



Flatback turtle



Leatherback turtle



Olive ridley turtle



Loggerhead turtle



Green turtle



Hawksbill turtle

Queensland marine turtle conservation strategy 2021–2031

An operational framework to guide Queensland Department of Environment and Science investment in marine turtle research, conservation and management

Threatened Species Program



Prepared by: Queensland Parks and Wildlife Service and Partnerships, Department of Environment and Science.

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Executive summary

Marine turtles have existed for more than 100 million years. They are a vital part of our marine environment, contribute to our unique Queensland way of life and are charismatic marine creatures that hold a special place in the hearts and minds of many people in the community. Marine turtles are also of enduring cultural, economic, social and spiritual significance to coastal Aboriginal peoples and Torres Strait Islander peoples. Historically, marine turtles supported early exploration of the coastline by European navigators and were unsustainably utilised in early commercial enterprises. A combination of historic and continuing human-caused threats operating at international to local scales have seen many global marine turtle populations decline. This strategy recognises that actions taken now are likely to determine the continuing capacity for marine turtles to survive and thrive along the Queensland coast and adjacent waters over the long-term.

The *Queensland Marine Turtle Conservation Strategy 2021–2031* (Queensland Strategy) aims to stop the decline and support the recovery of the six species of marine turtles found in Queensland. This includes the green (*Chelonia mydas*), flatback (*Natator depressus*), hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*) and leatherback (*Dermochelys coriacea*) turtles.

The strategy considers the conservation requirements of the six species in habitats along the Queensland coast and identifies the actions to be taken to ensure the long-term viability in the wild for the ten currently recognised genetic stocks of the marine turtle species that nest in Queensland and the turtles that forage and migrate in adjacent Australian waters. The overarching objective of the Queensland Strategy is to reduce all operationally-manageable threats to allow for the conservation status of marine turtles to improve.

This strategy has been developed primarily for the benefit of the Queensland Department of Environment and Science who has a leading role and interest in conserving marine turtles in Queensland and adjacent Australian waters. However, effective implementation and refinement will need the engagement of other groups, including First Nations peoples, government and non-government entities, other collaborators and neighbouring jurisdictions. A Queensland marine turtle conservation working group is proposed to guide implementation including to clarify roles and responsibilities and coordinate input from willing contributors operating at the local, state and national level (including through the Australian Government Marine Turtle Round Table).

This strategy expands on the previous *Queensland Marine Turtle Conservation Strategy 2018* and supports the national *Recovery Plan for Marine Turtles in Australia* (national Recovery Plan—NRP) which was developed in conjunction with state and territory governments, Indigenous communities and other stakeholders. This Queensland Strategy is operationally focused on the required actions and lead responsibilities; it relies on background information provided in the national Recovery Plan (including species biology, stock distribution, threats and conservation status) and, where relevant, includes updates to this information.

This Queensland Strategy builds on, is supplementary to, and should be read in conjunction with the national Recovery Plan.

Aboriginal peoples and Torres Strait Islander peoples have continuing and recognised rights, interests and responsibilities over traditional lands, including their sea country. Many Traditional Owners and Indigenous communities around Queensland's coastline are actively driving marine turtle recovery efforts, often as part of broader land and sea country management initiatives. This strategy acknowledges and seeks to support and reinforce the efforts of First Nations peoples to maintain healthy marine turtle stocks within their land and sea country in a way that is consistent

with their traditional knowledge, rights, customary laws/lores, community priorities, existing governance structures and broader management arrangements.

A range of threats operating at the international to local scale will inhibit the recovery of marine turtles in Queensland. The risk posed by these threats to Queensland's 10 marine turtle genetic stocks were reassessed using contemporary information and the same methods as for the 2017 national Recovery Plan. Overall, the risks of climate change and variability, marine debris, *national and international take*, terrestrial predation, *fisheries bycatch* and light pollution were rated highest for multiple stocks. Assessing the risks associated with *Indigenous take* requires further engagement with relevant First Nations communities.

A total of 31 overarching actions (that apply to most stocks) are identified with indicative priority, lead responsibilities, timeframes for implementation and cost. Priority actions are identified against the following five broad management strategies:

1. Foundational knowledge (research and monitoring to support scientific understanding of stocks, status, threats and conservation management requirements).
2. Enabling environment (policy, planning and regulatory framework).
3. Direct management (in-field actions and interventions to mitigate risks and recover populations).
4. Community education and engagement (communication, public participation and partnerships).
5. Management evaluation and improvement (monitoring effectiveness and adaptive management).

These five management strategies are overlapping and mutually supportive and reflect the combination of actions that are required to recover marine turtles in Queensland.

Tables have been developed for each of Queensland's ten marine turtle genetic stocks. The tables provide information on the characteristics and conservation status of each stock, a narrative outlining key background information and a total of 71 practical recovery actions and associated lead responsibilities that build on the national Recovery Plan. Many overarching actions and stock-specific actions are overlapping and mutually supportive, so dependencies between actions and potential barriers to delivery will need to be considered during the implementation phase.

Coordinated action by government, community and industry is required to reduce compounding threats, increase protection and management capacity and help recover Queensland's marine turtle stocks. Without significant additional effective mitigation efforts, the overarching risks of climate change and variability and marine debris have the potential to cause further decline or collapse of already depleted stocks. This includes loss of critical nesting, foraging and courtship habitats from rising sea levels and ocean acidification, the extreme feminisation (unsustainable sex ratios) of hatchlings due to increased nesting sand temperatures, and the ubiquitous presence of micro-hard plastics in the marine environment. Recovery actions for all stocks will be co-designed with First Nations peoples and will place greater emphasis on increasing sustainable management capacity for turtle stocks in the Gulf of Carpentaria, Torres Strait and Coral Sea.

The challenge is significant. However, by providing strategic direction and collaboration opportunities for managing agencies to attract and align resources with agreed priorities, this strategy aims to stop the decline and support the recovery of depleted genetic stocks of the six species of marine turtles found in Queensland, with a long-term goal of improving their conservation status.

1.0 Introduction

The Queensland Marine Turtle Conservation Strategy aims to stop the decline and support the recovery of depleted genetic stocks of the six species of marine turtles found in Queensland.

Table 1 Species of marine turtle found in Queensland and their conservation status

Common name	Scientific name	Threatened species listings		
		Queensland (NCA)	Commonwealth (EPBCA)	IUCN Red List
Green turtle	<i>Chelonia mydas</i>	Vulnerable	Vulnerable	Endangered—global
Flatback turtle	<i>Natator depressus</i>	Vulnerable	Vulnerable	Data deficient
Hawksbill turtle	<i>Eretmochelys imbricata</i>	Endangered	Vulnerable	Critically endangered—global
Loggerhead turtle	<i>Caretta caretta</i>	Endangered	Endangered	Vulnerable—global; critically endangered in South Pacific
Olive ridley turtle	<i>Lepidochelys olivacea</i>	Endangered	Endangered	Vulnerable—global
Leatherback turtle	<i>Dermochelys coriacea</i>	Endangered	Endangered	Endangered—global; critically endangered in West Pacific

The Queensland Strategy considers the conservation requirements of the six species found in habitats along the Queensland coast and identifies the actions to be taken to recover the 10 recognised turtle genetic stocks (and others that may be identified through future genetic analysis). The geographic scope of the strategy includes Queensland and Australian waters in the Gulf of Carpentaria, Torres Strait, Coral Sea, Great Barrier Reef and southern Queensland coastal waters.

The document is primarily for Queensland and Australian governments’ conservation agencies to plan, prioritise, coordinate and implement marine turtle protection, conservation, research, education and management actions, and facilitate input from other willing partners.

Managing marine turtles in Queensland is a shared responsibility with potential input from all levels of government, a range of research institutions, Traditional Owners, First Nations communities and Land and Sea Ranger groups, regional and local Natural Resource Management (NRM) groups and other non-governmental organisations (NGOs) and community-based organisations and individuals. Strong leadership from the state and Commonwealth governments can enable and facilitate the effective contribution from a diversity of willing delivery partners.

This strategy seeks to provide strategic direction and collaboration opportunities for both management agencies and other contributing groups, with a specific focus on improving internal and cross-agency coordination and communication, capitalising on emerging opportunities and better utilising the collective resources available with a clear, agreed management, governance and prioritisation process.

Both the national Recovery Plan and this Queensland Strategy recognise the significant cultural, social and spiritual ties that Queensland’s coastal Aboriginal peoples and Torres Strait Islander communities have with marine turtles, and that marine turtle conservation and ongoing customary use is a high priority and part of broader land and sea country management. Respecting and strengthening the traditional rights, interests, management capacity and customary obligations of First Nations peoples in relation to marine turtles is a cross-cutting theme and fundamental to the long-term success of marine turtle conservation in Queensland.

2.0 Context

Maintaining healthy marine turtle populations is important for Queensland’s biodiversity, cultural and social values and contributes significantly to the Queensland economy through tourism. Marine turtles play an important ecological role in the shaping and regulation of coastal marine communities by contributing to the maintenance of healthy seagrass beds and coral reefs, helping balance marine food webs and facilitating nutrient cycling. Turtles feature prominently within the knowledge systems, customary laws and livelihoods of many Indigenous coastal communities in Queensland. They are also an iconic species and key attraction for Queensland tourism, particularly at Mon Repos, Heron Island and Lady Elliott Island.

2.1 Legislative, policy and management framework

Marine turtles are recognised internationally as species of conservation concern including under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on the Conservation of Migratory Species of Wild Animals (CMS, also known as the Bonn Convention) and the International Union for Conservation of Nature (IUCN) Red List of Threatened Animals.

All six species of marine turtles that occur along and in waters adjacent to the Queensland coast are protected primarily under the Australian Government’s *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA), the Queensland *Nature Conservation Act 1992* (NCA) and related legislation. Table 1 provides an overview of the current conservation status (state, national and international) of each species.



Mon Repos Turtle Centre © Queensland Government

Marine turtles are also protected through a range of measures under state and Commonwealth legislation relating to fisheries management (e.g. requiring the use of turtle exclusion devices in high-risk fisheries) and environmental impact assessment and planning (e.g. the *National Light Pollution Guidelines for Wildlife including marine turtles, seabirds and migratory shorebirds*).

Turtles may be legally taken by Aboriginal peoples and Torres Strait Islander peoples in accordance with section 211 of the *Native Title Act 1993* for personal, domestic or non-commercial communal needs. Analysis of the interplay between various state and Commonwealth laws relating to Indigenous harvest is complex and described in more detail in the national Recovery Plan. This strategy seeks to take a holistic and pragmatic approach to supporting local, Indigenous-led marine turtle recovery and management efforts, including through empowering Indigenous communities to make informed decisions about the local recovery actions they could lead and support, based on best available knowledge.

The current national Recovery Plan provides for research and management actions necessary to stop the decline and support the recovery of marine turtles in Australia to maximise their chances of long-term survival in nature. **This Queensland Strategy builds on, is supplementary to, and should be read in conjunction with the national Recovery Plan.** It builds on a comprehensive suite of existing management actions for marine turtles and associated monitoring and research and is further supported by detailed management guidance in species-specific plans, such as the *CMS Single Species Action Plan for the Loggerhead Turtle (Caretta caretta) in the South Pacific Ocean*.

There are many roles and responsibilities involved in delivering marine turtle conservation in Queensland, ranging from making laws and shaping policies, preparing and implementing plans, undertaking research, building capacity, delivering on-ground actions, educating the public, and providing tourism experiences. A summary of existing and potential future collaborators is identified in Appendix B.

2.2 Queensland's marine turtle genetic stocks

The life history traits of marine turtles make them vulnerable to a wide range of anthropogenic threats. These traits include:

- decades to reach maturation
- elevated natural mortality of hatchlings and small juveniles compared to adults
- geo-magnetic imprinting and strong fidelity to breeding and foraging areas
- pelagic post-hatchling dispersal
- migrating over long distances to breed
- temperature-dependant sex determination
- use of both terrestrial and marine environments to complete their lifecycle.

At the same time, marine turtles have traits that contribute to population resilience, including discrete genetic stocks that are supported by multiple breeding locations and widely dispersed foraging populations.

Marine turtles return to the region where they hatched to breed, resulting in discrete genetic stocks within each species (Figure 1). This strategy identifies overarching priority actions for the protection of all marine turtle species and specific requirements that are unique to each stock. Amongst the six species of marine turtle there are 10 currently recognised genetic stocks along the Queensland coast and adjacent Australian waters (Figure 1).

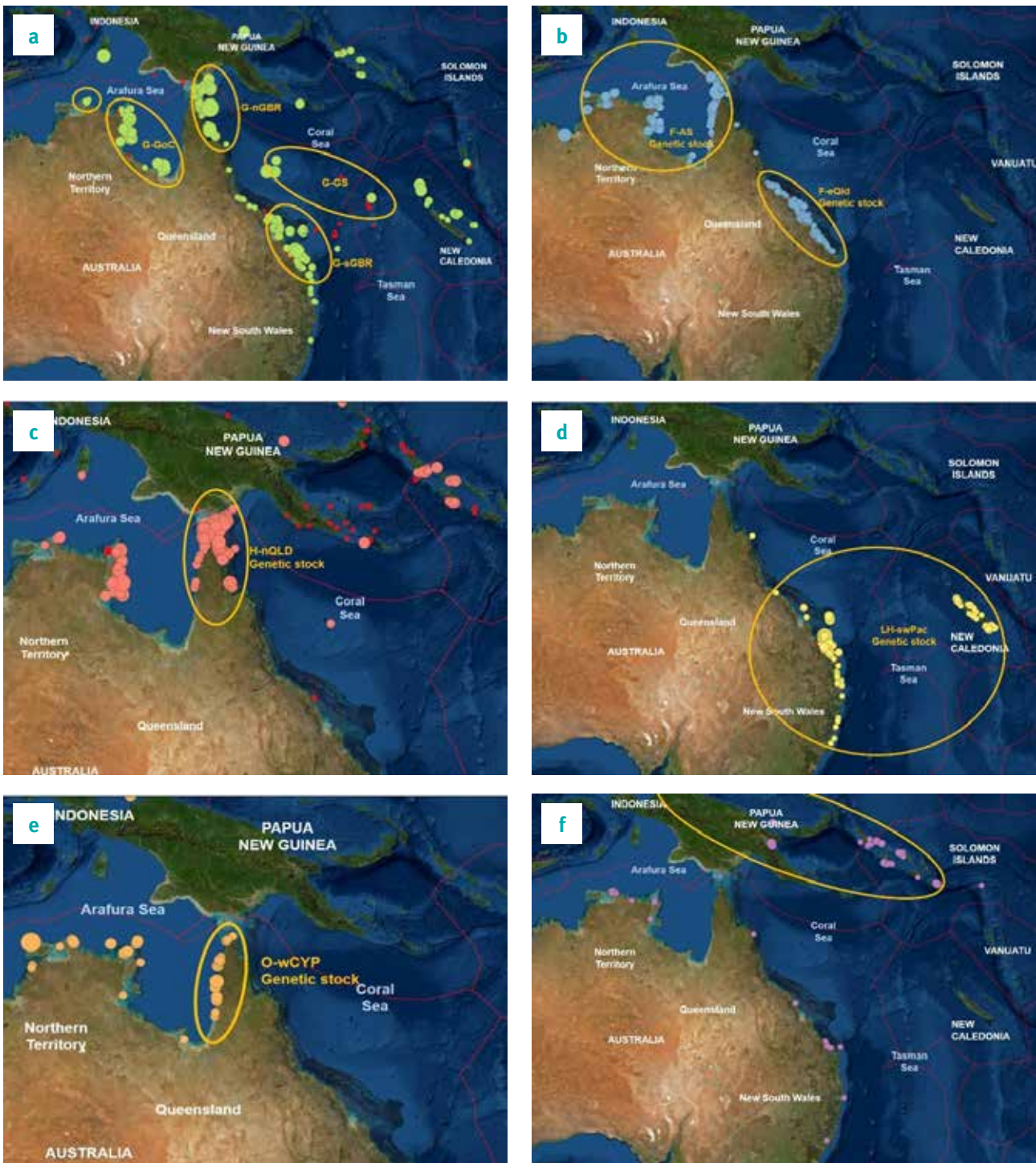


Figure 1 Breeding distribution of the 10 genetic stocks of the six species of marine turtles in Queensland

- a Green turtle southern Great Barrier Reef (G-sGBR), northern Great Barrier Reef (G-nGBR), Coral Sea (G-CS) and Gulf of Carpentaria (G-GoC).
- b Flatback turtle eastern Queensland (F-eQld) and Arafura Sea (F-AS).
- c Hawksbill turtle north Queensland (H-nQld).
- d Loggerhead turtle south-west Pacific (LH-swPac), shared with New Caledonia.
- e Olive ridley north-western Cape York (O-nwCYP).
- f Leatherback turtle genetic stock (LB). As there has been no reported nesting in Queensland since 1996, for the purpose of this strategy, leatherback turtles in Queensland are considered as part of a single regional stock that is possibly extinct for breeding in Queensland.

Although each genetic stock displays relatively localised nesting and courtship, stocks are highly dispersed with foraging occurring across multiple jurisdictions. Complementary conservation efforts are therefore required within and between Queensland, Australian and international jurisdictions. While the Australian Government has lead responsibility for management actions that require formal international engagement, there are many examples of direct collaboration between marine turtle managers in Queensland and neighbouring countries (including Indonesia, Papua New Guinea, the Solomon Islands, New Caledonia and Vanuatu). These ongoing collaborations are an essential foundation for effective management of the Queensland stocks of marine turtles.

The condition and trend of each of the 10 Queensland marine turtle genetic stocks was assessed using expert opinion and are shown in Table 2 and an overview of the various stock condition and trend categories used is provided in section 3.4.

Table 2 Queensland marine turtle genetic stock descriptions, codes, condition and trend

Species/ stock code	Species/stock description	Stock condition	Stock trend
G-sGBR	Green turtle southern Great Barrier Reef	Depleted	Moderate recovery
G-nGBR	Green turtle northern Great Barrier Reef	Severely depleted	Significant decline
G-CS	Green turtle Coral Sea	Unknown	Unknown
G-GoC	Green turtle Gulf of Carpentaria	Unknown	Unknown
F-eQld	Flatback turtle eastern Queensland	Depleted	Moderate decline
F-AS	Flatback turtle Arafura Sea	Severely depleted	Stable/possibly increasing
H-nQld	Hawksbill turtle north Queensland	Severely depleted	Significant decline
LH-swPac	Loggerhead turtle south-west Pacific	Severely depleted	Moderate recovery (declining)
O-nwCYP	Olive ridley north-western Cape York	Severely depleted	Significant decline
LB*	Leatherback turtle	Severely depleted	Significant decline

*As there has been no reported nesting in Queensland since 1996, for the purpose of this strategy, leatherback turtles in Queensland are considered as part of a single regional stock that is possibly extinct for breeding in Queensland, or a possible outlying part of the north-west Pacific genetic stock

2.3 Threats

There are a range of threats operating at the international to local scale that will inhibit the recovery of marine turtles in Queensland. The risk posed by these threats to Queensland's 10 marine turtle genetic stocks varies depending on the habitats they occupy, timing of habitat occupancy, life-cycle stage affected, abundance and trends in nesting and foraging numbers, and the management and mitigation currently in place. The national Recovery Plan assessed the risks of the following individual threats for each stock: climate change and variability, marine debris, chemical and terrestrial discharge, *international take*, terrestrial predation, *fisheries bycatch*, light pollution, habitat modification through infrastructure/coastal development and dredging and trawling, *Indigenous take*, vessel disturbance, noise interference, recreational activities, and disease and pathogens.

Since publication of the national Recovery Plan, new evidence has highlighted a change in the magnitude of the relative risks for Queensland’s marine turtle genetic stocks, especially related to climate change (e.g. sea level rise and the extreme feminisation and mortality of clutches resulting from increased nesting sand temperatures). For consistency, the national threat categories have been maintained. However, threat assessments have been further refined for each Queensland genetic stocks (using contemporary information and field observations where available) to help inform the stock management triage process and identify practical priority actions (see stock-specific tables in Section 5). The same process used to assess threats under the national Recovery Plan was used for the updated Queensland threat assessment. The outcomes of the 2017 national assessment were used as a starting point with the threat risk rating moved by exception where there was updated information available for Queensland. Regular reviews of the stock-based threat assessment are identified as an overarching priority action in this strategy. Further background on the threat assessment process and a summary of results is provided in Appendix A.

