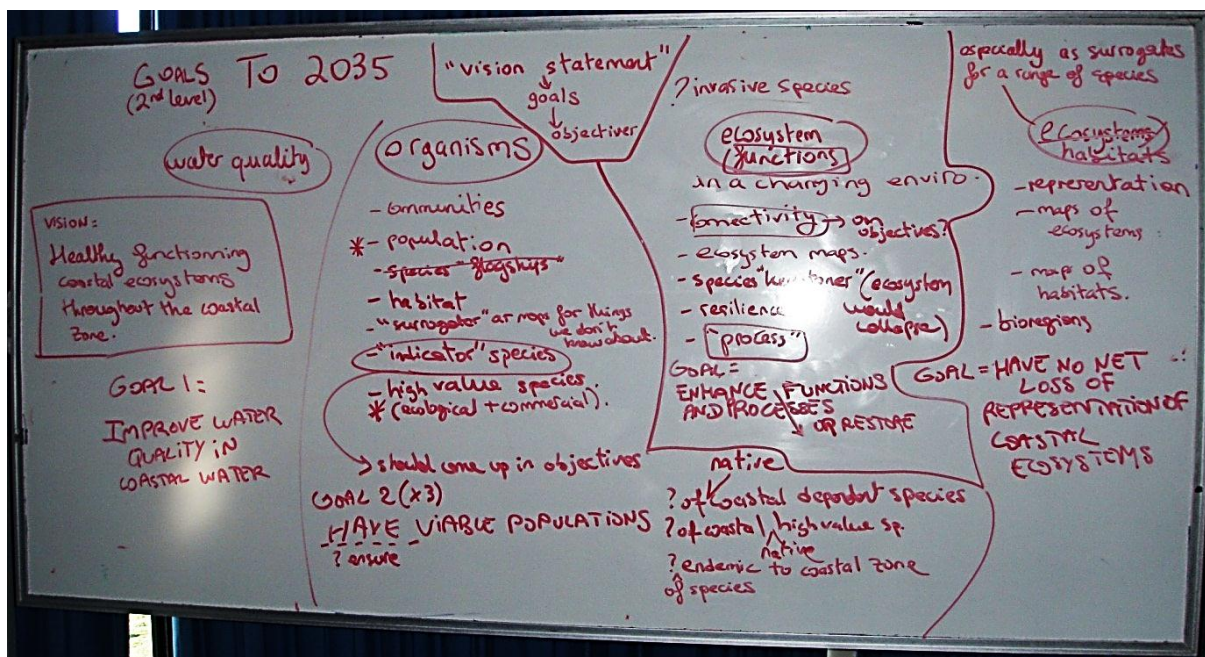


Figure 4: White board #2 on conservation goals in the GBR coast, after some refinement from board #1.

Conservation assets

Criteria to choose assets

A list of criteria to apply to the list of chosen assets was defined. It describes what kind of assets need to be investigated to understand fully the level to which goals are filled in each scenario. The criteria for this list of assets are:

- Coastal or partly coastal distribution/area
- Marine, terrestrial and freshwater representatives
- A mix of habitats, species and processes
- Various life histories for organisms
- Available knowledge and science to assess impacts
- A mix of migrating, sedentary and long range species
- A mix of localized and wide-spread habitats

Preliminary list of assets

Once the goals were framed, a brainstorming session of possible assets was conducted. These will be later checked for correctness and consistency with the criteria for the list of assets as in the previous section. Table 3 contains the potential assets that were mentioned in relation to each goal.

The EPBC (Environment Protection and Biodiversity Conservation) MNES (Matters of Natural Environmental Significance) in the Burdekin Dry Tropics Region (as found in Burdekin Dry Tropics NRM Plan) was summarised by Malcolm Turner (GBRMPA) who identified potential coastal assets from this list. The potential assets identified from this exercise are listed in Table 4.

Table 3: List of potential assets related to conservation goals for the GBRWHA coastal zone.

Water quality	Native coastal-dependent species	Native high value species	Endemic species to coastal zone	Coastal habitats	Ecosystem functions and processes
Turbidity Sediments Nutrients Pesticides UWQC (unrecognized water quality contaminants) pH DO (dissolved oxygen)	Barramundi Sawfish Prawns	Dugongs Turtles Crocodiles Mud crabs	Coastal vine tickets (but would be in RE) Snubfin dolphins Lungfish Peppermint stick insect Frogs? Plants? Beach stone curlews	Seagrass Freshwater wetlands Saltmarsh RE Mangroves Coral reefs GBRMP bioregions Intertidal mudflats Beach-dune complex Forested flood plains	Connectivity Continuity Contiguity Keystone species Hydrology

Table 4: List of some potential coastal assets for project NERP TE 9.4 as identified in the EPBC list found in Burdekin-Dry Tropics NRM Plan.