Table 3 provides an overview of the primary threats and updated threat risk assessments for each of the Queensland genetic stocks, as well as indicating those threats that pose the greatest threat across all stocks. Threats operating at the Queensland and national scale are broadly similar. The most significant variation in threat rating from the national Recovery Plan was climate change and variability.¹ Further engagement with relevant First Nations communities is required for risks related to *Indigenous take*.²

For most marine turtle stocks, it is the cumulative impacts of multiple threats operating at different scales that need to be addressed to secure their recovery. In the same way that threats are cumulative, the benefits of individual recovery actions can also be cumulative. While threats with a risk score of *very high* and *high* are specifically targeted in this strategy, any action to reduce threats (even lower priority threats) can have a combined positive benefit for the recovery of individual and multiple stocks with shared habitat.

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- 1 The impact of climate change was identified as a very high-risk threat to all genetic stocks. However, there remains knowledge gaps around the projected climate-related impacts, so the level of confidence varied between stocks. Accordingly, an overarching management action is to undertake more specific research based on detailed projections and modelling of climate-related impacts, to better understand the specific threats posed by climate change to marine turtle stocks in Queensland, as a basis for identifying feasible, low-regrets management actions. See also the *Queensland Biodiversity and Ecosystems Climate Change Adaptation Plan*.
 - 2 As part of broader, Indigenous-led approaches to sea country management, it is appropriate for Traditional Owners to have input into determining the risk that threats pose to each genetic stock, particularly the level of relative threat posed by Indigenous take of marine turtles and their eggs within their respective country estates, and how to address this issue locally in a way that reinforces (rather than undermines) customary management approaches.

Table 3: Summary of the threat risk assessment process undertaken for each Queensland marine turtle stock

THREAT	SPECIES									
	G-sGBR	G-nGBR	G-CS	G-GoC	F-eQld	F-AS	H-nQld	LH-swPac	O-nwCY	LB
A. Climate change and variability										
B. Marine debris–entanglement			U							
B. Marine debris–ingestion						U			U	
C. Chemical and terrestrial discharge–acute										
C. Chemical and terrestrial discharge–chronic										U
D. <i>International take</i> –outside Australia’s jurisdiction										
D. <i>International take</i> –within Australia’s jurisdiction										
E. Terrestrial predation										U
F. <i>Fisheries bycatch</i> –international					U					
F. <i>Fisheries bycatch</i> –domestic										
G. Light pollution										
H. Habitat modification–infrastructure/coastal development										
H. Habitat modification–dredging/trawling										
I. <i>Indigenous take</i> (requires further assessment)										
J. Vessel disturbance										
K. Noise interference–acute					U		U			U
K. Noise interference–chronic	U			U	U		U	U	U	U
L. Recreational activities										
M. Diseases and pathogens	U		U	U	U	U	U		U	U

Risk rating: Very high High Moderate Low U = unknown

2.4 Indigenous management of marine turtles

Aboriginal peoples and Torres Strait Islander people continue to actively assert and maintain their rights and responsibilities in relation to their traditional coastal and maritime estates (for the purpose of this strategy these areas will be collectively referred to as ‘sea country’), which encompass many areas of conservation significance for marine turtles.³ Traditional Owners are properly recognised as the primary custodians and stewards of their traditional estates. From an Indigenous perspective, the legal, practical, economic and spiritual dimensions of this custodial relationship extend to include the species dependent on these areas for their survival. Although marine turtles are migratory species and their populations are shared, local management efforts are crucial in terms of ensuring effective, appropriate and enduring approaches to secure the sustainability of marine turtle populations, and hence the success of this strategy.

The strategy takes a holistic approach to managing the many contemporary threats to the survival of marine turtles at a state-wide scale. For thousands of generations, Aboriginal peoples and Torres Strait Islander peoples have harvested these species in line with customary lore/laws and protocols within their traditional land and sea estates, and these continuing rights are recognised under native title legislation. Traditional harvest of marine turtles is not the primary cause of the dramatic decline in the populations of many species of marine turtles. Given the impacts of these turtle population declines on the culture and livelihoods of coastal Indigenous communities, Traditional Owners have a strong interest in—and should be recognised as essential partners in—recovery efforts. The knowledge, customary management protocols and practices, laws/lores, plans and governance structures of First Nations peoples should underpin and inform the local, community-based management initiatives for marine turtles that First Nations peoples drive in their own communities.

There have been increasing calls from First Nations peoples to be meaningfully involved in, and to lead, conservation planning and management initiatives within their traditional estates. Simultaneously, there are numerous international, national and state drivers for enhanced collaboration and partnership with First Nations peoples in conservation management arrangements. The Queensland Government has recently committed to a co-stewardship approach for protected area management, whereby First Nations peoples’ contemporary aspirations and enduring connections to country are recognised, respected and prioritised.⁴ Consistent with this approach, the Queensland Government (and federal partner agencies), through this strategy, reaffirms its commitment to supporting First Nations peoples in their efforts to lead and undertake management actions related to the conservation of marine turtles, as primary partners. As with other communities of interest, meaningful engagement, negotiation and co-design of collaborative management actions should primarily occur at a local level, to align with the geographic and cultural scale of First Nations peoples’ rights and interests over their traditional land and sea estates, using this state-wide strategy as a foundation.

³ The impact of climate change was identified as a very high-risk threat to all genetic stocks. However, there remains knowledge gaps around the projected climate-related impacts, so the level of confidence varied between stocks. Accordingly, an overarching management action is to undertake more specific research based on detailed projections and modelling of climate-related impacts, to better understand the specific threats posed by climate change to marine turtle stocks in Queensland, as a basis for identifying feasible, low-regrets management actions. See also the *Queensland Biodiversity and Ecosystems Climate Change Adaptation Plan*.

⁴ As part of broader, Indigenous-led approaches to sea country management, it is appropriate for Traditional Owners to have input into determining the risk that threats pose to each genetic stock, particularly the level of relative threat posed by Indigenous take of marine turtles and their eggs within their respective country estates, and how to address this issue locally in a way that reinforces (rather than undermines) customary management approaches.

This Queensland Strategy showcases some of many examples of successful contemporary, Indigenous-led marine turtle management initiatives. There is significant potential for building on the approaches, achievements, lessons and insights from these success stories in identifying and implementing future shared management actions.

The rights and interests of First Nations peoples in relation to the ongoing management of marine turtles in Queensland are critically important. This Queensland Strategy is being developed initially to clarify internal state and Commonwealth governments' understanding of issues and guide their actions but may also provide a working framework to guide engagement with relevant First Nations peoples and other collaborators. Management agencies operating at the stock level will play a lead role in carrying out preliminary engagement in relation to the priorities and opportunities for collaborative management identified in this strategy. Wherever possible, existing Indigenous governance and engagement mechanisms will be used, taking into account the outcomes from prior engagement with Indigenous communities on marine turtle-related issues.

The proposed process for engaging with First Nations peoples in relation to the development and implementation of this strategy should aim to:

- recognise and reinforce Indigenous-led plans and customary management approaches, traditional knowledge, governance structures, cultural protocols and community priorities for marine turtles
- be undertaken with adequate resources, over culturally-appropriate timeframes
- address the elements required to seek free, prior and informed consent (FPIC)⁵
- provide genuine opportunities for co-design and co-delivery of management responses
- provide a consistent framework, with iterative and flexible approaches to allow management responses to be determined locally, and aligned with customary laws/lores, community priorities, capacity and management aspirations.

⁵ The impact of climate change was identified as a very high-risk threat to all genetic stocks. However, there remains knowledge gaps around the projected climate-related impacts, so the level of confidence varied between stocks. Accordingly, an overarching management action is to undertake more specific research based on detailed projections and modelling of climate-related impacts, to better understand the specific threats posed by climate change to marine turtle stocks in Queensland, as a basis for identifying feasible, low-regrets management actions. See also the *Queensland Biodiversity and Ecosystems Climate Change Adaptation Plan*.

3.0 Desired future

The aim of the Queensland marine turtle conservation strategy is to stop the decline and support the recovery of the six species of marine turtles found in Queensland. This will require reducing all operationally-manageable threats to allow for the conservation status of marine turtles to improve, ideally so that they can be removed from Queensland and Commonwealth threatened species lists.

Given the continuing and increasing threats and the currently depleted populations in most stocks, the long-term recovery goal to remove all species from the threatened species list is ambitious and likely to require at least three marine turtle generations (potentially 100 years) to achieve. This may not be realistic for some stocks but remains an aspiration. Consequently, a 20-year planning horizon has been used to set the following interim objectives and targets for marine turtle management in Queensland with a focus on improving the conservation outlook, identifying and demonstrating positive recovery actions directed at real threats impacting the stocks. The strategy will be in operation until replaced and will be reviewed and updated at least every five years to ensure it remains current.

3.1 Guiding principles

Marine turtle management in Queensland will be guided by the following principles:

- a A stock-based approach and focus on using best available knowledge to reduce threats and recover the six species of marine turtles.
- b Respect and strengthen the traditional rights, interests and customary obligations of First Nations peoples in relation to marine turtles.
- c Support a collaborative approach that harnesses the contribution of all willing partners and aligns investment with priorities.
- d Seek to ensure all human interactions with marine turtles are ecologically sustainable.
- e Adopt a bias for active interventions that incorporate learning from experience.

3.2 Interim objectives and targets

Due to the long timeframes involved in recovering marine turtles, five interim objectives have been identified. The effectiveness of this Queensland Strategy will be measured on the basis of how well the targets for interim objectives are met. Where possible, the interim objectives align with the national Recovery Plan (relevant targets in the NRP are identified in brackets).

Interim objective 1—Sufficient foundational knowledge

- **Target 1.1.** Robust scientific information is available and used to support decision making (NRP T1.2) for each stock.
- **Target 1.2.** Indigenous ecological knowledge and customary laws/lores and protocols underpin local community-based management of marine turtles and their habitats (as part of broader, Indigenous-led sea country planning and management approaches). Indigenous ecological knowledge is integrated with western knowledge systems (with agreement of traditional knowledge holders).
- **Target 1.3.** Effective monitoring programs are implemented and maintained at index beaches and foraging areas for each stock (NRP T4.1).
- **Target 1.4.** Measures of success are identified for each stock.

Interim objective 2—Strong enabling environment

- **Target 2.1.** Domestic and international legislation and other agreements that support the recovery of Queensland marine turtles are maintained and, where possible, strengthened (NRP T1.1).
- **Target 2.2.** Strong collaborative governance arrangements provide clear state-wide direction and coordinated input from all willing partners.
- **Target 2.3.** Strategic investments align to priorities and create enduring legacy outcomes.
- **Target 2.4.** Indigenous-led marine turtle management and recovery efforts are recognised, resourced and supported.

Interim objective 3—Effective direct management

- **Target 3.1.** Nesting, foraging and courtship areas that support at least 80% of each stock are effectively protected and managed (e.g. in declared protected areas or equivalent enduring arrangements).
- **Target 3.2.** Nesting success and survivability of marine turtle clutches of eggs and hatchlings is increased to more than 80% with a target sex ratio above 30% male to support long-term stock recovery (the 80% target is higher than in the national Recovery Plan and considered necessary to recover depleted stocks in the face of increasing threats such as climate change).
- **Target 3.3.** Marine turtle bycatch mortality in commercial fisheries and the Queensland shark control program is reduced to a negligible level (i.e. no impact on the stock).
- **Target 3.4.** Measures of success identified for each stock are achieved within the life of the strategy.

Interim objective 4—Empowering community engagement

- **Target 4.1.** The sustainable management of marine turtles by Traditional Owners, Aboriginal communities and Torres Strait Islander communities and ranger groups to maintain long-term cultural, spiritual and economic associations with marine turtles is supported (NRP T2.1).
- **Target 4.2.** The capacity of programs to conduct effective monitoring, management and research of marine turtles at nesting beaches and feeding grounds is maintained and increased in partnership with NGOs and community-based organisations.
- **Target 4.3.** Community awareness and support for marine turtle conservation is increased.

Interim objective 5—Adaptive management and continuous improvement demonstrably reduce threats

- **Target 5.1.** Robust and adaptive management regimes that lead to a reduction in all manageable threats to marine turtles and their habitats are in place (NRP T3.1).
- **Target 5.2.** Threat mitigation strategies are supported by high-quality information (NRP T3.2).

3.3 Implementation arrangements

Managing marine turtles in Queensland is a shared responsibility with potential input from all levels of government, a range of research institutions, Traditional Owners, First Nations communities and Land and Sea Ranger groups, regional and local NRM groups, other non-government, community-based organisations and individuals. Strong leadership from the state and Commonwealth governments can enable and facilitate the effective contribution from a diversity of willing delivery partners.

A model to improve collaboration and build on existing interagency relationships and support to enhance marine turtle conservation and management in Queensland is proposed (Figure 2).

The model recognises the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, Queensland *Nature Conservation Act 1992*, and associated Commonwealth and Queensland environmental management legislation, together with international instruments and the national *Recovery Plan for Marine Turtles in Australia* (and related documents) provide the overarching legislative and policy framework to achieve marine turtle conservation in Queensland. The Australian Government Marine Turtle Round Table provides a forum to coordinate implementation of the national Recovery Plan among the Commonwealth and relevant state and territory agencies.

The Queensland Strategy is focused on integrating Australian, Queensland-wide and individual stock-based priorities with regionally-based management capacity and delivery partnerships. The Queensland Department of Environment and Science (or the state agency responsible for management of threatened species) will have ultimate responsibility for coordinating the implementation of the strategy and it is proposed that the department will be advised by a Queensland Marine Turtle Working Group (QMTWG).

The working group will be managed by the department and membership is proposed to include representatives from government agencies responsible for marine turtle management along the Queensland coast and adjacent Australian waters. The working group will work closely with delivery partners and stakeholders to ensure a coordinated approach to turtle management in Queensland. The strategy recognises that each delivery partner has different roles, responsibilities, resources and capabilities and that implementation needs to be based on a shared vision, agreed priorities and genuine collaboration that has sufficient flexibility to adapt to changing circumstances.

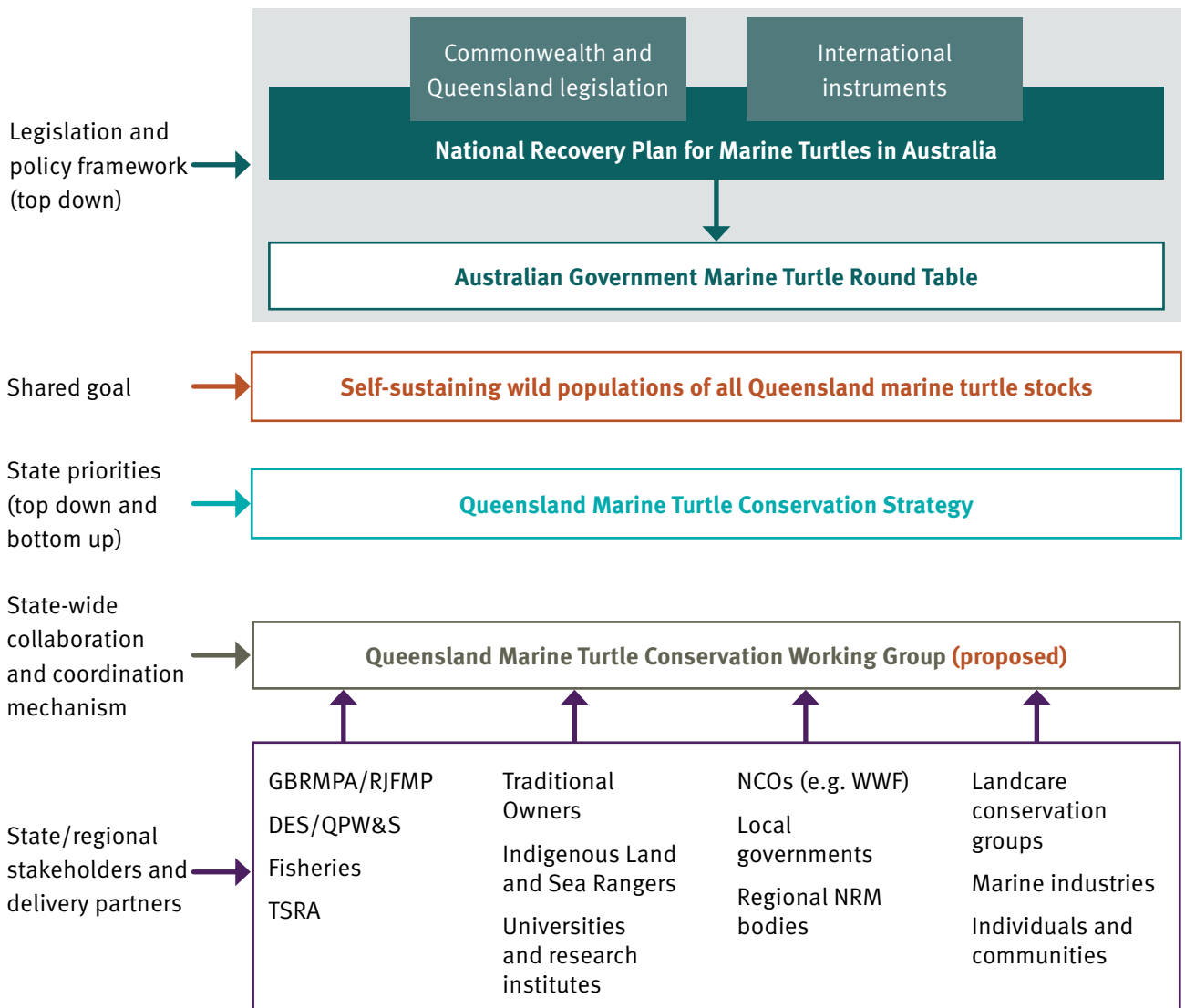


Figure 2: Proposed overarching collaboration arrangements for marine turtle management in Queensland

3.4 Guide to the recovery action tables

A range of management actions have been identified to address the highest threats and help recover the 10 Queensland marine turtle genetic stocks. Recovery actions are presented in two sets of tables which allow key information to be summarised in a concise and consistent manner:

- Overarching actions table—actions that apply to many or all stocks.
- Stock-specific tables—actions that are relevant primarily to a single stock.

Overarching action tables

For the overarching actions in Section 4, the standard table columns are as follows.

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
Unique reference code	Brief description of proposed recovery action—linked to interim objectives	Suggested foundational or preliminary activities to progress the relevant action	Combined measure of the significance of the threat, how practical implementation is and the likelihood of positive impact*	The key entities responsible for leading delivery of the action (see Appendix B abbreviations)	Potential collaborators to support delivery of the action (see Appendix B abbreviations)	Indicative timeframes for (initiating) the delivery of each action: Now (1–2 yrs) Next (3–5 yrs) Later (5–10 yrs) Ongoing	Indication of investment required to implement the action: No additional cost Low (<\$100k) Medium (\$10k–\$500k) High (>\$500k–\$2.5m) Very high (>\$2.5m)

* Conservation management priorities for each Queensland marine turtle genetic stock have been identified based on three key factors: the significance of the threat risk (threat risk), the feasibility of the recovery action (feasibility), and the likelihood of management intervention success (potential impact). This is based on best available information and expert judgement. Preference will be given to actions with compounding benefits (e.g. benefiting multiple stocks). (Refer to Appendix A)

The following describes the overall indicative priority of recovery actions, as per the priority matrix:

- Very high = High threat risk, high feasibility, very high potential impact.
- High = High threat risk, high feasibility, low potential impact.
- Medium = Low threat risk, high feasibility, high potential impact.
- Low = High threat, low feasibility, low potential impact.

Stock-specific action tables

The stock-specific tables in Section 5 contain both background information and recovery actions. In addition to the categories used for overarching actions, the stock-specific tables include the following standard information.

- Species/stock code name and descriptive name (consistent with national Recovery Plan).
- Status under the EPBCA and NCA.
- Current stock condition (based on expert judgement using the hierarchy below).

Depleted
Severely depleted

- Current trend (based on expert judgement using hierarchy below: supported by graphs).

	Significant recovery
	Moderate recovery
	Stable
	Moderate decline
	Significant decline
	—
	No clear trend

- A stock outlook statement is provided for each stock based on best available knowledge.

Very Good	The stock is depleted but increasing, most threats are being adequately addressed and a strong recovery is expected over the short term (one generation) if effective management is maintained or increased
Good	The stock is depleted but stable, many threats are being addressed and recovery is possible over the medium to long term (2–3 generations) if effective management is increased to further reduce remaininwg threats
Poor	The stock is very depleted, exposed to ongoing threats and is likely to decline further in the medium to long-term (2–3 generations) without increased management to effectively reduce threatening processes and improve recovery
Very poor	The stock is severely depleted, exposed to many significant ongoing threats and likely to decline further (including potentially collapse) in the short term (one generation) without significant increased management to effectively reduce threatening processes and improve recovery

- The confidence scores (shown below), which describe the level of confidence in the stock trend and outlook assessments.

	High—Adequate high-quality evidence and high level of consensus
	Medium—Limited evidence or limited consensus
	Low—Very limited evidence, assessment based on anecdotal information and professional judgement

- Overall Queensland priority for additional investment.

For each Queensland marine turtle stock, the overall relative priority for additional future management investment has been determined using a combination of the current stock trend and threatened species classification (risk of extinction) using the matrix shown in Table 4 (note that for the hawksbill turtle stock, the higher classification under the NCA was used to set the overall priority). The stock trend assessments were determined using best available information and expert judgement. While the feasibility of recovery is not a primary factor for setting overall stock management priority, it is a key consideration when identifying the priority to implement specific recovery actions (i.e. recovery actions are rated based on their feasibility and expected positive impact in the stock-specific tables). A triage approach was adopted to prioritise actions, whereby additional future management investment is to be directed towards those stocks that require the most urgent attention and where management actions have the highest chance of influencing the stock, while maintaining efforts to sustain stocks that are stable.

Table 4 Queensland marine turtle stock prioritisation matrix

Stock trend	Overall Queensland stock management priority **	
	Vulnerable	Endangered
Significant recovery	Very low	Low
Moderate recovery	Low	Low
Stable	Low	Medium
Moderate decline	Medium	High
Significant decline	High	High
Unknown (data deficient)	Medium	High

** Overall relative priority for future management investment (subject to feasibility of actions)

- Stock description, including stock characteristics, range, population trends, known cultural significance, primary threats, existing management arrangements and management requirements, including trend data for index sites and standard maps of range and key nesting sites.
- Important nesting locations (the major and minor nesting beaches and index sites):
 - Major nesting beaches are defined as an area that is estimated to be more than 20% of the total annual nesting population for the genetic stock.
 - Minor nesting beaches are defined as an area that is estimated to be between less than 20% of the total annual nesting population for the genetic stock.
 - Index (nesting) sites are a study site with more than five years of consecutive standardised monitoring of population size and other demographic parameters.
- Inter-nesting buffer (km), which is a defined zoned perimeter around a nesting beach to provide habitat protection to the nesting turtles when they are in the egg production phase (i.e. inter-nesting). These can be associated with Marine Park regulations.
- Timing of mating, nesting and hatching (showing range and peak periods, where known).
- Important foraging and courtship areas, where known, or noted where not known.
- Index (foraging) sites, which are study sites with more than five years of consecutive standardised monitoring of population size and other demographic parameters.
- Primary threats and level of risk (updated for Queensland using best available knowledge and professional judgement). Only high and very-high risk threats are listed in stock-specific tables.
- Primary management objectives (overarching strategic directions for the stock).
- National Recovery Plan actions specifically required to recover this stock, including Australia’s commitments to implement international agreements for marine turtle conservation.
- Specific Queensland actions to support the national Recovery Plan actions to recover this stock.

4.0 Overarching actions

Overarching actions are those that relate to multiple pressures, multiple species and stocks, knowledge gaps and foundational actions that are essential for a comprehensive Queensland-wide approach. The measures identified in Table 5 are in addition to the cross-cutting actions identified in the national Recovery Plan and have been grouped by management strategy type (e.g. foundational knowledge, enabling environment, direct management, community education and engagement, and management evaluation and improvement). Some of these measures are consistent with or have been drawn from existing strategies.



Girrigun rangers rescue injured marine turtle © Queensland Government

Table 5 Overarching marine turtle conservation management actions (Queensland)

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
OBJ1	Foundational knowledge						
OA1.1	Continue to improve marine turtle species knowledge with a focus on less well-understood stocks, including in relation to species ecology, mapping and modelling of habitats and species/stock distribution, population condition and trend information, threats and management requirements	Refer to stock-specific action tables for existing knowledge gaps, especially for less well understood stocks in the Gulf of Carpentaria, Torres Strait and Coral Sea	High	ALL	ALL	Now/ongoing	High/very high
OA1.2	Maintain population census monitoring and identification of threatening processes for index sites for each genetic stock: <ul style="list-style-type: none"> at least two index nesting beaches for each stock one index foraging site relevant to each stock (where possible) index foraging sites selected to allow monitoring of multiple genetic stocks and/or species) 	Refer to stock-specific action tables for existing and proposed additional index sites, including for G-nGBR (foraging), G-GoC (nesting and foraging), G-CS (nesting and foraging), F-eQld (foraging), F-AS (foraging), H-nQld (nesting and foraging), LH-swPac (foraging), O-nwCYP (nesting and foraging)	High	ALL	ALL	Now/ongoing	High
OA1.3	Maintain integrated databases for marine turtle field data collected using standardised methods, allowing for the collation and editing of data state-wide. Facilitate shared access to near-real time data to support evidence-based decision making by all delivery partners The integrated data management system should incorporate: <ul style="list-style-type: none"> StrandNet (temporal and spatial distribution of threatened marine wildlife strandings, mortality and injuries) TurtData (the Queensland Turtle Conservation Database collating the temporal and spatial distribution of tag applications, sightings, and incubation data for marine turtles) TurtleNet (publicly available Marine Turtle Nesting and Migration Mapping Tool that displays the temporal and spatial distribution and abundance of marine turtle nesting within Queensland, nationally and internationally with accompanying migration data from flipper tag recoveries and satellite telemetry to link the nesting beaches to the respective dispersed foraging areas) Fisheries interactions with marine turtles (including extent, effectiveness and enforcement of bycatch reduction measures) 	Review Strandnet to improve functionality and reporting Create data visualisation and analysis tools to support improved decision making Improve the data security and access arrangements for TurtData Establish public access to TurtleNet Mapping Tool	High	DES (QPWS&P)	GBRMPA RJFMP QDAF	Now/ongoing	Medium
OA1.4	Determine limits of acceptable change (triggers for management intervention) and the causes of change at key stages in the lifecycles of each Queensland marine turtle genetic stock to inform improved management and monitoring	Identify critical indicators (e.g. hatching success, feminisation, etc.) and limits of acceptable change	Medium	DES (QPWS&P)	QMTWG	Next	Medium
OA1.5	Monitor temperature at a minimum of one index nesting beach for each Queensland marine turtle stock	Confirm agreed index nesting beaches for ongoing temperature monitoring methods. (e.g. Mapoon, Milman Island, Crab Island, Peak Island, Deliverance Island, Heron Island, Curtis Island, Mon Repos and Sunshine Coast)	High	ALL	ALL	Now/ongoing	Medium

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
OA1.6	<p>Maintain and enhance engagement with Traditional Owners and First Nations Land and Sea managers through dialogue, knowledge and data exchange, co-design and collaborative management approaches</p> <p>Seek to integrate Indigenous ecological knowledge and management practices into marine conservation and management approaches (with agreement from Traditional Owners and ensuring appropriate recognition and protection of Indigenous peoples' Intellectual Property rights and culturally sensitive information)</p>	<p>Identify and explore opportunities for engaging with Traditional Owners and First Nations Land and Sea management groups to collaboratively design and deliver local recovery actions that align with community priorities (see action OA4.1)</p>	Very high	ALL	ALL	Now/ongoing	High
OA1.7	<p>Identify and plan for the implementation of feasible management techniques that can be applied at an ecologically meaningful scale to increase climate change resilience, including through:</p> <ul style="list-style-type: none"> development of a fine-scale mapping and modelling tool to identify and assess the quality of current and potential alternative refugial marine turtle nesting and foraging habitat improving the monitoring of habitat quality to include foraging habitat (i.e. seagrass, coral, etc.) recording changes over time, especially in relation to climate change impacts and associated changes in marine turtle behaviour and survivorship, nesting and foraging habitat assess the suitability of future large-scale relocation of turtle nests or hatchlings to address climate change and feminisation risks (i.e. Torres Strait, eastern Cape York Peninsula) (see action OA3.5) recording outcomes from trials of practical, nest cooling techniques (see action OA3.2) 	<p>Develop a toolbox of adaptation techniques, identify immediate low-regrets adaptation actions and prioritise feasible management techniques for each stock</p> <p>Confirm appropriate nesting beaches for relocation efforts to be trialled, including carrying out necessary consultation with Traditional Owners</p>	Very high	ALL	ALL	Now/ongoing	Very high
OA1.8	<p>Expand and share knowledge regarding best practice low-light solutions</p> <p>Maintain and make available (to the public and agencies) accurate maps of turtle nesting areas on the State Planning Policy Interactive Mapping System to inform local government planning and decision making</p>	<p>Ensure appropriate maps are included and regularly updated on the Interactive Mapping System</p> <p>Release guidelines regarding the data and mapping standards to assist plan making agencies (local governments and port authorities) seeking to locally refine turtle nesting area mapping</p> <p>Prepare material and establish a network and forums regarding best practice examples of low-light solutions for local government, port managers and asset manager audiences</p>	High	DES (EPP)	LGA DSDILGP NRME (Energy) Electricity Providers TMR (Ports)	Now Ongoing	No additional cost

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
OBJ 2	Enabling environment						
OA2.1	Establish a Queensland Marine Turtle Working Group (QMTWG) to coordinate marine turtle conservation efforts, strengthen relationships and existing networks, and ensure best use of available resources	Develop terms of reference and confirm membership for the Working Group to adequately reflect the geographic range, primary threats and management requirements of each Queensland stock	High	DES GBRMPA	ALL	Now/ongoing	Low
OA2.2	Develop and maintain a Queensland marine turtle investment prospectus to help secure additional investment for ongoing programs and specific projects. Identify co-benefits and potential co-investment partnership opportunities (e.g. offset funding, sponsorships, grant programs, etc.)	Develop project scope and identify resources to progress	Medium	QMTWG	ALL	Next	Low/medium
OA2.3	Ensure opportunities for education and participation in marine turtle management is incorporated into Indigenous and non-Indigenous ranger training and land and sea country programs	Develop a State-wide engagement and capacity development framework (see action OA4.3)	Medium	DES GBRMPA PA	FNP	Next	Low/medium
OA2.4	Provide broad-scale, long-term, secure habitat protection over at least 70% of the nesting population of each genetic stock of marine turtles in Queensland, including by: <ul style="list-style-type: none"> establishing and maintaining a network of protected areas (e.g. Marine Protected Areas (MPAs), national parks, ILUAs, TUMRAs, Indigenous Protected Areas (IPAs), or equivalent secure habitat protection mechanisms) throughout Queensland, including Torres Strait and the Gulf of Carpentaria maintaining the prohibition on mining within National Parks and Marine Parks in Queensland developing culturally appropriate protected areas and co-stewardship arrangements with Traditional Owners for conservation management of significant marine turtle habitat within Indigenous owned lands 	Identify those stocks that do not currently have adequate habitat protection over at least 70% of the nesting population to prioritise habitat protection measures (including in the Gulf of Carpentaria) Seek to instigate a whole-of-government process to address this issue	High	DES (QPWS&P) GBRMPA PA DAWE	NTRBs RNTBCS FNPs	Now/ongoing	Very high
OA2.5	Consider options to enhance protection of marine turtle populations including through: <ul style="list-style-type: none"> Appropriate spatial zoning where required to protect breeding turtles near nesting beaches, inter-nesting habitats, migratory corridors and courtship areas Go-slow Zones to minimise boat strike to turtles within shallow coastal waters and areas of elevated boating activity other complementary management tools, including those that can apply outside of marine parks (e.g. within designated port areas) 	Consider adequacy of marine turtle conservation measures in the review of Great Sandy Marine Park management arrangements	Low	DES (QPWS&P/ EPP) GBRMPA PA		Next	Very high

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
OA2.6	<p>Minimise marine turtle bycatch mortality within fisheries that have a significant bycatch of turtles, including by:</p> <ul style="list-style-type: none"> • working with and supporting fisheries managers and the fishing sector to reduce residual risks associated with negative marine turtle interactions with recreational and commercial fishing • enhancing vessel monitoring across all fisheries and/or developing innovative technologies to increase reporting of turtle interactions to species (and where feasible stock) • maintaining compulsory use of turtle excluder devices (TEDs) in prawn fisheries using otter trawls within the Arafura Sea-Gulf of Carpentaria, Torres Strait and waters of eastern Queensland • minimising the use of gillnet fisheries within the major seagrass pastures in Queensland waters • maintaining existing areas of the Queensland coast where gillnet fishing is prohibited and exploring additional mitigation measures for remaining high risk areas • improved data sharing between fisheries managers and threatened species managers 	<p>Promote this strategy with QDAF and AFMA to agree on collaborative approaches to minimise the impacts of commercial and recreational fishing on marine turtles, with a focus on marine turtle bycatch and the effectiveness and enforcement of existing bycatch reduction measures</p> <p>Conduct a review of major seagrass pastures to identify where appropriate additional measures may be required</p>	High	DES	QDAF AFMA PA	Now	Medium
OA2.7	<p>Review existing land use planning tools and light mitigation techniques to better manage impacts of light pollution, beach access and other threats to marine turtle nesting sites, and where appropriate develop or strengthen regulations and guidelines</p>	<p>Audit and update existing land use planning tools for marine turtle conservation and identify improvement opportunities</p> <p>Prepare new regulations specifically addressing light pollution impacts supported by guidelines and standard conditions regarding the practical installation of low-light outdoor lighting in both public and private settings, with a focus on best practice low-lighting solutions for streets, parks, sports and recreations facilities, industry and off-street car parking</p> <p>Where possible, adopt a state-wide policy of consolidating proposed new ports at fewer, multi-user locations to reduce the footprint of light pollution impacts</p>	Medium	DES (EPP)	DSDILGP LGA TMR (Ports)	Now/ongoing	Low/medium

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
OA2.8	Prepare dark sky buffer strategies around significant and very significant turtle nesting areas (up to 20km wide buffer areas), focusing on actions to reduce existing light pollution and avoid increases in light	<p>Release state-wide mapping of turtle nesting areas</p> <p>Map high conflict areas at a finer scale to prioritise appropriate light impact reduction measures. Areas of 'known existing high conflict' due to light pollution include the Woongarra Coast, Gladstone, Capricorn Coast, Capricorn and Bunker Group, Sunshine Coast, Mackay/ Whitsundays, Townsville, Moreton Bay.</p> <p>Areas of emerging concern include ports on the western Cape York Peninsula</p> <p>Recommend local initiatives to reduce existing light pollution and avoid increases in light pollution</p>	High	DES (EPP)	NRME (Energy) LGA NRMs	Now/next	Low
OA2.9	Increase the level of protection and quality of management of Habitat Critical to Survival of each of the Queensland marine turtle stocks to ensure that at least 70% of each stock's nesting habitat is secured (e.g. by expanding the marine and terrestrial protected area estate and similar mechanisms, over critical habitat and buffer areas)	<p>Identify stocks that do not have adequate habitat protection over at least 70% of the nesting habitat to prioritise habitat protection measures including appropriate planning and development controls, and site-specific management requirements</p> <p>Liaise with the Local Government Association of Queensland to update the standards and guidelines for developing coastal hazard adaptation strategies</p>	Medium	DES (EPP/ QPWS&P)	TMR NRME LGA	Next	Low (scoping) Medium (implementing)
OA2.10	Continue to liaise with relevant Australian Government agencies in relation to international threats to Queensland marine turtle stocks and opportunities to strengthen and support the implementation of international conservation measures	<p>Establish the QMTWG (see OA2.1) and confirm Queensland representatives to participate on the Australian Government Marine Turtle Round Table</p>	Med	DES DAWE		Now/ongoing	Medium

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
OBJ 3 Direct management							
OA3.1	Maintain, adapt and strengthen existing direct management efforts at key individual nesting beaches and foraging grounds for each genetic stock to implement management practices that promote successful hatching of at least 70% of clutches laid (including rescuing doomed eggs where feasible), and mean hatching emergence success in excess of 80% from clutches producing hatchlings	<p>For key individual nesting beaches and foraging groups for each genetic stock, identify, prioritise, plan for and implement direct management actions such as:</p> <ul style="list-style-type: none"> ensuring that nesting habitats are adequately managed to be free of pest animals and weeds that may negatively affect nesting or hatching success providing proactive nest protection and predator control actions at all identified priority rookeries during nesting seasons managing shade on nesting beaches to counter the impacts of increasing sand temperatures negatively impacting hatchling sex ratio and hatching success of eggs manipulation of dune vegetation and skylines behind nesting beaches to provide a dark horizon to minimise disruption to ocean finding behaviour of hatchlings and adult turtles restoration of sand dunes on nesting beaches where the natural process is no longer supporting the rebuilding of the sand dunes following storm erosion removal of beach washed debris (e.g. timber, ghost nets) that impedes successful nesting, and capture key habitats as Key Values under QPWS Values Based Management planning 	High	DES (QPWS&P) GBRMMPA RJFMP DAWE PA		Now/ongoing	Very high
OA3.2	Design, trial and implement practical nest cooling techniques that can be applied at an ecologically meaningful scale to increase the production of male hatchlings (to achieve ecologically appropriate sex ratios)	<p>Review international nest cooling techniques and their potential application in Queensland</p>	High	DES (QPWS&P) GBRMMPA RJFMP	Research partners	Now/ongoing	Very high
OA3.3	Collaborate with Traditional Owners, Indigenous Land and Sea Ranger Groups, relevant government agencies and NGOs to reduce the impacts of marine debris ingestion and entanglement on turtle health. Support the continuation and expansion of ghost nets management initiatives in the Gulf of Carpentaria and Arafura Sea (with a focus on prevention at international source hotspots and removal from key foraging and nesting habitats)	<p>Promote this strategy with prospective partners to agree on collaborative approaches and opportunities to address the issue of marine debris on marine turtle health</p>	Medium	DES (EPP) QILSR DAWE PA	QDAF AFMA NGOs	Now/next	Low

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
OA3.4	Support implementation of relevant actions in the Reef 2050 Water Quality Improvement Plan 2017–2022 (and similar mechanisms) to address all land-based sources of water pollution (sediment, nutrients and chemical) that impact the health of marine turtles, including through identifying opportunities for co-investment or alignment of funds and resources Work with landholders, communities and NRM groups to achieve similar outcomes in the Gulf of Carpentaria	Promote this strategy with Reef 2050 partners and regional NRM bodies to agree on collaborative approaches to address the impacts of land-based water pollution on marine turtle health	Very high	DES (OGBR) GBRMPA DAWE	NRMS	Now/ongoing	Low
OA3.5	Identify suitable beaches and islands that could provide refugial nesting habitat under a rising sea level scenario and implement appropriate planning controls and management actions to safeguard and optimise their potential future habitat value	Develop a fine-scale mapping and modelling tool to identify and assess the quality of current and potential alternative refugial marine turtle nesting and foraging habitat (see action OA1.7) Consider links to broader, related initiatives (e.g. GBR Green Turtle Research Program)	High	DES (QPWS&P) GBRMPA	Research partners	Now	Medium
OA3.6	Manage the effects of feral animals (including pigs, dogs and deer) on marine turtles by developing effective predator control zones around current and potential future critical nesting beaches	Support current effective programs and promote this Strategy with prospective partners to agree on collaborative approaches to minimise the impacts of feral animals on marine turtles	Very high	DES (QPWS&P, OGBR) QILSR RIFMP	NRMS LGA	Now	Very high
OBJ 4	Community education and engagement						
OA4.1	Explore Indigenous engagement and partnership opportunities to further refine and build shared ownership for marine turtle conservation in Queensland. Identify relevant key messages and promote opportunities to enter into co-management arrangements with Traditional Owners across all stocks	Progress Traditional Owner and Indigenous community engagement for specific projects at the stock level	Very high	DES (QPWS&P) GBRMPA RIFMP		Now	Medium
OA4.2	Engage with, support and empower First Nations communities in the Torres Strait, Gulf of Carpentaria, Cape York Peninsula and along the length of the Great Barrier Reef to: <ul style="list-style-type: none"> revitalise and strengthen relevant cultural practices and protocols to enhance autonomy as well as sustainable use of the stock share knowledge about the stock, better integrate Indigenous ecological knowledge and contemporary science and build support for agreed conservation actions identify opportunities for co-design and co-management approaches to promote sustainable, Indigenous-led, on-ground stock recovery efforts at a local (culturally appropriate) scale 	Consider opportunities for co-design of local level management actions identified in this strategy with First Nations peoples, and alignment of engagement efforts with related processes (see action OA4.1)	Very high	DES (QPWS&P) GBRMPA RIFMP QILSR DAWE TSRA	NIAA	Now/ongoing	Very high

Ref.	Action	Initial tasks	Priority	Lead	Support	Timeframe	Cost
OA4.3	<p>Develop a State-wide community engagement framework to:</p> <ul style="list-style-type: none"> increase community and industry awareness, support and involvement in marine turtle conservation initiatives and practice change provide community-based programs with clear guidelines for marine turtle species recovery activities and monitoring, ensuring quality assurance and control and generation of standardised data that enables informed management decisions develop measures of assessing educational impact, including increased community awareness and behavioural change further develop citizen science and volunteering programs (including training that meets needs of volunteers and citizen scientists) 	Develop and clarify project objectives, scope and identify resources to progress	Medium	DES (QPWS&P)	GBRMPA RIFMP QDAF	Ongoing	Medium
OA4.4	<p>Continue to provide advice to all stakeholders and the community in relation to:</p> <ul style="list-style-type: none"> habitat management of nesting beaches to minimise alteration of nesting habitat resulting from human activities and to maximise hatching production marine and terrestrial protected areas with associated zoning for habitat management maintaining dark horizons surrounding marine turtle nesting beaches in Queensland 	Promote this strategy within DES and GBRMPA and amongst external networks	High	DES (QPWS&P) GBRMPA		Ongoing	Low
OA4.5	Expand Mon Repos Turtle Centre's research, management, interpretation and ecotourism activities to build its status as a world-leading ecotourism destination and knowledge centre	Integrate with state-wide engagement framework (see action OA4.3)	Medium	DES (QPWS&P)		Ongoing	Low
OBJ 5 Management evaluation and improvement							
OA5.1	Undertake an annual rolling review for each marine turtle species so that the status and future management needs of all Queensland stocks for each species are reassessed on at least a five-year cycle	Identify priority stock/s for review in 2021	High	QMTWG		Ongoing	Low
OA5.2	Coordinate management agency (and collaborating partners) efforts to implement this strategy, including by incorporating the actions identified in annual operational plans, evaluating the effectiveness of actions, updating reporting frameworks and review of the strategy at least every five years	Review and update annual operational plans to incorporate priority actions identified in this strategy	High	QMTWG		Ongoing	Low

5.0 Stock-specific actions

For each Queensland marine turtle stock, recovery tables have been developed to summarise:

- essential background information (where are we now?)
- long-term desired outcomes (where do we want to be?)
- strategic directions and potential actions (how are we going to get there?)
- success indicators (using the interim objectives as performance measures) (how will we know we are on track?).