<p>Threatened species: Southern cassowary Herald petrel Australian painted snipe Semon’s lead-nosed bat Eastern long-eared bat Mahogany glider Spectacled flying-fox Water mouse Loggerhead turtle Green turtle Leatherback turtle Hawksbill turtle Olive ridley turtle Flatback turtle Freshwater sawfish</p>	<p>Migrating species: White-belly sea-eagle White-throated needletail Barn swallow Black-faced monarch Spectacled monarch Satin flycatcher Rufous fantail Japanese snipe Sarus crane Australian cotton pygmy-goose Little whimbrel Dugong Humpack whale Estuarine crocodile Whale shark</p>
<p>Other matters protected: Pipefish species (all species lumped together due to data deficiency at species level) Olive seasnake Stoke’s seasnake Minke whale Bryde’s whale Fraser’s dolphin Humpback dolphin</p>	<p>RAMSAR sites: Bowling Green Bay wetland</p>

Invasive species were suggested as assets, and also as a potential specific goal, due to their potential significant impacts on biodiversity and ecosystem functioning. Even though it was agreed that invasive species are important, there are often very little data available on their distribution, spread process, habitat preference or effects, in particular when looking at the scale of the entire GBR coast. They may also be included as part of the impact assessments as they can be a consequence of land use change but, overall, it was agreed that invasive species are outside the scope of project NERP TE 9.4.

Preliminary method to articulate objectives

Regional ecosystems (RE) were used as an example of assets under the conservation goals “No net loss of representation of coastal ecosystems”. These RE are mapped as pre-clearing and 2009 remnant extents in the entire GBR coastal zone, therefore measures are easily available and threats based on land use change in each scenario can also be part of the set of measures. They are terrestrial representatives and have a mix of localized and widespread habitats. They can also be used as proxy for a range of plant and animal species’ distribution. Measures to formulate objectives for each scenario could be put in equation such as Objective (area in ha) = f [Natural rarity (in ha) x 2009 rarity (% remnant in bioregion) x Coastality (% remnant in coastal zone)].

Throughout the discussions of the day, statements and ideas on method to articulate objectives from goals and assets were recorded. These included thoughts on links and relationships between different assets and how this could play out in objectives, the scales of objectives and the implication for rarity, genetic pool as an objective, functions as an important part of objectives for ecosystems and potential current quantitative objectives from plans to use.

Some links between the different constituents of the goals were established. For instance water quality is a proxy for the amount of sediment and nutrient in the coastal zone and therefore also a proxy for crown-of-thorn starfish (COT). COT was proposed as a potential asset but the argument that it is not an asset but an impact was accepted. Water quality is therefore a proxy for a wide variety of impact assessments for assets such as coral reefs.

Rarity was thought to be a good measure to be integrated in objectives. However, a cautious approach must be taken as a species may be deemed "rare" but can however be wide spread. Hence, such a species may only look rare. Rarity must be taken into consideration when formulating objectives but it needs to be adjusted to spatial scale. For instance, natural rarity can be combined to distribution area to develop an index of rarity.

The term "viable" was used to frame goals for organisms. Viable populations must have several characteristics that will ensure their species' persistence and distribution. Adaptability to change was pointed out as an important characteristic and is related to genetic pool. A number of individuals must be contained in a population to make it genetically viable. A minimum number of populations must also persist to maintain the extent of distribution of a species, possibly including a number of nesting sites, roosts, nursery areas etc. Hence there are a number of quantitative objectives that can be drawn from assets of the "organisms" category for the type of goals that are "viable populations". These objectives will however be limited by the amount of scientific knowledge on the species.

Ecosystem functioning was unanimously agreed to be an important aspect of biodiversity conservation. Assets for ecosystem functioning are, for instance, connectivity or continuity that can be mapped using a range of buffers and corridors. However, ecosystem functioning and the key elements on which these functions rely on, in particular in the coastal zone as connectivity varies between land and marine habitats but also exists between the land and the sea, is not well understood.

For the water quality objectives, it was suggested to use values from Water Quality Improvement Plans (QWIP) for river mouths. These plans have been gathered and quantitative objectives to 2035 will be drawn from the values presented in these plans along with consultation with water quality experts.

Formulating objectives for marine assets was discussed and it was unanimously agreed that this would be more difficult. The GBRMP Bioregion could be an asset for which there is the possibility to use the same approach as for RE. Objectives for seagrass beds could be framed using previous modeling. "We continue to lose coral communities and seagrass" said one of the participants, it is just not as obvious as on land and it is difficult to investigate and map. Dredging and resulting dump of dredge material was discussed as an impact to include in the scenario impact assessment part, however, their effects are not well known, in particular how they spread and how long they affect ecological communities.