Contemporary Queensland information is used to build on the national Recovery Plan and identify practical recovery actions and associated lead responsibilities for each stock. Many actions are overlapping and mutually supportive, so potential dependencies between actions and potential barriers to delivery will need to be considered during the implementation phase (e.g. through a project plan or similar).



Pompuraaw rangers setting up a turtle nest cage to prevent predation in Western Cape York Peninsula
© Queensland Government

5.1 Green turtle *Chelonia mydas*



Species/stock: **Green turtle (southern Great Barrier Reef) (G-sGBR)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Vulnerable	Vulnerable	Depleted	Moderate recovery	Very good	High

Overall Queensland priority (for additional investment): **LOW**

Stock description (Figures 3 and 4)

This genetic stock was severely depleted by commercial harvest for the manufacture of turtle soup between 1860 until 1950. The stock now appears to be recovering well, with good survivorship rates amongst juveniles at foraging grounds and adults at nesting beaches. Over the last 40 years, nesting populations are reported to have more than doubled, foraging populations have more than tripled, and sex ratios of foraging populations and small juvenile recruitment is 60–80% female with no significant change over the last 30 years. With continuing strong recovery, the stock has the potential to reach historic levels of abundance in the next 50 years. Combined nesting and foraging ground monitoring means that the demographics of this stock are relatively well understood. Given the longevity of monitoring (commencing at Heron Island in the 1960s), it is important to continue monitoring the progress of the stock. Many important nesting and foraging grounds have been protected within the Great Barrier Reef World Heritage Area and associated marine and terrestrial protected areas from as early as the 1930s.

This stock is largely managed by the Queensland Parks and Wildlife Service and the Great Barrier Reef Marine Park Authority (through the Reef Joint Field Management Program), with considerable contributions from volunteers, researchers, local and Indigenous communities and tourism operators. Historic protection measures and continuing strong management capability must be maintained to ensure long-term recovery of this stock.

Large numbers of green turtle strandings along the Queensland coast in 2010–11 were attributed to pulse flooding after extreme weather events which damaged seagrass, their main food source. These events are predicted to increase as a result of climate change. Climate change is also predicted to increase sand temperatures which may adversely affect sex ratios for this stock. Sea level rise is likely to reduce hatchling production on low-lying coral cays subject to increased inundation or extreme weather events and may significantly alter important foraging habitat. Increased frequency of coral bleaching and seagrass loss due to flood events are expected to adversely impact foraging habitat for this stock. Further analysis of climate change vulnerability and the identification of feasible management options to increase resilience is required.

Due to its proximity to agricultural and urban areas, the stock is at a high risk from the impacts of poor water quality (including increased sediments, nutrients and pesticides). This turtle stock is exposed to marine debris from local sources of urban rubbish and fishing gear, and by ingesting hard plastic debris, especially during early life stages spent in the open ocean. Both water quality and marine debris are currently addressed through the Reef 2050 Plan, of which continued implementation will help manage these threats. This stock is also subject to domestic and international fisheries bycatch and international take, both of which are largely unquantified.

Owing to the observed recovery over the last 40 years and continuing strong management of threats, the outlook for the Southern Great Barrier Reef green turtle stock is *very good*.

Important nesting locations

- Major: Northwest, Wreck, Hoskyn, Tryon, Heron, Lady Musgrave, Masthead.
- Minor: Bushy Island, the Percy Islands, Bell Cay, Lady Elliott Island, Swains Reef, North Fraser Island, mainland coast from Bustard Head to Bundaberg, Fairfax, North Reef and Wilson Islands, Erskin and the Sunshine Coast.
- Index beaches monitored: Heron Island (1964–), Wreck Island (1977–), North West Island (1977–), Lady Musgrave (1972–).

Inter-nesting buffer: 20 km

Seasons

- Mating: September–November
- Nesting: October–April (peak: late December – early January)
- Hatching: December–May (peak: February–March)

Important foraging and courtship areas

- Coral reefs of the Capricorn–Bunker Groups (including Heron/Wistari Reefs), and inshore embayment including Moreton Bay, Shoalwater Bay, Repulse Bay, Cleveland Bay, Hervey Bay, and the Sandy Strait.
- Index foraging sites currently monitored: Moreton Bay, Booral (south-west Hervey Bay), Port Curtis, Shoalwater Bay and Bowen.

Primary threats (updated Queensland assessment)

- Climate change and variability (sand temp, sea level rise, changing forage communities, extreme weather (e.g. flooding): **VERY HIGH**
- Marine debris—entanglement and ingestion (hard plastic PH, fishing line): **HIGH**
- Chemical and terrestrial discharge—chronic (sediment): **HIGH**

Primary management objectives

The primary management objectives for this stock include:

- supporting the continued recovery of this stock by maintaining and strengthening current protection arrangements at important foraging and nesting areas
- mitigating emerging threats from climate change and marine debris.

National Recovery Action Plan actions specifically required to recover G-sGBR

1. Quantify and predict the frequency of pulse flood events, their impacts on seagrass meadows, and implement relevant mitigation measures.
2. Identify and protect suitable beaches and islands that could be used as nesting habitat under a rising sea level model/scenario, to ensure that these are suitable for colonisation in the future.
3. Manage land-based pollution and recreational activities to reduce marine debris at the source.
4. Quantify the impact of marine debris ingestion on stock viability.
5. Understand the sub-lethal impacts of poor water quality and exposure to toxins.
6. Continue long-term monitoring of index beaches and key foraging areas.
7. Support implementation of the *Reef 2050 Long Term Sustainability Plan* to build on existing turtle monitoring and water quality management programs in Queensland.

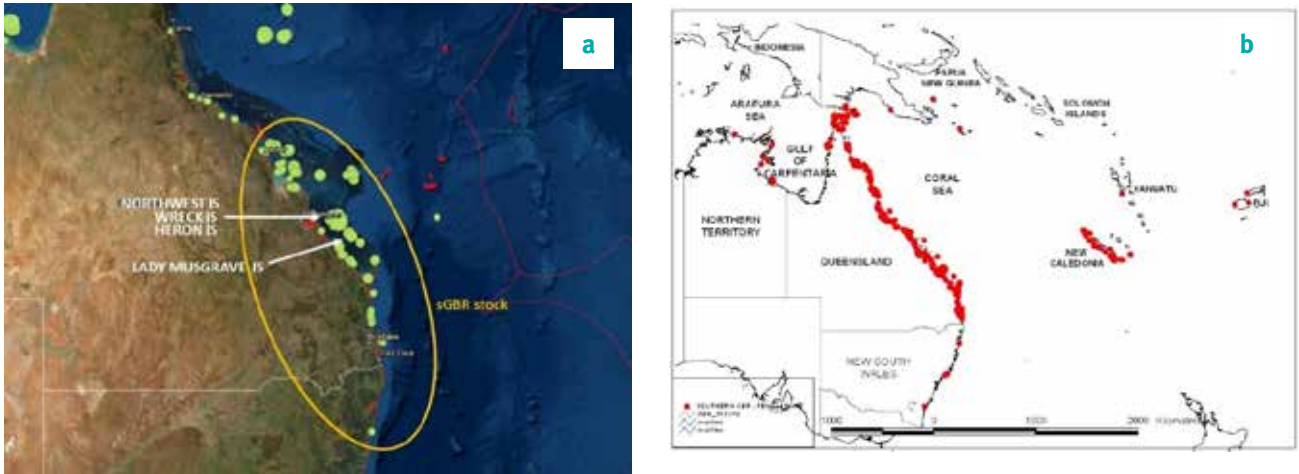


Figure 3 Nesting (a) and foraging (b) distribution for the G-sGBR genetic stock

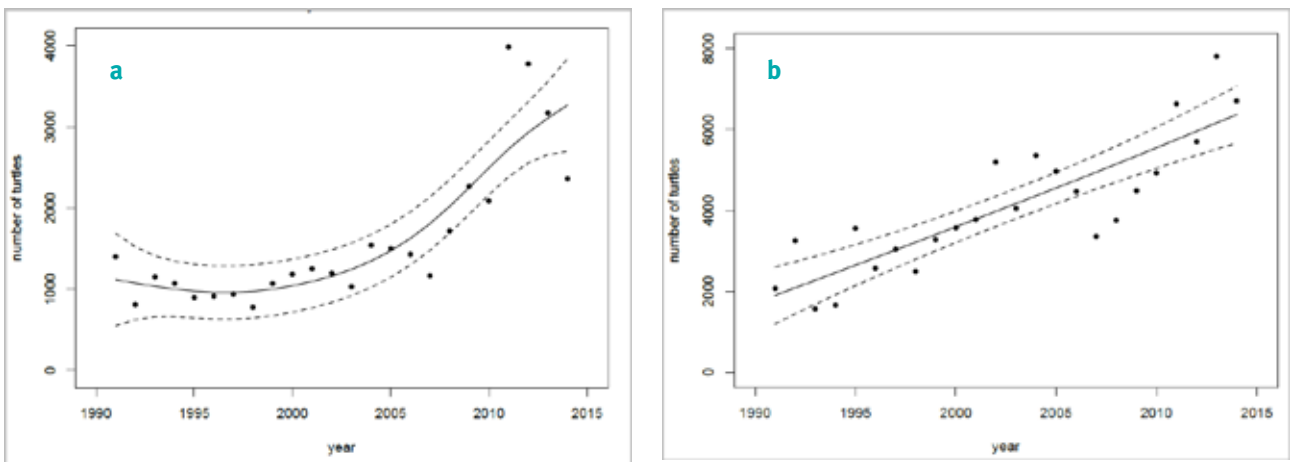


Figure 4 Twenty-five-year history of foraging population in eastern Moreton Bay, based on adult (a) juvenile (b) capture-mark-recapture analyses

Queensland actions to support the national Recovery Plan to recover G-sGBR

Reference	Targets	Action		
G-sGBR1 (see OA2.5)	1.1, 2.1	Review high-density foraging sites and explore opportunities to expand Go-slow Zones. Liaise with the Department of Transport and Main Roads to expand Go-slow Zones where required outside of marine parks, based on StrandNet data. Link to an effective compliance program.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	TMR
			Timeframe:	Now/next
G-sGBR2 (see OA2.5)	1.1, 2.1, 3.1	Identify important inshore, shallow foraging grounds for G-sGBR, assess the residual risk posed for those areas that aren't currently protected and consider the most appropriate habitat mechanisms to ensure adequate protection.	Priority:	High
			Lead:	GBRMPA
			Support:	RJFMP DES QDAF
			Timeframe:	Now/next
G-sGBR3	1.1, 1.3, 2.1,	Strengthen StrandNet data by aiming to record accurate causes of mortality to improve effectiveness of management interventions.	Priority:	High
			Lead:	DES
			Support:	RJFMP
			Timeframe:	Ongoing
G-sGBR4 (see OA2.6)	2.1, 2.2, 3.3, 5.2	Support QDAF to implement strong auditing and compliance processes and improved technologies for crab fisheries to substantially reduce turtle bycatch.	Priority:	Very high
			Lead:	DES
			Support:	QDAF GBRMPA
			Timeframe:	Ongoing
G-sGBR1	1.1, 1.3, 3.1, 5.1	Improve visitor use guidelines and review options for seasonal closures or other management options to minimise potential impacts on turtles nesting on remote beaches.	Priority:	Low
			Lead:	DES
			Support:	
			Timeframe:	Next
			Cost:	Low

Lady Musgrave Island © Queensland Government



Species/stock: **Green turtle (northern Great Barrier Reef) (G-nGBR)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Vulnerable	Vulnerable	Severely depleted	Significant decline	Very poor	High

Overall Queensland priority (for additional investment): **HIGH**

Stock description (Figures 5 and 6)

Although this has been described as one of the world’s largest green turtle genetic stocks, there is evidence of low hatchling production at Raine Island (the primary rookery for this stock), feminisation of the stock and a resulting decline in the proportion of northern Great Barrier Reef green turtle juveniles recruiting to foraging areas.

There are over 60 recorded nesting locations between Princess Charlotte Bay and north-western Torres Strait, however, Raine Island and Moulter Cay support more than 90% of nesting for this stock. Raine Island, Moulter Cay and MacLennan Cay make up the Raine Island National Park (Scientific). Raine Island is surrounded by a separate Marine National Park Zone. Access to the island is a ‘Restricted Area—Special Management Area’ designated under the Great Barrier Reef Marine Park Zoning Plan 2003. It is also subject to an ILUA. Reproductive output at Raine Island has decreased with low nesting success and hatchling production since 1996. Numerous adult turtles have died on the island as a result of heat exhaustion and cliff falls since at least the 1840s. The cause of the low hatchling production is not fully understood, although changes to the landscape of the island with reduced sand depth above the underlying water table and changes in extreme weather causing tidal inundation are likely contributors. Ocean acidification due to climate change may be affecting the availability of suitable nesting habitat. The Raine Island Recovery Project (2015–2021), aimed at addressing these issues, included reprofiling beaches to optimise nesting habitat, installing extensive fencing to prevent cliff fall mortality and increased monitoring of the nesting population and environmental factors. The project installed 1,750 m of cliff-top fencing to reduce turtle mortality and has doubled the amount of viable nesting area on the island to 70,000 square metres through beach reprofiling. While the project has been successful in increasing hatchling production, with beach reprofiling producing 640,000 additional hatchlings between 2014 and 2018, overall annual hatchling production is still insufficient to maintain the current large nesting population. Some minor nesting beaches, such as McLellen Cay, which supported low-density nesting in the 1970s, is now a submerged sandbank. If the productivity of Raine Island cannot be recovered, other nearby islands or alternative mainland sites with elevated sand dunes may offer refugial nesting habitat that is more resilient to climate change-related impacts.

Satellite tracking suggests that approaching two-thirds of G-nGBR greens migrate or forage in Torres Strait and the southern Gulf of Carpentaria where there are no marine protected areas in their shallow water foraging habitats. Green turtles in these regions are subject to a range of threats, including direct harvest by coastal communities in northern Australia, Papua New Guinea and eastern Indonesia, domestic fisheries bycatch, habitat modification from flooding impacts on feeding grounds, coastal development and associated industrial activities. Establishing effective conservation management arrangements and protection of habitats that are critical to survival of the stock remains a very high priority, especially in the Gulf of Carpentaria.

Sex ratios from studies at the Howick Islands indicate a substantial failure of the production of hatchlings in the last decade and an unsustainable female bias. With reduced recruitment of sub-adult (especially males) to the population, there are growing concerns that this stock is at significant risk of catastrophic decline within one generation, and consequently the outlook for the G-nGBR stock is *very poor*.

The Torres Strait provides important foraging and courtship habitat for G-nGBR stock and a migratory corridor for green turtles foraging throughout the Gulf and Northern Territory waters, as well as from eastern Indonesia. Foraging in these waters to the west of Torres Strait increases the risk of entanglement by ghost nets. As with most stocks, ingestion of marine debris (hard plastics) is a major threat, especially during the post-hatchling phase spent in the open ocean. Turtles in this stock support the Torres Strait Turtle Fisheries—a traditional subsistence fishery that is limited to Traditional Inhabitants of the Torres Strait and adjacent Papua New Guinea—and are hunted throughout coastal Gulf of Carpentaria and the Northern Territory.

Traditional take in the Torres Strait is managed through community-based management plans. The Torres Strait Regional Authority (TSRA) employs Indigenous rangers and a dedicated Sea Team to support the implementation of community-based management plans, with a focus on marine turtles and dugong. The TSRA, in conjunction with Australian Border Force, works to address the additional pressures of international illegal take. An assessment of the threat posed by Indigenous take (international and domestic) requires further engagement with relevant Indigenous communities.

The utilisation of marine turtles as a food resource and other customary practices by Torres Strait Islanders and Aboriginal peoples is totally dependent on an abundance of foraging or migrating green turtles. A population decline will impact the cultural fabric and Indigenous way of life across the region. Indigenous take over millennia has not caused the current declines but, given other growing threats, traditional management practices may need to be reconsidered.

Important nesting locations

- Major: Raine Island and Moulter Cay.
- Minor: Murray Island, Bramble Cay, sandbanks nos. 7 and 8, Dauar Island, Milman Island and mainland coast from Cape Grenville to Torres Strait.
- Index beaches monitored: Raine Island (1974–), Moulter Cay, Bramble Island and Dauar Island (2006–).

Inter-nesting buffer: 20 km

Seasons

- Mating: August–December
- Nesting: October–March (peak: late December – early January)
- Hatching: December–May

Important foraging and courtship areas

- Torres Strait and the Howick Group
- Index foraging sites currently monitored: None

Primary threats (updated Queensland assessment)

- Climate change and variability (increased extreme weather events, floods in Gulf, increased sand temperatures, ocean acidification): **VERY HIGH**
- Terrestrial predation (pig and goanna—mainland and Torres Strait): **VERY HIGH**
- Marine debris—entanglement (fishing line): **HIGH**
- Marine debris—ingestion (plastics): **HIGH**
- Habitat modification—infrastructure/coastal development (historical mining): **HIGH**
- Indigenous take (meat and eggs)*: **REQUIRES FURTHER ASSESSMENT**

Primary management objectives

The primary management objectives for this stock include:

- increasing the productivity and resilience of key nesting sites (e.g. Raine island and potential refugia sites)
- strengthening conservation management arrangements in the Gulf of Carpentaria (protected areas and management capacity)
- reducing impacts of threatening processes identified as *very high* and *high*.

National Recovery Action Plan actions specifically required to recover G-nGBR

1. Continue demonstrably successful intervention at Raine Island (Recovery Project), including reducing adult mortality and increasing hatchling production.
2. Support and expand community-based management programs in the Torres Strait and northern Australia.
3. Continue monitoring nest and hatching success at Bramble Cay and Dauar Island to assess these islands as potential areas of refugia for this stock.
4. Undertake genetic testing of foraging populations to support assessment of Raine Island population demographics.