It was established that, currently, the science behind the formulation of conservation objectives is not defined and that there is scope in this project to work on this issue.

Next steps

The assets related to each conservation goal will be finalised. A complete list of MNES (as in Appendix 1) from the EPBC list will be examined to determine all potential coastal assets. From this list, a filter will be applied to determine the selected assets based on the criteria developed during the workshop. The list of preliminary assets that were nominated during the workshop will be part of the filter.

A literature review will then be conducted for each asset to determine the amount of scientific knowledge available to 1. Assess impacts in scenarios and 2. Formulate quantitative objectives. Lists of experts for assets that have insufficient published materials to establish impacts or objectives will be produced and these experts will be contacted to take part in small workshops or meetings. This step was identified in the workshop as a potential other outputs of this project as knowledge gaps will be identified for particular assets.

Appendix 1

List of species in the EPBC list when searching “Queensland + coast” in SPRAT (Species Profile and Threats Database on DSEWPaC website). This list will be filtered to identify a group of assets for the GBRWHA coastal zone. The links in taxon id brings to the DSEWPAC description webpage on the species. Note: the search is not fully correct; some species are not found in the Queensland coast and some that are found there are missing from this list.

Taxon Id	Scientific Name	Common Name	EPBC Listings	Threat Status
68453+	<i>Galeorhinus galeus</i>	School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark	Threatened	Conservation Dependent
76339+	<i>Rexea solandri (eastern Australian population)</i>	Eastern Gemfish	Threatened	Conservation Dependent
1115+	<i>Aipysurus apraefrontalis</i>	Short-nosed Seasnake	Marine; Threatened	Critically Endangered
1118+	<i>Aipysurus foliosquama</i>	Leaf-scaled Seasnake	Marine; Threatened	Critically Endangered
68751+	<i>Carcharias taurus (east coast population)</i>	Grey Nurse Shark (east coast population)	Threatened	Critically Endangered
67090+	<i>Epthianura crocea macgregori</i>	Yellow Chat (Dawson)	Threatened	Critically Endangered
82453+	<i>Glyphis glyphis</i>	Speartooth Shark	Threatened	Critically Endangered
1841+	<i>Litoria loricata</i>	Armoured Mistfrog	Threatened	Critically Endangered
1820+	<i>Litoria nyakalensis</i>	Mountain Mistfrog	Threatened	Critically Endangered
81869+	<i>Phebalium distans</i>	Mt Berryman Phebalium	Threatened	Critically Endangered
66973+	<i>Pterodroma heraldica</i>	Herald Petrel	Threatened	Critically Endangered
1889+	<i>Taudactylus pleione</i>	Kroombit Tinker Frog, Pleione's Torrent Frog	Threatened	Critically Endangered
7559+	<i>Acacia ruppia</i>	Rupp's Wattle	Threatened	Endangered
21926+	<i>Allocasuarina emuina</i>	Emu Mountain Sheoak	Threatened	Endangered
21927+	<i>Allocasuarina thalassoscopica</i>		Threatened	Endangered
82338+	<i>Anthochaera phrygia</i>	Regent Honeyeater	Mapped Migratory; Migratory (JAMBA); Threatened	Endangered
66844+	<i>Bettongia penicillata ogilbyi</i>	Woylie	Threatened	Endangered
1001+	<i>Botaurus poiciloptilus</i>	Australasian Bittern	Threatened	Endangered
1763+	<i>Caretta caretta</i>	Loggerhead Turtle	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Endangered
25977+	<i>Ceyx azureus diemenensis</i>	Tasmanian Azure Kingfisher	Threatened	Endangered
55794+	<i>Cycas megacarpa</i>		Threatened	Endangered
59714+	<i>Cyclopsitta diophthalma coxeni</i>	Coxen's Fig-Parrot	Mapped Migratory; Migratory (JAMBA); Threatened	Endangered
12533+	<i>Cynanchum elegans</i>	White-flowered Wax Plant	Threatened	Endangered
533+	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	Threatened	Endangered
331+	<i>Dasyurus hallucatus</i>	Northern Quoll	Threatened	Endangered
64475+	<i>Dasyurus maculatus gracilis</i>	Spotted-tailed Quoll or Yarri (North Queensland subspecies)	Threatened	Endangered
75184+	<i>Dasyurus maculatus maculatus (SE mainland population)</i>	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Threatened	Endangered

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1768+	<i>Dermochelys coriacea</i>	Leatherback Turtle, Leathery Turtle, Luth	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Endangered
413+	<i>Erythrura gouldiae</i>	Gouldian Finch	Mapped Migratory; Migratory (JAMBA); Threatened	Endangered
40+	<i>Eubalaena australis</i>	Southern Right Whale	Cetacean; Mapped Migratory; Migratory (Bonn); Threatened	Endangered
24038+	<i>Fontainea oraria</i>	Coastal Fontainea	Threatened	Endangered
55459+	<i>Graptophyllum reticulatum</i>	Veiny Graptophyllum	Threatened	Endangered
180+	<i>Hipposideros semoni</i>	Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat	Threatened	Endangered
744+	<i>Lathamus discolor</i>	Swift Parrot	Marine; Threatened	Endangered
1767+	<i>Lepidochelys olivacea</i>	Olive Ridley Turtle, Pacific Ridley Turtle	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Endangered
56204+	<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray, Grassland Paper-daisy	Threatened	Endangered
1848+	<i>Litoria castanea</i>	Yellow-spotted Tree Frog, Yellow-spotted Bell Frog	Threatened	Endangered
1817+	<i>Litoria nannotis</i>	Waterfall Frog, Torrent Tree Frog	Threatened	Endangered
1802+	<i>Litoria rheocola</i>	Common Mistfrog	Threatened	Endangered
25960+	<i>Mixophyes fleayi</i>	Fleay's Frog	Threatened	Endangered
1944+	<i>Mixophyes iteratus</i>	Giant Barred Frog, Southern Barred Frog	Threatened	Endangered
83888	<i>Myrsine richmondensis</i>	Purple-leaf Muttonwood, Lismore Muttonwood	Threatened	Endangered
64468+	<i>Nannoperca oxleyana</i>	Oxleyan Pygmy Perch	Threatened	Endangered
1813+	<i>Nyctimystes dayi</i>	Lace-eyed Tree Frog, Australian Lacelid	Threatened	Endangered
26775+	<i>Petaurus gracilis</i>	Mahogany Glider	Threatened	Endangered
226+	<i>Petrogale persephone</i>	Proserpine Rock-wallaby	Threatened	Endangered
5872+	<i>Phaius australis</i>	Lesser Swamp-orchid	Threatened	Endangered
17340+	<i>Planchonella eerwah</i>	Shiny-leaved Condo, Black Plum, Wild Apple	Threatened	Endangered
55742+	<i>Plectranthus nitidus</i>	Nightcap Plectranthus	Threatened	Endangered
55728+	<i>Plectranthus torrenicola</i>		Threatened	Endangered
720+	<i>Psephotus chrysopterygius</i>	Golden-shouldered Parrot	Mapped Migratory; Migratory (JAMBA); Threatened	Endangered
1915+	<i>Pseudophryne corroboree</i>	Southern Corroboree Frog	Threatened	Endangered
26033+	<i>Pterodroma leucoptera leucoptera</i>	Gould's Petrel	Mapped Migratory; Migratory (JAMBA); Threatened	Endangered
10577+	<i>Randia moorei</i>	Spiny Gardenia	Threatened	Endangered
66890+	<i>Rhinolophus philippinensis</i> (large form)	Greater Large-eared Horseshoe Bat	Threatened	Endangered
20109+	<i>Rhizanthella gardneri</i>	Underground Orchid, Western Australian Underground Orchid	Threatened	Endangered
11768+	<i>Rhizanthella slateri</i>	Eastern Underground Orchid	Threatened	Endangered
1887+	<i>Taudactylus eungellensis</i>	Eungella Day Frog	Threatened	Endangered
1890+	<i>Taudactylus rheophilus</i>	Tinkling Frog	Threatened	Endangered
66491+	<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Endangered
64545+	<i>Wollemia nobilis</i>	Wollemi Pine	Threatened	Endangered