* Assessment of this threat requires broader consultation with stakeholders

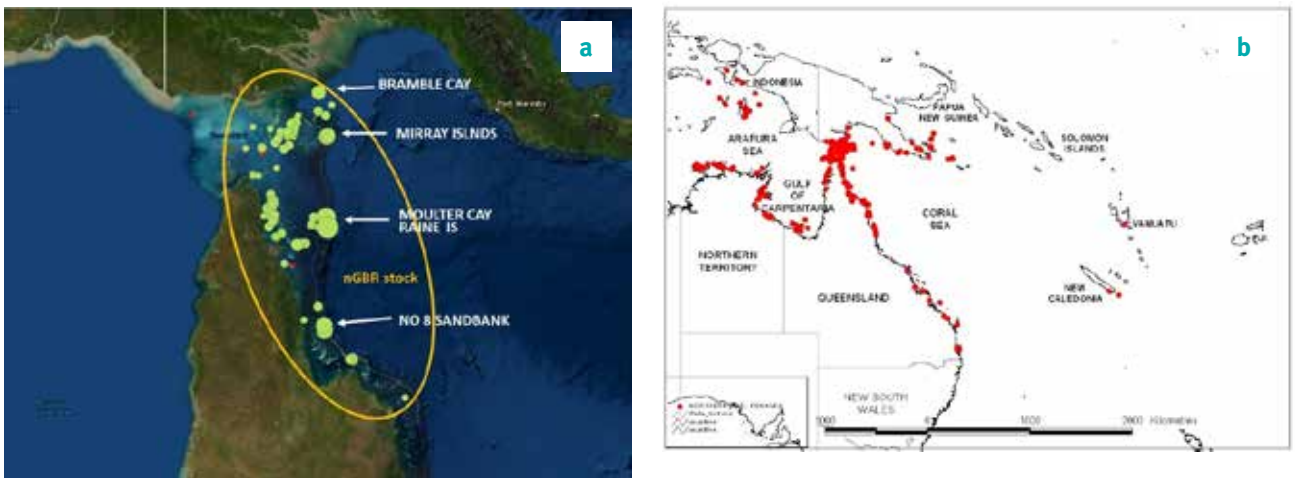


Figure 5 Nesting (a) and foraging (b) distribution for G-nGBR genetic stock

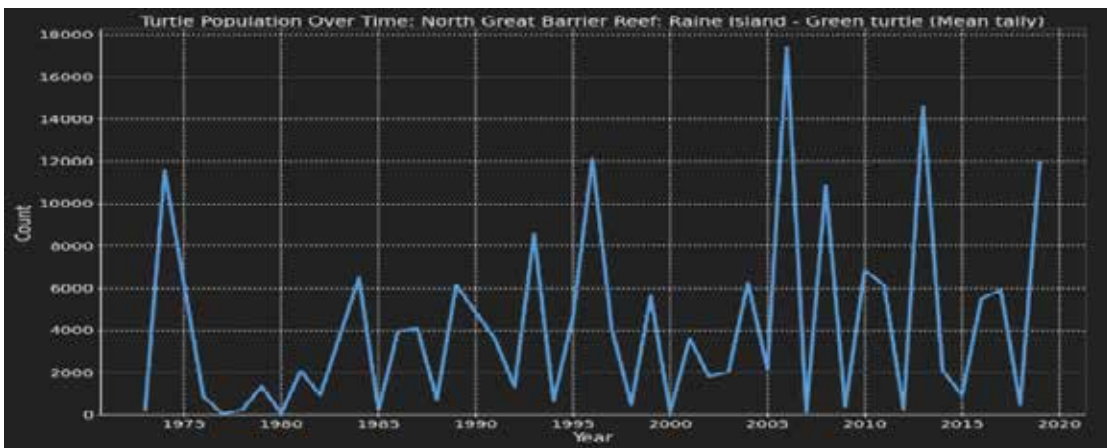


Figure 6 Mean nightly tally count of nesting green turtles recorded annually (early December) at Raine Island

Queensland actions to support the national Recovery Plan to recover G-nGBR

Reference	Targets	Action		
G-nGBR1 (see OA1.7, OA3.1, OA3.2)	3.1, 3.2, 5.1	Improve hatchling output from Raine Island and Moulter Cay (preferably to achieve a sex ratio of more than 30% male hatchlings), including through adoption of appropriate nest cooling techniques.	Priority:	Very high
			Lead:	DES (QPWS&P)
			Support:	RJFMP
			Timeframe:	Now
			Cost:	Very high
G-nGBR2	2.3, 2.4, 3.1, 3.2, 4.1, 4.2	Seek resources and funding to continue and expand the Raine Island Recovery Project.	Priority:	High/very high
			Lead:	DES (QPWS&P)
			Support:	RJFMP
			Timeframe:	Now
			Cost:	Very high
G-nGBR3 (see OA1.1, OA1.7, OA2.4)	1.1, 1.2, 1.3, 2.4, 4.1	Improve understanding of the foraging distribution of nGBR greens (particularly sub-adults), including in the southern Gulf of Carpentaria, to give an early indication of population trends and the effectiveness of management interventions on nesting beaches. Identify important inshore, shallow foraging grounds for nGBR green turtles, assess the residual risk posed for those areas that aren't currently protected and consider the most appropriate mechanisms to ensure adequate habitat protection.	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	GBRMPA TSRA QILSR
			Timeframe:	Now/ongoing
			Cost:	Very high
G-nGBR4 (see OA1.6, OA4.1, OA4.2)	1.2, 2.4, 4.1, 4.3	Continue to support Indigenous Land and Sea Ranger groups and Traditional Owner organisations to develop and implement community-based management strategies to ensure local harvest is culturally appropriate and sustainable.	Priority:	Medium
			Lead:	TSRA
			Support:	DES (QILSR, QPWS&P) GBRMPA NIAA
			Timeframe:	Now/ongoing
			Cost:	High
G-nGBR5 (see OA1.6, OA3.1, OA3.6, OA4.1, OA4.2)	2.4, 3.1, 3.2, 4.1	Resource, support and build the capacity of Indigenous Land and Sea Ranger groups in the Torres Strait and on Cape York to undertake effective, on-ground management actions to protect nesting habitat from predation (including from pigs, dogs and goannas on the mainland, and rats on Warul Kawa IPA) to ensure at least 70% of all clutches survive.	Priority:	High/very high
			Lead:	TSRA
			Support:	DES (QILSR, QPWS&P) GBRMPA RJFMP NIAA
			Timeframe:	Now/ongoing
			Cost:	High
G-nGBR6 (see OA1.7, OA3.5)	1.1, 1.2, 2.4, 3.2, 4.1, 5.1, 5.2	Explore potential opportunities to trial localised translocation of clutches of eggs or hatchlings to habitat that is less vulnerable to climate change impacts (taking into account international experiences, improved contemporary understanding of marine turtle biology, logistical challenges and level of support from Traditional Owners). Prioritise potential refugial areas that are sufficiently elevated, provide favourable nesting sand temperature and are close to existing Indigenous communities with established Land and Sea Ranger groups.	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	RJFMP TSRA
			Timeframe:	Now/ongoing
			Cost:	Very high

Reference	Targets	Action	Priority:	Medium
G-nGBR7 (see OA1.7, OA3.1, OA3.5, OA3.6)	1.1, 1.3, 2.4, 3.1, 4.1, 5.1, 5.2	<p>Design, trial, plan for and implement targeted actions to maintain the viability of key nesting beaches, as well as other potential refugial areas to supplement nesting by:</p> <ul style="list-style-type: none"> • reviewing available datasets (including from nesting aerial surveys) to identify potential future refugial mainland nesting sites. • working with management agencies to protect mainland refugial areas, including through reducing depredation and other disturbance by native and feral animals (in preparation for potential natural and assisted translocations). • undertaking detailed geomorphological mapping of Raine Island, Milman Island, Moulter Cay, Maizab Kaur, eastern Torres Strait islands and other potential refugial areas. • engaging with Torres Strait Traditional Owners (including for Dauar and Waier) and with mainland Cape York communities to identify and protect potential refugial nesting habitats that are more resilient to climate change-related impacts (i.e. with elevated sand dunes). • designing a pilot project to successfully relocate clutches from Maizab Kaur to Dauar (or other suitable nesting habitat) with support from Traditional Owners. • developing data recording methods to detect if climate-induced changes to nesting habitat are negatively impacting nesting or hatching success. • exploring options to replenish sand on Raine Island (consistent with recommendations from the Raine Island Recovery Project). 	Lead:	DES (QPWS&P)
			Support:	GBRMPA RJFMP TSRA Research partners
			Timeframe:	Now
			Cost:	Very high

Incoming turtles at Raine Island © Queensland Government



Species/stock: **Green turtle (Gulf of Carpentaria) (G-GoC)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Vulnerable	Vulnerable	Unknown	Unknown	Poor	Low

Overall Queensland priority (for additional investment): **MEDIUM**

Stock description (Figure 7)

The Gulf of Carpentaria green turtle stock has a restricted foraging range and has been subject to historic and ongoing fisheries-related threats and increasing climate change risks. Management is primarily undertaken by community groups and Indigenous rangers, with the support of the Queensland and Northern Territory governments and Commonwealth Government. Nesting in the Gulf of Carpentaria was estimated to include around 5,000 females per year in 2008, and thousands per year in the north-east Arnhem Land rookeries. The majority of this stock nests within Indigenous Protected Areas, including: Laynhapuy (Yirralka), Dhimurru, Anindilyakwa (Groote Eylandt Archipelago), Yanyuwa (Li-Anthawirriyarra), Barni-Wardimantha Awara Yanyuwa (Sir Edward Pellew) and Thuwathu/Bujimulla (Wellesley Islands). The stock has a foraging range restricted predominately to the Gulf of Carpentaria. Management activities include ghost net and marine debris patrols and clean up, monitoring of nesting turtle abundance and some satellite tracking of adult females.

Historically, this stock is likely to have been impacted by bycatch in the Northern Prawn Fisheries until turtle excluder devices were introduced in 2001. The Gulf of Carpentaria is considered to be a ghost net hotspot with estimates ranging from 672 to 2,015 green turtles being captured each year in ghost nets. Similarly, fisheries bycatch hotspots have been identified in the Gulf of Carpentaria, with pelagic gillnets particularly problematic for green turtles in the Northern Territory and the Gulf of Carpentaria. Concerns were raised during community consultation for the national Recovery Plan about the potential impacts of trawling, in which gear damages the benthic environment in this region.

There has also been a reported continual take of eggs of nesting and foraging green turtles in many parts of this region over time. Communities that identified take as a potential concern have proposed increasing education and support for ranger groups as the most effective means to manage this threat. Predation by people, dogs and pigs is thought to be minimal on islands but higher on the Arnhem Land mainland coast. The potential for future oil and gas expansion in the Gulf of Carpentaria also poses a threat to this stock from increased habitat disturbance, noise, lighting, and risk of oil and chemical spills. Anecdotal evidence suggests that an increase in foreign fishing vessels entering the Gulf peaked in 2005, but by 2011 had declined due to enforcement and education.

Climate change impacts are likely to be the greatest threat to this stock, including the increased frequency and severity of cyclones and habitat damage to foraging and nesting areas from flood runoff, as well as increasing sand temperatures leading to feminisation. The effects of climate change specific to this stock are recognised as a key knowledge gap. Elevated sand dunes on Bountiful Islands may offer refugial nesting habitat that is more resilient to climate change-related impacts.

The Commonwealth Gulf of Carpentaria Marine Park protects 23,771 square kilometres (km²) of important marine habitats adjacent to the Wellesley Islands. The area is culturally important for the Lardil, Yangkaal, Kaiadlit and Gangalidda people who have responsibilities for sea country, including the Thuwatha/Bujimulla Indigenous Protected Area which overlaps with the Commonwealth Marine Park. Day-to-day management of the Commonwealth Marine Park is limited and there are no marine protected areas over Queensland waters. Important nesting beaches are not included in the Queensland protected area estate. Consequently, compared to the east coast of Queensland, the capacity to manage this stock is very limited in the Gulf of Carpentaria. Establishing effective conservation management arrangements and protection of habitats that are critical to survival of the stock remains a very high priority in the Gulf of Carpentaria.

The utilisation of marine turtles as a food resource and other customary practices by Aboriginal peoples is dependent on an abundance of foraging or migrating green turtles. A population decline will impact the cultural fabric and Indigenous way of life across the region. While the impact of Indigenous take over in recent decades has not been quantified, given other growing threats, traditional management practices may need to be reconsidered.

There is no long-term monitoring data for index beaches or foraging areas available for this stock. To determine whether the stock is recovering from historical threats or in decline, it is necessary to establish long-term monitoring at appropriate index beaches and/or foraging areas. While there are data deficiencies in terms of population trends, the long-term outlook for the G-GoC stock is Poor in light of cumulative impacts from commercial fisheries, Indigenous take, plastic ingestion, entanglement and climate change.

Important nesting locations

- Major: Wellesley Islands (Bountiful, Pisonia and Rocky Islands), Binanangoi Point to Cape Shield, Gove, Borroloola, Groote Eylandt and Sir Edward Pellew Islands
- Minor: Drysdale, Burbidge, Dudley, Hawksnest, Sandy, Watson, Pearce Islands and Isle Woodah, Wedge Rock and North East Isle
- Index beaches monitored: None
- Census: Wellesley Group, Groote Eylandt and Sir Edward Pellew Islands.

Inter-nesting buffer: 20 km

Seasons

- Mating: Unknown
- Nesting: Year round (peak: June–August)
- Hatching: (peak) August–September

Important foraging and courtship areas

- Unknown
- Index foraging sites currently monitored: None

Primary threats (updated Queensland assessment)

- Climate change and variability (increased sand temp, mangrove die off, extreme weather events (both nesting and foraging), floods in Gulf, sea surface temperatures and ocean acidification) **VERY HIGH**
- Marine debris—entanglement **VERY HIGH**
- Marine debris—ingestion (hard plastic) **HIGH**
- Indigenous take (eggs and meat)* **REQUIRES FURTHER ASSESSMENT**
- Fisheries bycatch—domestic (cumulative) **HIGH**

Primary management objectives

The primary management objectives for this stock are:

- improving understanding of population dynamics and nesting patterns
- strengthening conservation management arrangements in the Gulf of Carpentaria (protected areas and management capacity)
- exploring options to increase the productivity and resilience of key nesting sites to climate change impacts
- reducing impacts of threatening processes identified as *very high* and *high*.

National Recovery Action Plan actions specifically required to recover G-GoC

1. Ensure clean-up activities are timed appropriately to coincide with on-shore peaks in marine debris (i.e. prior to wet season).
2. Devise innovative methods for the early identification and intervention of ghost nets entering the Gulf of Carpentaria.
3. Develop and support alternate technologies for the disposal of collected waste.
4. Support collection of tissue samples from stranded marine turtles.
5. Support and expand indigenous ranger and community management programs.
6. Engage in and implement bi- and multi- lateral agreements to improve the protection of Australia's marine turtles through best practice fisheries management.
7. Better understand risk from fisheries interactions.
8. Commence long-term monitoring of index beaches and key foraging areas.

* Assessment of this threat requires broader consultation with stakeholders

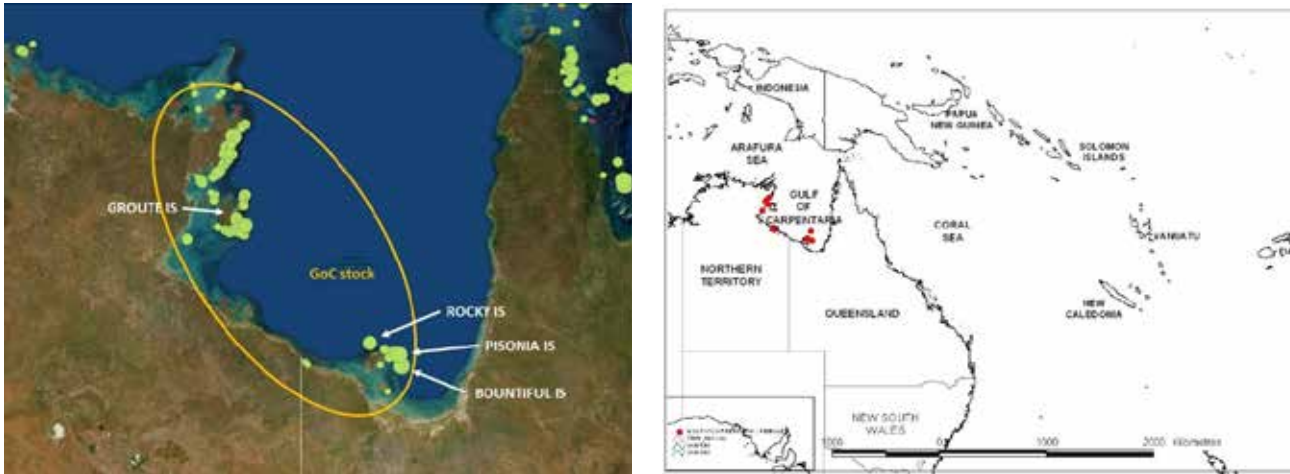


Figure 7 Nesting (a) and foraging (b) distribution of G-GoC genetic stock

Queensland actions to support the national Recovery Plan to recover G-GoC

Reference	Targets	Action	Priority:	
G-GoC1 (see OA2.4, OA4.1, OA4.2)	1.2, 2.4, 3.1, 4.1, 4.2	Explore and support expanded Indigenous-led and other conservation management arrangements for the Gulf of Carpentaria, including establishing a network of protected areas (e.g. Sea Country IPAs, broad-scale MPAs or national parks) or ILUAs. Develop joint management and funding arrangements to deliver marine turtle conservation through genuine partnerships with Indigenous communities.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	PA NTRBs RNTBCs FNP
			Timeframe:	Now/ongoing
G-GoC2 (see OA1.1, OA3.1)	1.1, 5.1, 5.2	Improve understanding of stock population dynamics, nesting and foraging patterns and develop direct management actions to achieve successful hatching of at least 70% of clutches laid and mean hatchling emergence success in excess of 80% from clutches producing hatchlings.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	PA QILSR
			Timeframe:	Now
G-GoC3 (see OA1.7)	1.1, 5.1, 5.2	Develop feasible management techniques that can be applied at an ecologically-meaningful scale to increase climate change resilience for nesting and foraging populations (including in relation to increased sand temperatures, mangrove die off and extreme weather events).	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	PA DAWE
			Timeframe:	Now
G-GoC4 (see OA1.6, OA4.1, OA4.2)	1.2, 2.4, 4.1, 4.3	Continue to support Indigenous Land and Sea Ranger groups and Traditional Owner organisations to develop and implement community-based management strategies to ensure local harvest is culturally appropriate and sustainable.	Priority:	Medium
			Lead:	QILSR
			Support:	DES (QPWS&P)
			Timeframe:	Now/ongoing
			Cost:	High

Reference	Targets	Action		
G-GoC5 (see OA3.3)	2.4, 3.1, 3.2, 3.3, 4.1, 4.2	Collaborate with Indigenous Land and Sea Ranger groups, relevant government agencies and NGOs (e.g. Tangaroa Blue) to address the impacts of marine debris on turtle health (especially plastic ingestion and entanglement in discarded fishing gear). Support the continuation and expansion of ghost nets management initiatives in the Gulf of Carpentaria and Arafura Sea (with a focus on prevention at international source hotspots and removal from key foraging and nesting habitats).	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	DAWE PA QILSR
			Timeframe:	Now
			Cost:	Very high
G-GoC6 (see OA1.2, OA1.5, OA1.6)	1.1, 1.3, 2.4, 4.1	Identify potential additional index beaches with Indigenous partners that are ready, willing and able to support sustained monitoring and management efforts.	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	QILSR
			Cost:	Low
G-GoC7 (see OA2.6)	2.1, 2.2, 3.3	Work with and support fisheries managers and the fisheries sector to reduce residual risks associated with negative green turtle interactions with all fisheries operating in the Gulf of Carpentaria. Where necessary, advocate for stronger regulations, reporting and compliance efforts to minimise the impact of domestic bycatch on marine turtles (cumulative impacts of all fisheries).	Priority:	Very high
			Lead:	DES (QPWS&P)
			Support:	DAWE PA QDAF AFMA
			Cost:	Low

Species/stock: **Green turtle (Coral Sea) (G-CS)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Vulnerable	Vulnerable	Unknown	Unknown	Poor	Low (very limited evidence)

Overall Queensland priority (for additional investment): **MEDIUM**

Stock description (Figure 8)

While at present the Coral Sea green turtle stock is likely to be robust, the long-term outlook is considered *poor*, primarily because of climate change-related risks to low-lying nesting beaches. Capacity for direct on-site management of the Coral Sea stock is very limited.