83095	<i>Zieria bifida</i>		Threatened	Endangered
+				
66658	<i>Bettongia penicillata penicillata</i>	Brush-tailed Bettong (south-east mainland)	Threatened	Extinct
+				
1909+	<i>Rheobatrachus silus</i>	Southern Gastric-brooding Frog	Threatened	Extinct
+				
10690	<i>Acacia attenuata</i>		Threatened	Vulnerable
+				
4067+	<i>Arenga australasica</i>	Australian Arenga Palm	Threatened	Vulnerable
67034	<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	Threatened	Vulnerable
+				
68752	<i>Carcharias taurus (west coast population)</i>	Grey Nurse Shark (west coast population)	Threatened	Vulnerable
+				
64470	<i>Carcharodon carcharias</i>	Great White Shark	Mapped Migratory; Migratory (Bonn); Threatened	Vulnerable
+				
183+	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat, Large Pied Bat	Threatened	Vulnerable
+				
1765+	<i>Chelonia mydas</i>	Green Turtle	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Vulnerable
+				
68161	<i>Conospermum hookeri</i>	Variable Smoke-bush	Threatened	Vulnerable
+				
19533	<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	Threatened	Vulnerable
+				
75183	<i>Dasyurus maculatus maculatus (Tasmanian population)</i>	Spotted-tail Quoll, Spot-tailed Quoll, Tiger Quoll (Tasmanian population)	Threatened	Vulnerable
+				
25930	<i>Delma labialis</i>	Striped-tailed Delma, Single-striped Delma	Threatened	Vulnerable
+				
1420+	<i>Egernia rugosa</i>	Yakka Skink	Threatened	Vulnerable
+				
1766+	<i>Eretmochelys imbricata</i>	Hawksbill Turtle	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Vulnerable
+				
942+	<i>Erythrotriorchis radiatus</i>	Red Goshawk	Threatened	Vulnerable
+				
20433	<i>Eucalyptus hallii</i>	Goodwood Gum	Threatened	Vulnerable
+				
16344	<i>Eucalyptus raveretiana</i>	Black Ironbox	Threatened	Vulnerable
+				
64438	<i>Fregetta grallaria grallaria</i>	White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian)	Threatened	Vulnerable
+				
26172	<i>Geocrinia vitellina</i>	Orange-bellied Frog	Threatened	Vulnerable
+				
8601+	<i>Graptophyllum ilicifolium</i>	Holly-leaved Graptophyllum, Mt Blackwood Holly	Threatened	Vulnerable
+				
1973+	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Threatened	Vulnerable
+				
1870+	<i>Litoria aurea</i>	Green and Golden Bell Frog	Threatened	Vulnerable
+				
1821+	<i>Litoria olongburensis</i>	Wallum Sedge Frog	Threatened	Vulnerable
+				
1827+	<i>Litoria piperata</i>	Peppered Tree Frog	Threatened	Vulnerable
+				
1828+	<i>Litoria raniformis</i>	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	Threatened	Vulnerable
+				
64581	<i>Livistona lanuginosa</i>	Waxy Cabbage Palm	Threatened	Vulnerable
+				
7326+	<i>Macadamia integrifolia</i>	Macadamia Nut, Queensland Nut, Smooth-shelled Macadamia, Bush Nut, Nut Oak	Threatened	Vulnerable
+				
7214+	<i>Macadamia ternifolia</i>	Small-fruited Queensland Nut, Gympie Nut	Threatened	Vulnerable
+				
6581+	<i>Macadamia tetraphylla</i>	Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut	Threatened	Vulnerable
+				
38+	<i>Megaptera novaeangliae</i>	Humpback Whale	Cetacean; Mapped Migratory; Migratory (Bonn); Threatened	Vulnerable

Conservation goals and objectives for the Great Barrier Reef coastal zone:
Report from a workshop to identify goals, define assets and formulate methods to articulate quantitative objectives

59257 +	<i>Natator depressus</i>	Flatback Turtle	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Vulnerable
64443 +	<i>Neochmia phaeton evangelinae</i>	Crimson Finch (white-bellied)	Threatened	Vulnerable
83395 +	<i>Nyctophilus corbeni</i>	South-eastern Long-eared Bat	Threatened	Vulnerable
56133 +	<i>Ozothamnus eriocephalus</i>		Threatened	Vulnerable
64445 +	<i>Pachyptila turtur subantarctica</i>	Fairy Prion (southern)	Threatened	Vulnerable
5831+	<i>Persicaria elatior</i>	Knotweed	Threatened	Vulnerable
225+	<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Threatened	Vulnerable
85104 +	<i>Phascolarctos cinereus</i> (combined populations of Qld, NSW and the ACT)	Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)	Threatened	Vulnerable
66645 +	<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo (SE mainland)	Threatened	Vulnerable
68447 +	<i>Pristis clavata</i>	Dwarf Sawfish, Queensland Sawfish	Threatened	Vulnerable
66182 +	<i>Pristis microdon</i>	Freshwater Sawfish	Threatened	Vulnerable
68442 +	<i>Pristis zijsron</i>	Green Sawfish, Dindagubba, Narrowsnout Sawfish	Threatened	Vulnerable
26180 +	<i>Pseudomugil mellis</i>	Honey Blue-eye	Threatened	Vulnerable
96+	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	Threatened	Vulnerable
64385 +	<i>Pseudophryne covacevichae</i>	Magnificent Brood Frog	Threatened	Vulnerable
1036+	<i>Pterodroma mollis</i>	Soft-plumaged Petrel	Marine; Threatened	Vulnerable
185+	<i>Pteropus conspicillatus</i>	Spectacled Flying-fox	Threatened	Vulnerable
186+	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Threatened	Vulnerable
66680 +	<i>Rhincodon typus</i>	Whale Shark	Mapped Migratory; Migratory (Bonn); Threatened	Vulnerable
77037 +	<i>Rostratula australis</i>	Australian Painted Snipe	Mapped Migratory; Marine; Migratory (CAMBA); Threatened	Vulnerable
82950 +	<i>Sternula nereis nereis</i>	Fairy Tern (Australian)	Threatened	Vulnerable
3539+	<i>Syzygium hodgkinsoniae</i>	Smooth-bark Rose Apple, Red Lilly Pilly	Threatened	Vulnerable
21407 +	<i>Tetradlea juncea</i>	Black-eyed Susan	Threatened	Vulnerable
82345 +	<i>Thalassarche cauta cauta</i>	Shy Albatross, Tasmanian Shy Albatross	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Vulnerable
66472 +	<i>Thalassarche melanophris</i>	Black-browed Albatross	Mapped Migratory; Marine; Migratory (Bonn); Threatened	Vulnerable
66+	<i>Xeromys myoides</i>	Water Mouse, False Water Rat	Threatened	Vulnerable
56761 +	<i>Zieria verrucosa</i>		Threatened	Vulnerable
1114+	<i>Acalyptophis peronii</i>	Horned Seasnake	Marine	
59309 +	<i>Actitis hypoleucos</i>	Common Sandpiper	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)	
1116+	<i>Aipysurus duboisii</i>	Dubois' Seasnake	Marine	
1117+	<i>Aipysurus eydouxii</i>	Spine-tailed Seasnake	Marine	
1119+	<i>Aipysurus fuscus</i>	Dusky Seasnake	Marine	
1120+	<i>Aipysurus laevis</i>	Olive Seasnake	Marine	

66061+	<i>Aipysurus pooleorum</i>	Shark Bay Seasnake	Marine
1121+	<i>Aipysurus tenuis</i>	Brown-lined Seasnake	Marine
678+	<i>Apus pacificus</i>	Fork-tailed Swift	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA, ROKAMBA)
59542+	<i>Ardea ibis</i>	Cattle Egret	Mapped Migratory; Mapped Migratory; Marine; Migratory (CAMBA, JAMBA)
82410+	<i>Ardea modesta</i>	Eastern Great Egret	Mapped Migratory; Mapped Migratory; Marine; Migratory (CAMBA, JAMBA)
82404+	<i>Ardenna carneipes</i>	Flesh-footed Shearwater, Flesh-footed Shearwater	Mapped Migratory; Marine; Migratory (JAMBA, ROKAMBA)
84292+	<i>Ardenna pacifica</i>	Wedge-tailed Shearwater	Mapped Migratory; Marine; Migratory (JAMBA)
872+	<i>Arenaria interpres</i>	Ruddy Turnstone	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)
1122+	<i>Astrotia stokesii</i>	Stokes' Seasnake	Marine
82013+	<i>Balaenoptera acutorostrata</i> unnamed subsp.	Dwarf Minke Whale	
35+	<i>Balaenoptera edeni</i>	Bryde's Whale	Cetacean; Mapped Migratory; Migratory (Bonn)
70+	<i>Berardius arnuxii</i>	Arnoux's Beaked Whale	Cetacean
83759+	<i>Brachionichthys australis</i>	Australian Handfish, Common Handfish	
874+	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)
875+	<i>Calidris alba</i>	Sanderling	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)
853+	<i>Calidris alpina</i>	Dunlin	Mapped Migratory; Marine; Migratory (CAMBA, ROKAMBA)
854+	<i>Calidris bairdii</i>	Baird's Sandpiper	Mapped Migratory; Marine; Migratory (JAMBA)
855+	<i>Calidris canutus</i>	Red Knot, Knot	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)
856+	<i>Calidris ferruginea</i>	Curlew Sandpiper	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)
858+	<i>Calidris melanotos</i>	Pectoral Sandpiper	Mapped Migratory; Marine; Migratory (Bonn, JAMBA, ROKAMBA)
860+	<i>Calidris ruficollis</i>	Red-necked Stint	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)
861+	<i>Calidris subminuta</i>	Long-toed Stint	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)
895+	<i>Charadrius bicinctus</i>	Double-banded Plover	Mapped Migratory; Marine; Migratory (Bonn)
877+	<i>Charadrius leschenaultii</i>	Greater Sand Plover, Large Sand Plover	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)
879+	<i>Charadrius mongolus</i>	Lesser Sand Plover, Mongolian Plover	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)