An undetermined proportion of this stock nests on remote low-lying coral cays protected within the Coral Sea Marine Park and forages within the Great Barrier Reef Marine Park. Early studies indicate wide-spread, low-density nesting prior to 1992, however, no surveys have been undertaken to assess the contemporary extent of nesting across the region. This genetic stock nesting within the Australian Coral Sea is shared with New Caledonia (Chesterfields Reefs region) (Figure 6).

The Coral Sea Marine Park is one of the world’s largest and protects 989,836 km² of important marine habitats, such as coral reefs, sandy cays, deep sea plains and canyons adjacent to the Great Barrier Reef. Many of the 57 islands are used by nesting female turtles. Day-to-day management of the Commonwealth Marine Park is limited, but aligned with management programs in the Great Barrier Reef World Heritage Area. The Coral Sea Marine Park has National Park, Habitat Protection and Special Purpose zones.

Management of this stock is primarily undertaken by Parks Australia, the Great Barrier Reef Marine Park Authority and the Queensland Government (for foraging grounds in the coastal waters of northern and eastern Australia). Due to the extreme remoteness of the Coral Sea nesting beaches, the capacity for direct on-site management of this stock is very limited. Measures to protect nGBR and sGBR green turtles in feeding grounds are expected to contribute to the G-SC foraging population’s health. The use of Coral Sea islands is restricted, thus anthropogenic impacts are minimised.

The main uncertainty surrounding this stock is its resilience to predicted changes in cyclone activity as a result of climate change and how quickly low-lying coral cays will recover after extreme weather events. This includes significant alteration to *Pisonia* and other coastal vegetation communities, with subsequent impacts on nest shading levels and sand temperature. The ubiquitous presence of hard plastic in the global marine environment means that post-hatchlings of all marine turtle species are exposed to elevated risks of marine debris ingestion. While there are no direct studies, marine debris ingestion is highly likely a threat for this genetic stock. Due to the remote nature of its nesting and foraging habitats and lack of data, it is also not known to what extent this stock is affected by *international take* and *fisheries bycatch*.

While at present the Coral Sea green turtle stock is likely to be robust, the long-term outlook is assessed as *poor* due to climate change-related risks to nesting beaches (the lack of reliable historical data and longitudinal monitoring supports only a low level of confidence in this assessment), marine debris and longline bycatch.

Important nesting locations

- Sand cays of Coringa-Herald and Lihou Reef Cays Ramsar site (note that many of the 57 islands in the Coral Sea support turtle nesting and have not been adequately surveyed to identify all important nesting locations)
- Index beaches monitored: Coringa-Herald National Nature Reserve (1991–92 to 2003–04)

Inter-nesting buffer: 20 km

Seasons

- Mating: Unknown
- Nesting: October–April (peak November–February)
- Hatching: December–June

Important foraging and courtship areas

- New Caledonia, Moreton Bay, Heron/Wistari Reefs, Shoalwater Bay, Hervey Bay
- Index foraging sites currently monitored: None

Primary threats (updated Queensland assessment)

- Climate change and variability (extreme weather events, sea level rise, sand temperature) **VERY HIGH**
- Marine debris—entanglement **VERY HIGH**
- Marine debris—ingestion (hard plastic, fishing line) **HIGH**
- Indigenous take (meat) in foraging grounds* **REQUIRES FURTHER ASSESSMENT**

Primary management objectives

The primary management objectives for this stock are:

- improving understanding of nesting patterns
- exploring options to increase the resilience of key nesting sites to climate change impacts
- reducing impacts of threatening processes identified as *very high* and *high*.

National Recovery Action Plan actions specifically required to recover G-CS

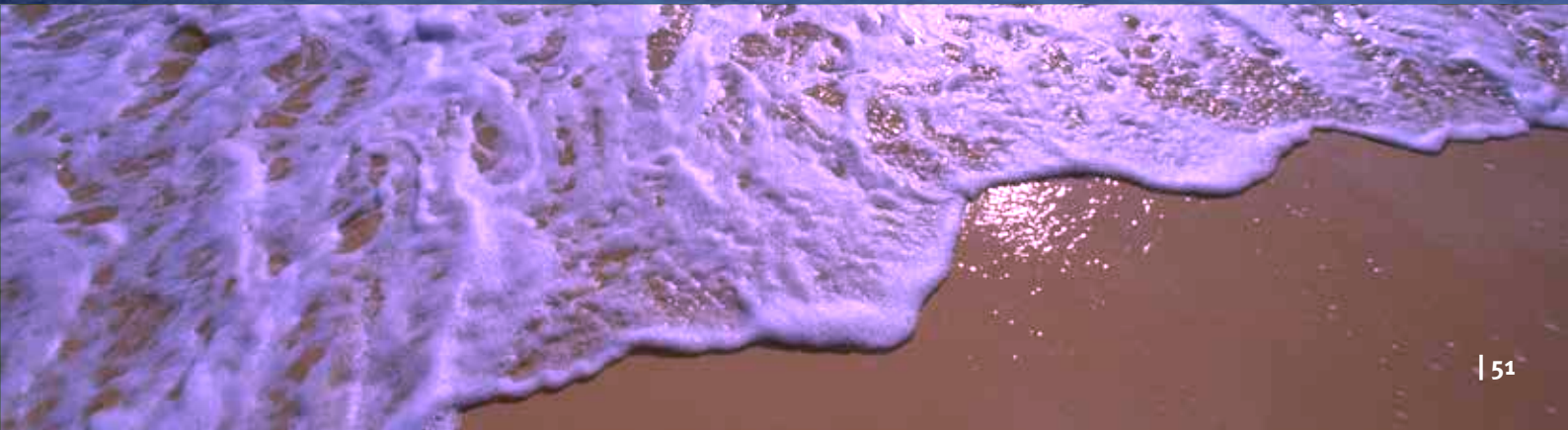
1. Assess long-term impacts of extreme weather on nesting beaches.
2. Identify and protect suitable beaches and islands that could be used as nesting habitat under a rising sea level model/scenario to ensure that these are suitable for colonisation in the future.

* Assessment of this threat requires broader consultation with stakeholders

Queensland actions to support the national Recovery Plan to recover G-CS

Reference	Targets	Action		
G-CS1 (see OA1.1, OA1.2)	1.1, 5.1, 5.2	Work with partners to conduct a nesting habitat census on all 57 islands and cays across the Coral Sea Marine Park (in addition to those already monitored in the Coringa-Herald area), including baseline data on habitat quality, nesting behaviour and potential vulnerability to climate change impacts. This could include a review of historic data, rapid mapping (via remote sensing, satellite imagery, drones, etc.) of habitats and finer-scale data collection for priority sites (including in relation to nesting behaviour and vulnerability analysis) to better understand long-term viability and management needs of the stock. Initially identify potential appropriate index sites.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	PA
			Timeframe:	Now
			Cost:	Medium
G-CS2 (see OA1.1, OA3.1)	1.1, 5.1, 5.2	Improve understanding of stock population dynamics, nesting and foraging patterns and assess feasibility of direct management actions to support successful hatching of at least 70% of clutches laid and mean hatchling emergence success in excess of 80% from clutches producing hatchlings.	Priority:	Low
			Lead:	DES (QPWS&P)
			Support:	PA
			Timeframe:	Later
			Cost:	Very high
G-CS3 (see OA1.7, OA3.2)	1.1, 5.1, 5.2	Develop feasible management techniques that can be applied at an ecologically-meaningful scale to increase climate change resilience for nesting and foraging populations (including in relation to extreme weather events, sea level rise and sand temperatures).	Priority:	Low
			Lead:	DES (QPWS&P)
			Support:	RJFMP PA
			Timeframe:	Later
			Cost:	Very high
G-CS4	1.1, 2.1, 3.1, 3.2	Develop and implement visitor use guidelines (including for commercial tourism operations such as charters and cruising) to reduce potential impacts on nesting and foraging turtles (including vessel operation, shore-based activities and biosecurity risks for key nesting habitats).	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	FJFMP PA
			Timeframe:	Now/ongoing
			Cost:	Low
G-CS5 (see OA1.2)	1.2, 2.2	Explore opportunities to partner with the Bureau of Meteorology to establish a suitable turtle index monitoring site at Willis Island.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	PA
			Timeframe:	Now
			Cost:	Low
G-CS6 (see OA1.1, OA1.3, OA3.3)	1.1	Review outcomes from surveys of debris and marine microplastics in the Coral Sea to determine the severity of this threat and opportunities for further comparative research and policy measures to minimise the threats posed by plastic pollution in the marine environment.	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	PA
			Timeframe:	Next
			Cost:	Low

5.2 Flatback turtle *Natator depressus*



Species/stock: **Flatback turtle eastern Queensland (F-eQld)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Vulnerable	Vulnerable	Depleted	Moderate decline	Poor	Medium

Overall Queensland priority (for additional investment): **MEDIUM**

Stock description (Figures 9 and 10)

While there are strong protection and management programs in place, the long-term outlook for this relatively small stock is considered *poor*, largely because of the unexplained significant decline in the nesting population at the critical Peak Island rookery, increased feminisation from climate change and light pollution associated with coastal development near nesting beaches.

Breeding for this stock is predominantly in the southern Great Barrier Reef region on the inshore continental islands and mainland beaches between Mackay and Bundaberg. Low-density nesting is characteristic on the mainland beaches. This stock appears to have passed through a period of population decline from the 1970s until the 1990s and is now showing signs of recovery at the nesting beaches. The most severe decline was recorded at Peak Island (the largest nesting population) which declined by 50% in two decades. The cause of this decline is not known, however, it may be related to trawl bycatch mortality prior to the introduction of turtle excluder devices in 2001. Other causes could be related to post-hatchling survivorship and dispersal issues. Plastic ingestion in post-hatchlings is a growing concern.

The flatback nesting population has declined, coinciding with industrial expansion, shipping and associated light pollution between Bundaberg and Mackay which has affected breeding and recruitment. Increased predation has been observed around marine infrastructure (e.g. jetties), and where hatchlings are attracted to artificial light on or near marine infrastructure predation is likely to be even higher. This stock may be susceptible to increased sand temperatures associated with climate change as egg survival is reduced when temperatures exceed 32°C.

Extremely high feminisation of clutches has also recently been observed at Mon Repos, Peak and Avoid Islands due to high sand temperatures. Predator control efforts have largely been successful on Curtis Island and the Woongarra Coast; however, on beaches where no management measures are in place, intense levels of predation on clutches by foxes and goannas have been observed. The small size of this stock's breeding population (estimated to be lower than 1,500 nesting females) is likely to amplify the potential consequence of identified threats.

This stock is limited to the east coast of Queensland and adjacent Australian waters and is largely managed by the Queensland Parks and Wildlife Service and the Great Barrier Reef Marine Park Authority, with considerable contributions from the Queensland Trust for Nature (Avoid Island), local community groups and various Indigenous communities with active land and sea ranger programs. The majority of important nesting sites and foraging grounds are included in the Great Barrier Reef World Heritage Area and associated Queensland and Commonwealth-protected areas.

While there are strong protection and management programs in place, the long-term outlook for this relatively small genetic stock is *poor*, largely because of the unexplained significant decline in the nesting population, especially at the critical Peak Island rookery.

Important nesting locations

- Major: Peak Island, Wild Duck Island, Avoid Island and Curtis Island
- Minor: Mackay Coast, inner shelf islands with beaches between Mackay and Shoalwater Bay, Agnes Water to Moore Park Coast and Woongarra Coast
- Index beaches monitored: Peak Island (1980–), Wild Duck Island (1981–), Curtis Island (1980–), Avoid Island (2007, 2012-2019) and Woongarra Coast (Mon Repos) (1968–)

Inter-nesting buffer: 60 km

Seasons

- Mating: Unknown
- Nesting: October–January (peak: late November – early December)
- Hatching: December–March (peak: February)

Important foraging and courtship areas (and monitoring sites)

- The sub-tidal, non-reef habitats of the Great Barrier Reef
- Index foraging sites currently monitored: None

Primary threats (updated Queensland assessment)

- Climate change and variability (sand temperature, feminisation, reduced hatching success) **VERY HIGH**
- Light pollution **VERY HIGH**
- Marine debris—ingestion (hard plastic, pH) **HIGH**

Primary management objectives

The primary management objectives for this stock are:

- improving understanding of and reversing the apparent decline in nesting on Peak Island
- exploring options to increase the resilience of key nesting sites to climate change impacts
- reducing impacts of threatening processes identified as *very high* and *high*.

National Recovery Action Plan actions specifically required to recover F-eQld

1. Understand the decline in nesting numbers at Peak Island, including impacts of light.
2. Quantify and model how changes in ambient temperatures (sand and water), sea level, frequency of extreme weather events, ocean circulation and acidification affect marine turtle nesting, sex ratios, hatching success, habitats, food availability and their ability to adapt to these changes.
3. Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches.
4. Support retrofitting of lighting at coastal communities and industrial developments, including imposing restrictions around nesting seasons.
5. Understand flatback turtle foraging requirements and identify key foraging areas for this stock.
6. Continue long-term monitoring of index beaches.



Figure 9 Nesting (a) and foraging (b) distribution of F-eQld genetic stock

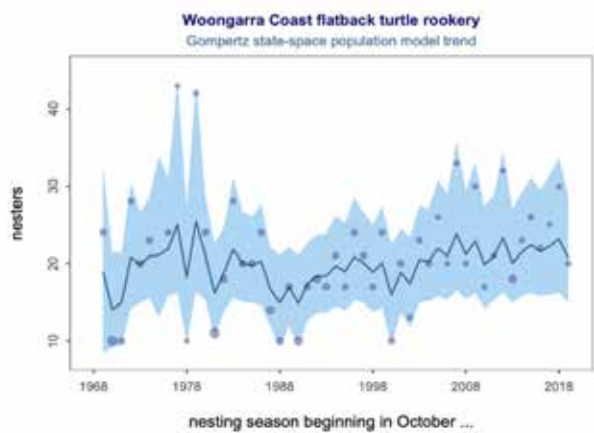
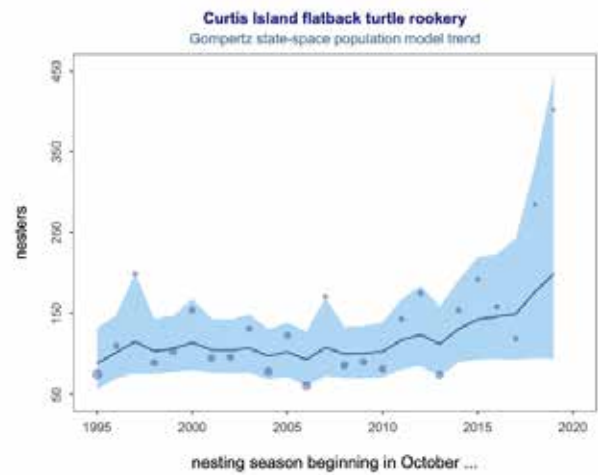
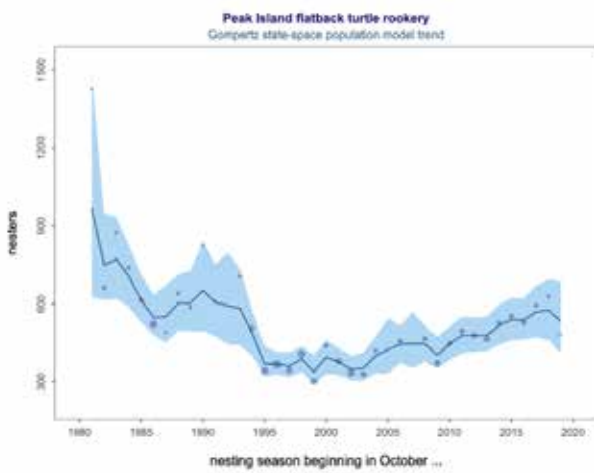


Figure 10 Trend in the total number of adult females supporting the (a) Peak Island, (b) Curtis Island, and (c) Woongarra Coast flatback turtle rookery. Solid curve shows the trend fitted to annual estimates, whereas Polygon shows the 95% credible region for that trend

Queensland actions to support the national Recovery Plan to recover F-eQld

Reference	Targets	Action		
F-eQld1 (see OA1.1)	1.1, 3.2, 5.1, 5.1, 5.2	Investigate potential causes of the apparent decline in nesting on Peak Island and implement management actions to reverse the decline, including through working with community groups (e.g. Trust for Nature).	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DES (QPWS&P)
			Timeframe:	Now
Cost:	Low/medium			
F-eQld2 (see OA1.1, 3.1)	1.1, 1.3, 5.1, 5.2	Improve understanding of stock population dynamics, foraging and nesting patterns and assess the feasibility of direct management actions to support successful hatching of at least 70% of clutches laid, and mean hatchling emergence success in excess of 80% from clutches producing hatchlings.	Priority:	Medium
			Lead:	RJFMP
			Support:	DES (QPWS&P) QILSR
			Timeframe:	Now/next
Cost:	Medium			
F-eQld3 (see OA1.7, OA3.2)	1.1, 5.1, 5.2	Develop feasible management techniques that can be applied at an ecologically-meaningful scale to increase climate change resilience for nesting and foraging populations (including in relation to sand temperatures, feminisation and reduced hatching success).	Priority:	Low
			Lead:	DES (QPWS&P)
			Support:	LGA TMR (Ports) NRME
			Timeframe:	Now
Cost:	Low			
F-eQld4 (see OA2.8)	1.1, 2.2	Work with port authorities, local governments and other partners to develop and implement measures outlined in the National Light Pollution Guidelines for existing and future developments adjacent to existing and potential refugial flatback turtle nesting beaches.	Priority:	High
			Lead:	DES (EPP)
			Support:	FJFMP PA
			Timeframe:	Now/ongoing
Cost:	Low			
F-eQld5	3.1	Seek to include the (vacant) leasehold tenure on Wild Duck Island into the protected area estate to minimise the impacts of development. Review expanded/thickened beach vegetation to determine if this affects the quality of the nesting habitat and needs management intervention.	Priority:	High
			Lead:	RJFMP
			Support:	RJFMP DES
			Timeframe:	Now
Cost:	High			
F-eQld6 (see OA3.6)	3.2	Maintain and expand feral animal control programs to reduce the impacts of pest species (including goats, pigs, and deer) on key nesting sites, including on Peak Island, Wild Duck Island, Avoid Island and Curtis Island.	Priority:	High
			Lead:	RJFMP
			Support:	RJFMP
			Timeframe:	Now/ongoing
Cost:	Medium			
F-eQld7 (see OA4.2)	4.1, 4.2	Continue and enhance collaborative marine turtle management and recovery efforts with Traditional Owners and Indigenous Land and Sea Ranger groups and community-based entities, including Gidarjil, Woppaburra, Yirriburra, Gudjuda and Darumbal.	Priority:	Medium
			Lead:	RJFMP
			Support:	RJFMP QILSR DES (QPWS&P)
			Timeframe:	Next/ongoing
Cost:	Medium			
F-eQld8 (see OA3.3)	2.4, 3.1, 3.2, 3.3, 4.1, 4.2	Collaborate with Traditional Owners, Indigenous Land and Sea Ranger groups, relevant government agencies and NGOs (e.g. Tangaroa Blue) to address the impacts of marine debris on turtle health, particularly plastic ingestion and entanglement in discarded fishing gear.	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	DAWE QILSR
			Timeframe:	Ongoing
Cost:	Medium			

Reference	Targets	Action	Priority:	Very high
F-eQld9 (see OA2.6)	2.1, 2.2, 3.3	Work with and support fisheries managers and the fisheries sector to reduce residual risks associated with negative flatback turtle interactions with all fisheries operating in waters off eastern Queensland. Where necessary, advocate for better reporting and stronger regulations and compliance efforts to minimise the impact of domestic bycatch on marine turtles (cumulative impacts of all fisheries).	Lead:	DES (QPWS&P)
			Support:	GBMPA DAWE PA QDAF AFMA
			Timeframe:	Now/ongoing
			Cost:	Low



Flatback turtle hatchlings © Queensland Government

Species/stock: **Flatback turtle Arafura Sea (F-AS)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Vulnerable	Vulnerable	Severely depleted	Stable (increasing)	Very poor	Low (limited evidence)

Overall Queensland priority (for additional investment): **HIGH**

Stock description (Figures 11 and 12)

Nesting occurs in the western Torres Strait, around the Gulf of Carpentaria, northeast Arnhem Land, Cobourg Peninsula and into western Northern Territory. The F-AS stock forages on continental shelf waters of northern Australia, eastern Indonesia and southern Papua New Guinea, from the Timor Sea, throughout the Arafura Sea (including the Gulf of Carpentaria) and eastward through the Gulf of Papua. Within Australia, this shared stock is managed by the Queensland and Northern Territory Governments in collaboration with the Torres Strait Regional Authority and a wide range of community and ranger groups. Crab Island, in the Gulf of Carpentaria, is one of the largest flatback turtle nesting populations and it is estimated that approximately 3,000 turtles nest there each year. Recent studies have reported that the number of nesting flatbacks at Field Island appear to be relatively stable. Monitoring at Bare Sand Island has indicated a 3% decline per year, which may be due to cumulative impacts from multiple sources of mortality. Flatbacks have been the most commonly-caught species in the trawl fisheries of this region for half a century, as turtle excluder devices have only been in use in Australian waters since 2001. Annual monitoring on Flinders Beach, Mapoon, began in 2004 and has seen recovery in nesting numbers. Approximately 10% of all turtles captured in ghost nets are flatback turtles. Ghost net hotspots have been identified throughout this stock’s nesting and foraging habitats. Flatback turtles are captured in gillnets in Australian, Indonesian and Papua New Guinean waters. The main source of egg mortality is from terrestrial predation by pigs, dogs, goannas and coastal communities, with an estimated 70–90% of clutches affected in many areas. Significant predation by black rats on Warul Kawa (Deliverance Island) in the north-west Torres Strait, has become a focus for current management efforts for this Indigenous Protected Area. Efforts to address predation threats on western Cape York through the Nests to Oceans Program is showing some success and it is imperative that ongoing funding is directed towards sustaining nest protection initiatives into the future.