Conservation goals and objectives for the Great Barrier Reef coastal zone:
Report from a workshop to identify goals, define assets and formulate methods to articulate quantitative objectives

			KAMBA)
882+	<i>Charadrius veredus</i>	Oriental Plover, Oriental Dotterel	Mapped Migratory; Marine; Migratory (Bonn, JAMBA,ROKAMBA)
59598+	<i>Chlidonias leucopterus</i>	White-winged Tern, White-winged Black Tern	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA,ROKAMBA)
1774+	<i>Crocodylus porosus</i>	Salt-water Crocodile, Estuarine Crocodile	Mapped Migratory; Marine; Migratory (Bonn)
1123+	<i>Disteira kingii</i>	Spectacled Seasnake	Marine
1124+	<i>Disteira major</i>	Olive-headed Seasnake	Marine
28+	<i>Dugong dugon</i>	Dugong	Mapped Migratory; Marine; Migratory (Bonn)
1125+	<i>Emydocephalus annulatus</i>	Turtle-headed Seasnake	Marine
1126+	<i>Enhydrina schistosa</i>	Beaked Seasnake	Marine
1127+	<i>Ephalophis greyi</i>	North-western Mangrove Seasnake	Marine
61+	<i>Feresa attenuata</i>	Pygmy Killer Whale	Cetacean
863+	<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA,ROKAMBA)
864+	<i>Gallinago megala</i>	Swinhoe's Snipe	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA,ROKAMBA)
841+	<i>Gallinago stenura</i>	Pin-tailed Snipe	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA,ROKAMBA)
840+	<i>Glareola maldivarum</i>	Oriental Pratincole	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA,ROKAMBA)
62+	<i>Globicephala macrorhynchus</i>	Short-finned Pilot Whale	Cetacean
64+	<i>Grampus griseus</i>	Risso's Dolphin, Grampus	Cetacean
943+	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Mapped Migratory; Marine; Migratory (CAMBA)
682+	<i>Hirundapus caudacutus</i>	White-throated Needletail	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA,ROKAMBA)
662+	<i>Hirundo rustica</i>	Barn Swallow	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA,ROKAMBA)
1100+	<i>Hydrelaps darwiniensis</i>	Black-ringed Seasnake	Marine
1101+	<i>Hydrophis atriceps</i>	Black-headed Seasnake	Marine
1103+	<i>Hydrophis caeruleus</i>	Dwarf Seasnake	Marine
25925+	<i>Hydrophis coggeri</i>	Slender-necked Seasnake	Marine
59233+	<i>Hydrophis czeblukovi</i>	Fine-spined Seasnake	Marine
1104+	<i>Hydrophis elegans</i>	Elegant Seasnake	Marine
1106+	<i>Hydrophis gracilis</i>	Slender Seasnake	Marine
1107+	<i>Hydrophis inornatus</i>	Plain Seasnake	Marine
75601+	<i>Hydrophis macdowelli</i>	Small-headed Seasnake	Marine
1109+	<i>Hydrophis melanosoma</i>	Black-banded Robust Seasnake	Marine
1111+	<i>Hydrophis ornatus</i>	a seasnake	Marine

1112+	<i>Hydrophis pacificus</i>	Large-headed Seasnake	Marine
72+	<i>Indopacetus pacificus</i>	Longman's Beaked Whale	Cetacean
57+	<i>Kogia breviceps</i>	Pygmy Sperm Whale	Cetacean
41+	<i>Lagenodelphis hosei</i>	Fraser's Dolphin, Sarawak Dolphin	Cetacean
83554+	<i>Lapemis curtus</i>	Spine-bellied Seasnake	Marine
1092+	<i>Laticauda colubrina</i>	a sea krait	Marine
842+	<i>Limicola falcinellus</i>	Broad-billed Sandpiper	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
843+	<i>Limnodromus semipalmatus</i>	Asian Dowitcher	Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
844+	<i>Limosa lapponica</i>	Bar-tailed Godwit	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
845+	<i>Limosa limosa</i>	Black-tailed Godwit	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
670+	<i>Merops ornatus</i>	Rainbow Bee-eater	Mapped Migratory; Marine; Migratory (JAMBA)
74+	<i>Mesoplodon densirostris</i>	Blainville's Beaked Whale, Dense-beaked Whale	Cetacean
59564+	<i>Mesoplodon ginkgodens</i>	Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale	Cetacean
25556+	<i>Mesoplodon layardii</i>	Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale	Cetacean
612+	<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mapped Migratory; Marine; Migratory (Bonn)
67118+	<i>Neochmia ruficauda clarescens</i>	Star Finch (Cape York Peninsula)	
846+	<i>Numenius arquata</i>	Eurasian Curlew	Marine; Migratory (Bonn, CAMBA)
847+	<i>Numenius madagascariensis</i>	Eastern Curlew	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
848+	<i>Numenius minutus</i>	Little Curlew, Little Whimbrel	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
849+	<i>Numenius phaeopus</i>	Whimbrel	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
1034+	<i>Oceanites oceanicus</i>	Wilson's Storm-Petrel	Mapped Migratory; Marine; Migratory (JAMBA)
82845+	<i>Onychoprion anaethetus</i>	Bridled Tern	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA)
81322+	<i>Orcaella heinsohni</i>	Australian Snubfin Dolphin	Cetacean; Mapped Migratory; Migratory (Bonn)
82411+	<i>Pandion cristatus</i>	Eastern Osprey	Mapped Migratory; Marine; Migratory (Bonn)
1091+	<i>Pelamis platurus</i>	Yellow-bellied Seasnake	Marine
47+	<i>Peponocephala electra</i>	Melon-headed Whale	Cetacean
67047+	<i>Pezoporus wallicus wallicus</i>	Ground Parrot (eastern)	
838+	<i>Phalaropus lobatus</i>	Red-necked Phalarope	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)

Conservation goals and objectives for the Great Barrier Reef coastal zone:
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850+	<i>Philomachus pugnax</i>	Ruff (Reeve)	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
1076+	<i>Phoebastria palpebrata</i>	Light-mantled Sooty Albatross	Mapped Migratory; Marine; Migratory (Bonn)
59+	<i>Physeter macrocephalus</i>	Sperm Whale	Cetacean; Mapped Migratory; Migratory (Bonn)
25545+	<i>Pluvialis fulva</i>	Pacific Golden Plover	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
865+	<i>Pluvialis squatarola</i>	Grey Plover	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
48+	<i>Pseudorca crassidens</i>	False Killer Whale	Cetacean
1040+	<i>Pterodroma solandri</i>	Providence Petrel	Mapped Migratory; Marine; Migratory (JAMBA)
66977+	<i>Puffinus assimilis assimilis</i>	Little Shearwater (Tasman Sea)	
50+	<i>Sousa chinensis</i>	Indo-Pacific Humpback Dolphin	Cetacean; Mapped Migratory; Migratory (Bonn)
51+	<i>Stenella attenuata</i>	Spotted Dolphin, Pantropical Spotted Dolphin	Cetacean
52+	<i>Stenella coeruleoalba</i>	Striped Dolphin, Euphrosyne Dolphin	Cetacean
29+	<i>Stenella longirostris</i>	Long-snouted Spinner Dolphin	Cetacean
30+	<i>Steno bredanensis</i>	Rough-toothed Dolphin	Cetacean
85040+	<i>Stercorarius antarcticus lonnbergi</i>	Brown Skua (Lonnberg's)	
59467+	<i>Sterna caspia</i>	Caspian Tern	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA)
795+	<i>Sterna hirundo</i>	Common Tern	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA, ROKAMBA)
800+	<i>Sterna sumatrana</i>	Black-naped Tern	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA)
82849+	<i>Sternula albifrons</i>	Little Tern	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
66987+	<i>Sula dactylatra bedouti</i>	Masked Booby (eastern Indian Ocean)	
59298+	<i>Sula dactylatra fullagari</i>	Masked Booby (Tasman Sea)	
1022+	<i>Sula leucogaster</i>	Brown Booby	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA, ROKAMBA)
1023+	<i>Sula sula</i>	Red-footed Booby	Mapped Migratory; Marine; Migratory (CAMBA, JAMBA)
66726+	<i>Thinornis rubricollis rubricollis</i>	Hooded Plover (eastern)	Marine
851+	<i>Tringa brevipes</i>	Grey-tailed Tattler	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
829+	<i>Tringa glareola</i>	Wood Sandpiper	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
831+	<i>Tringa incana</i>	Wandering Tattler	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA)
832+	<i>Tringa nebularia</i>	Common Greenshank, Greenshank	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)

833+	<i>Tringa stagnatilis</i>	Marsh Sandpiper, Little Greenshank	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
835+	<i>Tringa totanus</i>	Common Redshank, Redshank	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, ROKAMBA)
68418 +	<i>Tursiops aduncus</i>	Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin	Cetacean
68417 +	<i>Tursiops truncatus</i> . str.	Bottlenose Dolphin	Cetacean
59300 +	<i>Xenus cinereus</i>	Terek Sandpiper	Mapped Migratory; Marine; Migratory (Bonn, CAMBA, JAMBA, RO KAMBA)
56+	<i>Ziphius cavirostris</i>	Cuvier's Beaked Whale, Goose-beaked Whale	Cetacean