There are historic reports that the level of egg harvest in some areas has been unsustainable. Indigenous communities that identified take as a potential concern during the development of the national Recovery Plan have proposed increasing education and support for ranger groups as the most effective means to manage this threat. The opportunity for collection of eggs by humans is likely to increase where the impact of predation by native and introduced animals has been actively reduced.

Peak nesting for this stock occurs in winter–spring and this suggest that this stock may have some resilience to climate change, noting that further temporal shifts in nesting may be limited due to the stock nesting in winter–spring. Crab Island, a critical rookery and important refugia, is particularly vulnerable to the impacts of projected sea level rise and inundation, particularly in the northern low-lying section. Warul Kawa (Deliverance Island) is also highly vulnerable to sea level rise. Nesting beaches with white sand and natural shade may help ameliorate the impacts of increased sand temperatures and consequential bias towards producing female hatchlings.

The Gulf of Carpentaria nesting region for this stock is impacted by multiple port developments associated with mining that are altering coastal habitats and elevating sky-glow over adjacent beaches Scardon River, Weipa, Boyd Pont, Karumba, McCarthur River and Groote Island. While light pollution at Skardon River and Boyd Point may have a significant impact on nearby nesting populations, much of the nesting population is located far enough away from major port facilities for the overall impacts to be considered *high*.

Future seabed mining is also considered a potential high risk for the ongoing viability of this stock. Currently, the moratorium on seabed mining in the Northern Territory has been extended for another three years to 2021. If this moratorium, or the moratorium on mining of the seabed in Torres Strait, were lifted, this may pose a significant future threat to turtle foraging habitats. There are planned further port developments for the Gulf of Carpentaria in Weipa, MacArthur River, Groote Eylandt and Gove.

Risks associated with fisheries bycatch (e.g. trawling, gill nets) are potentially less for flatbacks as they have the best breath-holding capacity of all marine turtles. However, the cumulative impact of all fishery types throughout the stocks range should be considered.

The Commonwealth Gulf of Carpentaria Marine Park protects 23,771 km² of important marine habitats offshore of to the Wellesley Islands. The area is culturally important for the Lardil, Yangkaal, Kaiadlit and Gangalidda people who have responsibilities for sea country, including the Thuwatha/Bujimulla Indigenous Protected Areas which overlap with the Commonwealth Marine Park. Day-to-day management of the Commonwealth Marine Park is limited. There are no marine-protected areas over Queensland waters and important nesting beaches are not included in the Queensland protected area estate. Consequently, compared to the east coast of Queensland, the capacity to manage marine turtles at the stock level is very limited in the Gulf of Carpentaria. Establishing effective conservation management arrangements and protection of marine habitats and nesting beaches that are critical to survival of the stock remains a very high priority in the Gulf of Carpentaria.

The utilisation of marine turtles as a food resource and other customary practices by Aboriginal peoples is totally dependent on an abundance of foraging or migrating marine turtles. A reduction in the F-AS genetic stock will impact significantly on the cultural fabric and Indigenous way of life across the region. While the impact of Indigenous take over in recent decades has not been quantified, given other growing threats, traditional management practices may need to be reconsidered (e.g. targeting doomed clutches, following local traditional practice of taking only 10 eggs from a nest, where relevant).

Owing to climate change risks (including feminisation of the population) and unsustainable egg predation and without significantly increasing hatchling production with an appropriate gender balance, the long-term outlook for the Arafura Sea flatback turtle stock is *very poor*.

Important nesting locations

- Major: Deliverance, Crab Islands and Flinders Beach
- Minor: Wellesley and Jardine River to Edward River and in western Torres Strait
- Index beaches monitored: Deliverance (1987), Crab (1978, 1991, 2000–2002, 2005), Flinders Beach (2004–2019)

Inter-nesting buffer: 60 km

Seasons

- Mating: Unknown
- Nesting: All year (peak: August–September)
- Hatching: All year (peak: September–November)

Important foraging and courtship areas (and monitoring sites)

- Foraging grounds currently unknown, but within sub-tidal, non-reef habitats across the continental shelf
- Index foraging sites currently monitored: None

Primary threats (updated Queensland assessment)

- Climate change and variability (sand temp, sea level rise, reduced nesting Crab and Deliverance Islands) **VERY HIGH**
- Terrestrial predation (pig, dog, goanna Western Cape York and rats in Torres Strait) **VERY HIGH**
- Marine debris—entanglement **VERY HIGH**
- Light pollution (Boyd Point, Skardon River) **HIGH**
- Habitat modification—infrastructure/coastal development (ports) **HIGH**
- Fisheries bycatch—domestic (cumulative impacts of all fisheries) **HIGH**
- Fisheries bycatch—international (longline and gillnet) **HIGH**
- Indigenous take (eggs)* **HIGH**

Primary management objectives

The primary management objectives for this stock are:

- reducing predation and improving hatchling production to ensure at least 70% of all clutches survive to hatch
- exploring options to increase the resilience of key nesting sites to climate change impacts
- reducing impacts of threatening processes identified as *very high* and *high*.

National Recovery Action Plan actions specifically required to recover F-AS

1. Support Indigenous and Torres Strait community programs to manage turtles and the implementation of their land and sea country management plans.
2. Determine important flatback turtle foraging areas across northern Australia and compare marine debris hotspots with foraging areas, post-hatchling dispersal and migratory pathways to identify high priority mitigation areas.
3. Quantify predation of eggs and hatchlings by terrestrial predators and implement terrestrial predator management programs.
4. Continue long-term monitoring of index beaches to assess trends in nesting abundance.

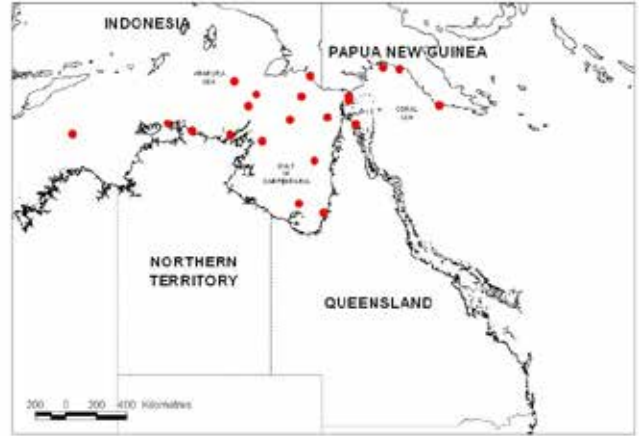


Figure 11 Nesting (a) and foraging (b) distribution of F-AS genetic stock

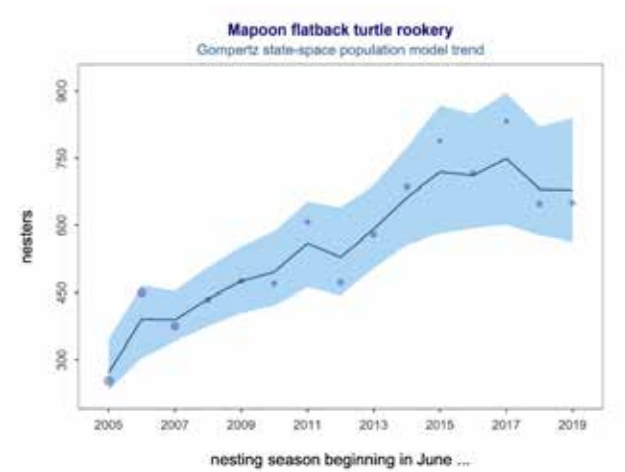


Figure 12 Trend in the total number of adult females supporting the flatback turtle rookery at Flinders Beach, Mapoon. Solid curve shows the trend fitted to annual estimates (dots), whereas Polygon shows the 95% credible region for that trend

Queensland actions to support the national Recovery Plan to recover F-AS

Reference	Targets	Action		
F-AS1 (see OA1.6, OA3.1, OA3.6, OA4.1, OA4.2)	2.4, 3.1, 3.2, 4.1	Resource and support Indigenous Land and Sea Ranger groups to undertake effective, on-ground management actions to protect nesting habitat from predation (including from pigs, dogs and goannas on the mainland, and rats on Warul Kawa IPA) to ensure at least 70% of all clutches survive.	Priority:	High
			Lead:	QILSR
			Support:	DAWE TSRA RNTBCs LGAs Indigenous councils
			Timeframe:	Now/ongoing
			Cost:	Medium
F-AS2 (see OA2.4)	1.2, 2.4, 3.1, 4.1	Consider opportunities to support Traditional Owners for Crab Island to declare a Sea Country IPA over this area given its high biodiversity and cultural significance.	Priority:	High
			Lead:	NTRBs
			Support:	RNTBCs NIAA DAWE
			Timeframe:	Now
Cost:	High			
F-AS3 (see OA1.1, OA3.1)	1.1, 1.3, 5.1, 5.2	Improve understanding of stock population dynamics, foraging and nesting patterns and assess the feasibility of direct management actions to support successful hatching of at least 70% of clutches laid and mean hatchling emergence success in excess of 80% from clutches producing hatchlings.	Priority:	Medium
			Lead:	DES
			Support:	QISLR
			Timeframe:	Now/next
Cost:	Medium			
F-AS4 (see OA1.7, OA3.2)	1.1, 5.1, 5.2	Develop feasible management techniques that can be applied at an ecologically-meaningful scale to increase climate change resilience for nesting and foraging populations (including in relation to sand temp, sea level rise, reduced nesting Crab and Deliverance Islands), focusing on hotspots such as Crab Island and Warul Kawa.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	TSRA CU MR< (WCTTAA) QISLR PA DAWE
			Timeframe:	Now
Cost:	Medium			
F-AS5 (see OA2.4, OA4.1, OA4.2)	1.2, 2.4, 3.1, 4.1, 4.2	Explore and support expanded Indigenous-led and other conservation management arrangements for the Gulf of Carpentaria, including establishing a network of protected areas (e.g. Sea Country IPAs), broad-scale MPAs or national parks) or ILUAs or other covenants (e.g. Crab Island). Develop joint management and funding arrangements to deliver marine turtle conservation with Indigenous communities.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DAWE PA NTRBs RNTBCs FNPs
			Timeframe:	Now/ongoing
Cost:	Very high			

Reference	Targets	Action		
F-AS6 (see OA2.8)	1.1, 2.2	<p>Work with port authorities, local governments and other partners to develop and implement measures outlined in the National Light Pollution Guidelines for existing and future developments adjacent to existing and potential refugial flatback turtle nesting beaches.</p> <p>Minimise other impacts on foraging and nesting habitat from port infrastructure and coastal development (especially at Skardon River and Boyd Point).</p> <p>Identify mining companies involved and seek to negotiate appropriate measures to reduce light pollution impacts associated with operations, including with advice and assistance from the National Offshore Petroleum Safety Management Authority.</p>	Priority:	Medium/high
			Lead:	DES (EPP)
			Support:	TMR NRME Port authorities LGA
			Timeframe:	Now
			Cost:	Low
F-AS7 (see OA2.6)	2.1, 2.2, 3.3	<p>Continue working with and supporting fisheries managers to reduce residual risks associated with negative flatback turtle interactions with all fisheries operating in the Gulf of Carpentaria and Arafura Sea. Where necessary, advocate for better reporting and stronger regulations and compliance efforts to minimise the impact of domestic bycatch on marine turtles (cumulative impacts of all fisheries).</p>	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DAWE PA QDAF AFMA
			Timeframe:	Now
			Cost:	Medium

5.3 Hawksbill turtle *Eretmochelys imbricata*



Species/stock: **Hawksbill turtle north Queensland (H-nQld)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Vulnerable	Endangered	Severely depleted	Significant decline	Very poor	Medium (limited evidence)

Overall Queensland priority (for additional investment): **HIGH**

Stock description (Figures 13 and 14)

Hawksbill turtles nesting in Queensland and the Torres Strait appear to be from the same genetic stock as those nesting in east Arnhem Land; however, given the seasonal separation in nesting between these two nesting aggregations, they are considered separate stocks. In Queensland, there was a large-scale legal commercial harvest and trade of hawksbill turtles for tortoiseshell from the late 1700s or 1800s which ceased in 1968. This is likely to have substantially depleted the stock. In 2000, nesting in north Queensland and the Torres Strait was estimated to involve approximately 4,000 females. Milman Island provides the only long-term monitoring data for this stock. It is estimated that this nesting aggregation has declined by about 57% since monitoring began in 1990, and models predict that nesting could approach extinction by 2036. It is not known but possible that this decline is representative across the stock.

This species' ability to recover from a decline is hampered by its unusually long interval between nesting seasons (approximately five years) and late maturation (greater than 30 years). Management of this stock is undertaken by the Queensland Parks and Wildlife Service, Great Barrier Reef Marine Park Authority and Torres Strait Regional Authority, in conjunction with local NGOs and Indigenous communities.

Hawksbill turtles that breed in Australia migrate to foraging grounds across northern Australia, the Great Barrier Reef, Indonesia and Papua New Guinea. In the broader Coral Sea region, there is an ongoing substantial harvest of hawksbill turtles for legal and illegal tortoiseshell trade that is likely to be a continuing source of mortality in this stock. Ghost nets are responsible for the death of many hundreds of turtles annually in the Gulf of Carpentaria, with immature hawksbill turtles being the most frequently reported in nets washed ashore in the Northern Territory and the second most common species in north Queensland. Although hawksbill turtles were not captured in large numbers in commercial trawling fisheries in northern Australia, they will have contributed to the cumulative mortality for the species.

On western Cape York, there are high levels (70–90% clutch loss) through dog, pig, varanid and human predation on clutches for all species of turtle, which means that the low-density hawksbill turtle nesting in this region will be affected. Rates of terrestrial predation are not known throughout the remainder of their range. However, goannas are known to exist on most islands throughout the Torres Strait, and anecdotal evidence suggests that predation by goannas is high. Indigenous harvest of eggs, particularly in central Torres Strait, as well as in Arnhem Land, eastern Indonesia and other Queensland Indigenous communities, is unquantified and of concern and will be impacting on subsequent recruitment to the adult nesting population. Hawksbill turtles foraging in the Great Barrier Reef have high survivorship but appear to be in decline as a result of breeding migrations to outside of Australian waters into Papua New Guinea, Solomon Islands and Vanuatu.

Changes in ocean circulation, ocean acidification and increased coral bleaching will directly affect the availability of hawksbill turtle foraging habitat and food availability. Temperature loggers from the last two decades indicate that the pivotal temperature at the peak of nesting periods has consistently been exceeded, and feminisation of clutches is becoming a significant issue for hawksbill populations. Current loss of nesting on outer Great Barrier Reef coral cays, at the perimeter of their nesting range, could also be indicative of a broader population decline.

The utilisation of marine turtles as a food resource and other customary practices by Torres Strait and Aboriginal peoples is totally dependent on an abundance of foraging or migrating marine turtles. A reduction in the H-nQld genetic stock will impact significantly on the cultural fabric and Indigenous way of life across the region. While the impact of Indigenous take over in recent decades has not been quantified, given other growing threats, traditional management practices may need to be reconsidered (e.g. targeting doomed clutches and following local traditional practice of taking only 10 eggs from a nest, where relevant).

With reduced recruitment of sub-adults to the population, there are growing concerns that the (H-nQld) genetic stock is at risk of catastrophic decline within one generation, and consequently the outlook for this stock is *very poor*.

Important nesting locations

- Major: Long (Sassie), Hawkesbury, Daymon, Milman, Boydong, Zuizin, Mimi, Bourke, Aukane, and Layoak, Bet and Dadalai Islands
- Minor: Islands in the far northern Great Barrier Reef and Torres Strait, and the mainland coast of western Cape York Peninsula, north of Cotterell River, and Mt Adolphus and Albany Islands
- Index beaches monitored: Milman Island (1991–2021)

Inter-nesting buffer: 20 km

Seasons

- Mating: Year round
- Nesting: Year round (peak: December–February)
- Hatching: Year round (peak: February–May)

Important foraging and courtship areas (and monitoring sites)

- Howick Group, GBR Reefs north of Princess Charlotte Bay and Torres Strait, Capricorn-Bunker reefs including Heron and Wistari Reefs, and Moreton Bay
- Index foraging sites currently monitored: Howick Group and Moreton Bay

Primary threats (updated Queensland assessment)

- Climate change and variability (feminisation, sea level rise, coral bleaching) **VERY HIGH**
- Marine debris—entanglement **VERY HIGH**
- International take—outside Australia’s jurisdiction (shell) **VERY HIGH**
- Unknown threats—recruitment to nesting population **VERY HIGH**
- Terrestrial predation (pig, dog, goanna and rats) **VERY HIGH**
- Indigenous take (meat and eggs)* **REQUIRES FURTHER ASSESSMENT**

* Assessment of this threat requires broader consultation with stakeholders

Primary management objectives

The primary management objectives for this stock are:

- reducing egg predation and improving hatchling production to ensure at least 80% of all clutches survive
- exploring options to increase the resilience of key nesting sites to climate change impacts and improved sex ratios
- international collaboration around black-market shell trade and impacts on migratory stocks
- reducing impacts of threatening processes identified as *very high* and *high*.

National Recovery Action Plan actions specifically required to recover H-nQld

1. Work on a regional scale to understand market supply chains and to reduce unsustainable harvest and illegal and unregulated trade.
2. Liaise at a regional scale to address and reduce the source of marine debris in Australian waters.
3. Ensure clean-up activities are timed appropriately to coincide with on-shore peaks in marine debris (i.e. prior to wet season).
4. Determine the extent of terrestrial predation on hawksbill turtle clutches on beaches and islands and where necessary undertake nest protection programs.
5. Quantify and model how changes in ambient temperatures (sand and water), sea level, frequency of extreme weather events, ocean circulation and acidification affect marine turtle nesting, sex ratios, hatching success, habitats, food availability and their ability to adapt to these changes.
6. Initiate and continue long-term monitoring of multiple index beaches to assess trends in nester abundance and determine whether trends observed at Milman Island are representative of the stock.
7. Continue and initiate long-term monitoring at important foraging grounds to assess efficacy of management programs.

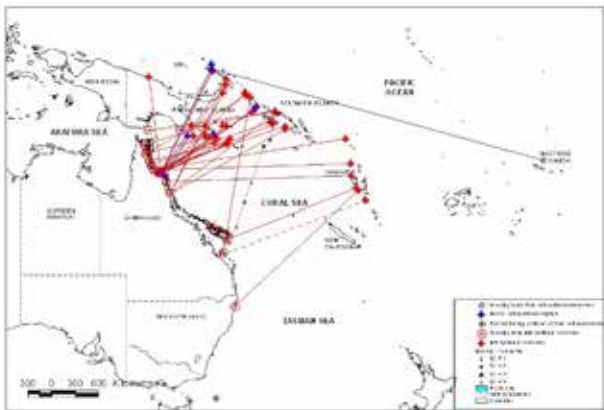
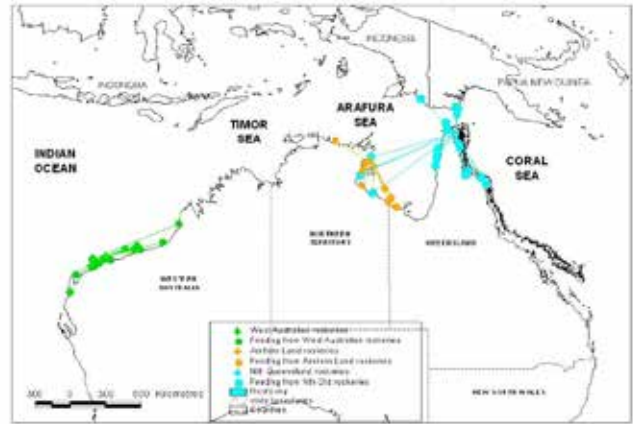


Figure 13 Nesting (a) and foraging (b) distribution of H-nQld genetic stock. Blue dots (b) denote foraging sites for Queensland nesting females

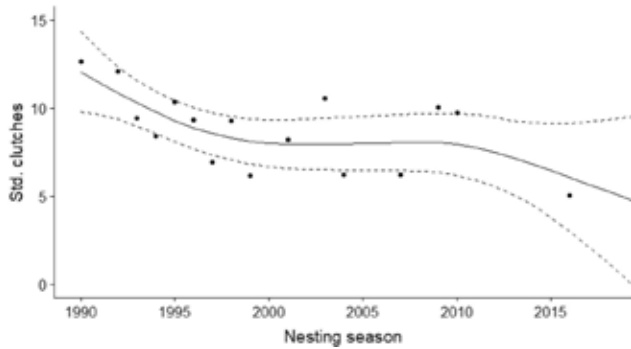


Figure 14 Trend in the number of clutches laid/night during one-month index monitoring at Milman Island hawksbill rookery. Solid curve shows trend fitted to annual estimates (dots), whereas Polygon shows the 95% credible region for that trend

Queensland actions to support the national Recovery Plan to recover H-nQld

Reference	Targets	Action		
H-nQld1 (see OA1.1, OA1.7)	1.1, 5.1, 5.2	Address knowledge gaps and develop feasible management techniques that can be applied at an ecologically-meaningful scale to increase climate change resilience for nesting and foraging populations including through: <ul style="list-style-type: none"> • geospatial mapping of Milman Island and Gebar Island to better understand island geomorphology. • developing data recording methods to detect if climate-induced changes to nesting habitat are negatively impacting nesting or hatching success. 	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	TSRA Research partners
			Timeframe:	Now/ongoing
			Cost:	Low/medium
H-nQld2 (see OA1.1)	1.1, 3.2, 5.1, 5.1, 5.2	Investigate potential causes of the unique continued decline in recruitment to the north Queensland (H-nQld) hawksbill stock and implement management actions to reverse the decline.	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	TSRA RJFMP
			Timeframe:	Now/ongoing
			Cost:	Medium
H-nQld3 (see OA1.2, OA1.5, OA1.7)	1.1, 1.2, 1.3, 2.4, 4.1	Subject to Traditional Owner consultation and support, secure resources to identify and develop additional index sites for nesting and foraging (possibly at Gebar, in the Torres Strait), and build local capacity to undertake ongoing monitoring.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	TSRA
			Timeframe:	Now
			Cost:	Low
H-nQld4 (see OA3.3)	2.4, 3.1, 3.2, 3.3, 4.1, 4.2	Collaborate with Indigenous Land and Sea Ranger groups, relevant government agencies and NGOs (e.g. Tangaroa Blue) to address the impacts of marine debris on turtle health, particularly plastic ingestion and entanglement in discarded fishing gear. Support the continuation and expansion of ghost nets management initiatives in the Gulf of Carpentaria and Arafura Sea with a focus on prevention at international source hotspots and removal from key foraging and nesting habitats.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DAWE PA QILSR
			Timeframe:	Now
			Cost:	Very high
H-nQld5 (see OA2.10)	2.1, 4.2	Liaise with the Australian Government to reduce unsustainable harvest and illegal and unregulated trade of hawksbills (including through partnership initiatives with NGOs to reduce turtle harvesting and local trade in the Coral Triangle, through the wildlife trade monitoring network, training local rangers to protect turtles from poaching and patrol nesting beaches, raising community awareness and developing alternative livelihoods).	Priority:	High
			Lead:	DAWE
			Support:	DFAT TSRA DES NGOs
			Timeframe:	Now
			Cost:	Low
H-nQld6 (see OA1.6, OA3.1, OA3.6, OA4.1, OA4.2)	2.4, 3.1, 3.2, 4.1	Resource and support Indigenous Land and Sea Ranger groups to undertake effective, on-ground management actions to protect nesting habitat from predation (including from pigs, dogs, goannas and rats) to ensure at least 70% of all clutches survive.	Priority:	High
			Lead:	QILSR
			Support:	NIAA RJFMP
			Timeframe:	Now/ongoing
			Cost:	Medium
H-nQld7 (see OA1.6, OA4.1, OA4.2)	1.2, 2.4, 4.1, 4.3	Continue to support Indigenous Land and Sea Ranger groups and Traditional Owner organisations to develop and implement community-based management strategies to ensure local harvest of turtle eggs is culturally appropriate and sustainable.	Priority:	Medium
			Lead:	TSRA
			Support:	DES (QILSR, QPWS&P) GBRMPA RJFMP NIAA
			Timeframe:	Now/ongoing
			Cost:	High

5.4 Loggerhead turtle *Caretta caretta*



Species/stock: **Loggerhead turtle south-west Pacific (LH-swPac)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Endangered	Endangered	Severely depleted	Moderate recovery (decline)	Poor	High (adequate)

Overall Queensland priority (for additional investment): **HIGH**

Stock description (Figures 15 and 16)

Nesting of the south-west Pacific loggerhead turtle stock occurs entirely on beaches of the east coast of Australia and New Caledonia. Post-hatchlings disperse south on the east Australian Current and through the South Pacific gyre, reaching waters off Peru, Chile and Ecuador. Post-hatchlings spend approximately 16 years at sea before returning to the Coral Sea–Tasman Sea, region of the south-west Pacific. There has been a severe reduction in the number of turtles recruiting to Australian foraging grounds from this oceanic phase. This may be due to bycatch in long-line and gill-net fisheries or ingesting marine debris whilst at sea.

The population has severely decreased (by 86%) caused by trawling bycatch mortality throughout their foraging range in northern and eastern Australia and in their inter-nesting habitat adjacent to the nesting beaches during the 1970s to 2001. Introduction of the mandatory use of turtle excluder devices in the Northern Prawn Fishery, the Torres strait Prawn Trawl Fishery and the East Coast Otter Trawl Fishery in 2001 led to a recovery in the nesting turtle abundance on the mainland nesting beaches. However, there has been negligible recovery of the nesting populations on the Great Barrier Reef island rookeries which originally supported the majority of loggerhead turtle nesting in eastern Australia.

Excessive loss of clutches to predation by foxes, dogs and goannas is a threat on the mainland beaches south of Agnes Water and at Sandy Cape since the 1970s. A range of predator control measures have been implemented on these beaches across the decades with variable success. The use of predator proof cages and the use of sniffer dogs to guide den fumigation at fox breeding time appear to be the most successful methods to minimise clutch loss to these predators.

Draining of swamps behind Mon Repos Beach in the 1960s–1970s lowered the water tables beneath the loggerhead turtle-nesting habitat on the adjacent beach. This has resulted in a reduction in hatchling production during hot or low rainfall years on the (currently) most important nesting beach for loggerhead turtles in the South Pacific. QPWS has acquired this drained swamp land and plans to re-establish the swamp and help increase the flow of water through the dunes to the beach.

Mainland nesting occurs adjacent to expanding urbanised coastal areas and the Port of Bundaberg, and is at risk from the negative impacts of anthropogenic light on nesting success and dispersal of hatchlings to the sea. Climate change impacts also appear to be affecting nesting beaches with changes in hatchling sex ratios and emergence success, and increased extreme weather events, resulting in erosion of nesting sites. The potential impacts of altered sand budgets, rising sea levels, changes in forage communities, ocean acidification and shifts in prevailing ocean currents are poorly understood and are likely to be beyond the influence of local management efforts. Boat strikes pose a very high threat.

The ubiquitous presence of hard plastic in the global marine environment means the risk of ingesting marine debris is high and potentially increasing, particularly for post-hatchlings.

Existing management efforts (e.g. mandatory use of turtle excluder devices, predator control programs and beach cooling projects, including re-establishments of the swamp behind Mon Repos Beach) are considered essential to the long-term recovery of the stock.

With greater than 80% of nesting in Australia occurring in protected areas, management of the stock is primarily undertaken by the Queensland Parks and Wildlife Service, community volunteers and increasingly through Indigenous Land and Sea Ranger programs.

In 2014, the Convention on the Conservation of Migratory Species of Wild Animals (CMS) agreed to a framework for the regional management of this stock through the Single Species Action Plan for the Loggerhead Turtle (*Caretta caretta*) in the South Pacific Ocean. This plan addresses threats to this stock throughout their range. Australia, as a signatory state to CMS and in collaboration with the States, is expected to implement these actions where appropriate within their jurisdictions.

Given the longevity of existing nesting and foraging ground monitoring, continued monitoring will allow the assessment of efficacy of threat management and demonstrate stock recovery.

Despite significant improvements in management, the continuing and undetermined threats mean that the outlook for the LH-swPac genetic stock is *poor*.

Important nesting locations

- Major: Mainland coast Mon Repos to Wreck Rock, Tryon and Erskine Islands
- Minor: Wreck, Heron, Lady Musgrave, and Northwest Islands, Swains Reef, New Caledonia and Sunshine coast
- Index beaches monitored: Mon Repos (1969–), Wreck Rock (1978–), Capricorn Bunker Group (1977–)

Inter-nesting buffer: 20 km

Seasons

- Mating: October–December (peak: October–November)
- Nesting: October–March (peak: December–January)
- Hatching: December–May (peak: February–March)

Important foraging and courtship areas (and monitoring sites)

- Moreton Bay, Hervey bay, and Capricorn-Bunker reefs, including Heron-Wistari Reefs
- Index foraging sites currently monitored: Moreton Bay

Primary threats (updated Queensland assessment)

- International climate change and variability (extreme weather, coral bleaching—foraging, sand temperatures) **VERY HIGH**
- Fisheries bycatch—international (longline) **VERY HIGH**
- Vessel disturbance (strike) **VERY HIGH**
- Unknown threat in foraging ground **VERY HIGH**
- Marine debris—entanglement and ingestion (hard plastic by pH, fishing line) **HIGH**
- Light pollution **HIGH**

Primary management objectives

The primary management objectives for this stock are:

- maintaining current protection measures
- increasing protection of mainland nesting beaches
- identifying the threat most likely causing the unexplained apparent decline
- reducing impacts of threatening processes identified as Very High and High
- re-establish the freshwater water table under the Mon Repos nesting habitat.

National Recovery Action Plan actions specifically required to recover LH-swPac

1. Implement the Single Species Action Plan for the Loggerhead Turtle (*Caretta caretta*) in the South Pacific Ocean.
2. Quantify the impact of international fishery bycatch on this stock.
3. Assess the impacts of marine debris, particularly on post-hatchling life phase.
4. Manage artificial light from onshore and offshore sources to ensure that biologically important behaviour of nesting adults and dispersing hatchlings can continue.
5. Understand changes in stock trends through monitoring of nesting beaches and demographics at key foraging areas to assess recruitment of juveniles from the pelagic life phase.
6. Identify potential nesting and foraging.

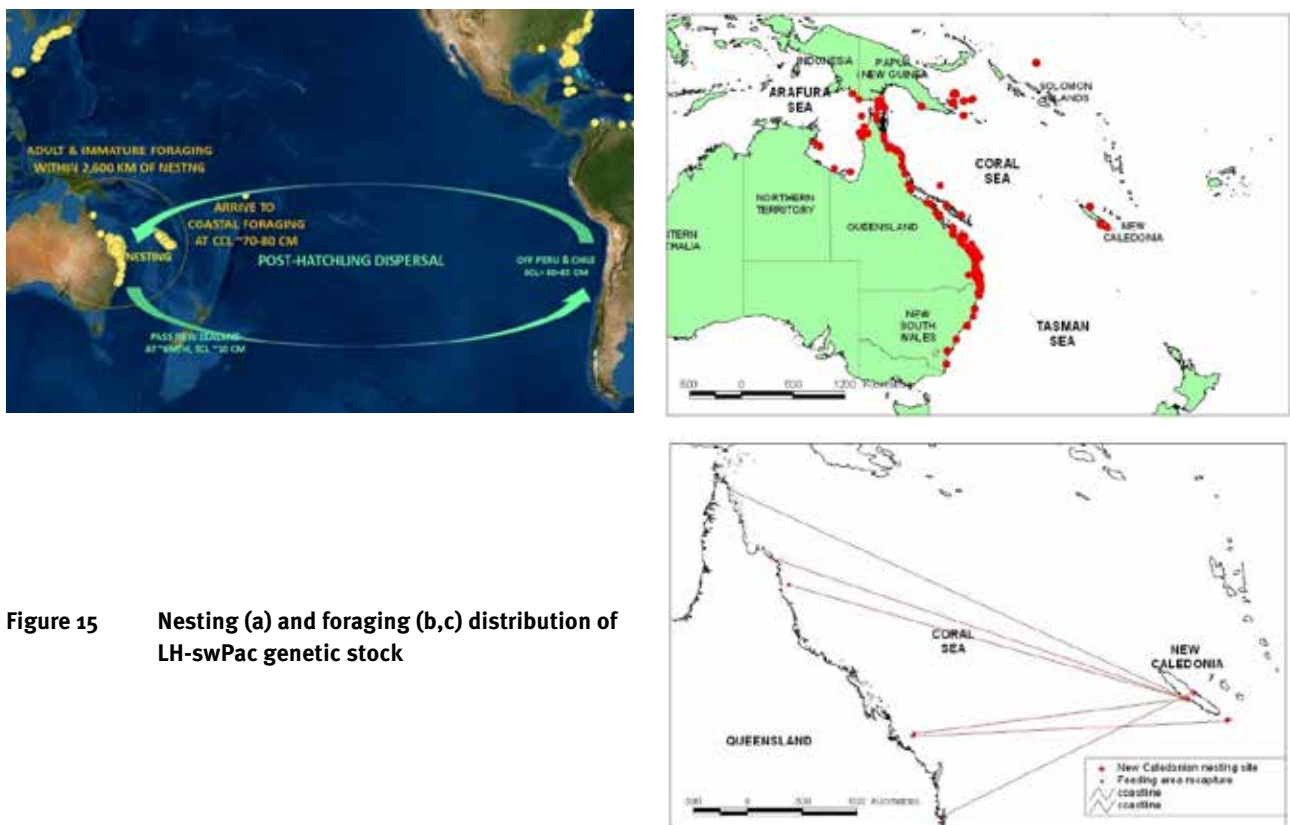


Figure 15 Nesting (a) and foraging (b,c) distribution of LH-swPac genetic stock

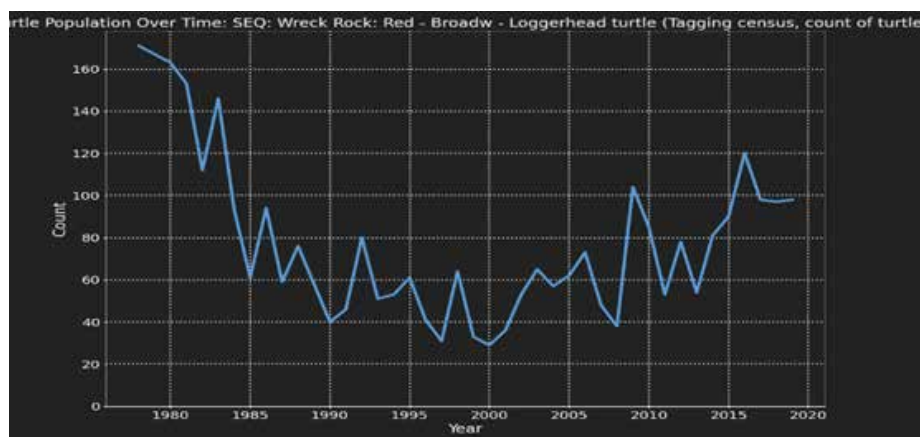
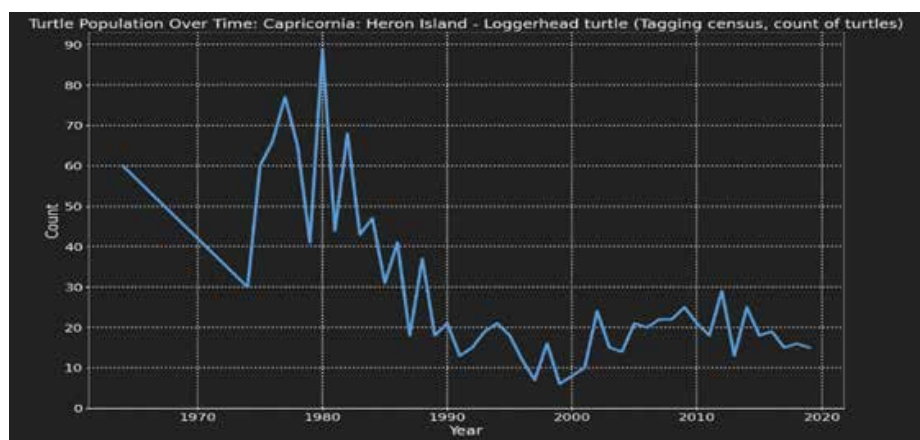


Figure 16 Number of nesting turtles tagged annually at (a) Wreck Island, (b) Heron Island, (c) Woongarra coast, (d) Wreck Rock beaches, illustrating poor recovery on island rookeries compared to mainland beaches

Queensland actions to support the national Recovery Plan to recover LH-swPac

Reference	Targets	Action		
LH-swPac1 (see OA2.10)	All	Work with other partners to implement the <i>Single Species Action Plan for the Loggerhead Turtle (Caretta caretta) in the South Pacific Ocean</i> .	Priority:	Medium
			Lead:	DAWE
			Support:	DES
			Timeframe:	Now/ongoing
LH-swPac2 (see OA1.2)	1.1, 1.3, 5.1	Identify, develop and monitor additional index sites for foraging populations (to assess potential increases in recruitment resulting from management efforts).	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	
			Timeframe:	Now
LH-swPac3 (see OA1.1, OA1.7)	1.1, 5.1, 5.2	Develop feasible management techniques that can be applied at an ecologically-meaningful scale to increase climate change resilience for nesting and foraging populations (including in relation to extreme weather, coral bleaching—foraging, sand temperatures), including through: <ul style="list-style-type: none"> • addressing knowledge gaps. • investigating methods for cooling beaches under threat of global warming. • undertaking geospatial mapping of key index sites and potential refugial areas (including the Cap Bunker Group, Wreck and Heron Islands, Hervey Bay and Moreton Bay). • developing data recording methods to detect if climate induced changes to nesting habitat are negatively impacting nesting or hatching success. 	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	PA DAWE GBRMPA RJFMP
			Timeframe:	Now
LH-swPac4 (see OA2.10)	2.1, 3.3	Liaise with the Australian Government in relation to international mitigation measures to reduce the impact of longline fisheries on loggerhead turtles.	Priority:	High
			Lead:	DES
			Support:	DAWE
			Timeframe:	Now/ongoing
LH-swPac5 (see OA2.5)	1.1, 2.1	Review high density foraging sites and explore opportunities to expand Go-slow Zones (including for foraging habitat in Moreton Bay, Cleveland Bay, the Whitsundays and Gladstone Harbour). Liaise with the Department of Transport and Main Roads to expand Go-slow Zones where required outside of marine parks, based on StrandNet data. Link to an effective compliance program.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	TMR
			Timeframe:	Now/next
LH-swPac6	1.1, 5.1, 5.2	Investigate potential causes of the historic decline in offshore island nesting populations since the 1970s and implement management actions to reverse the decline.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	
			Timeframe:	Now
			Cost:	Medium

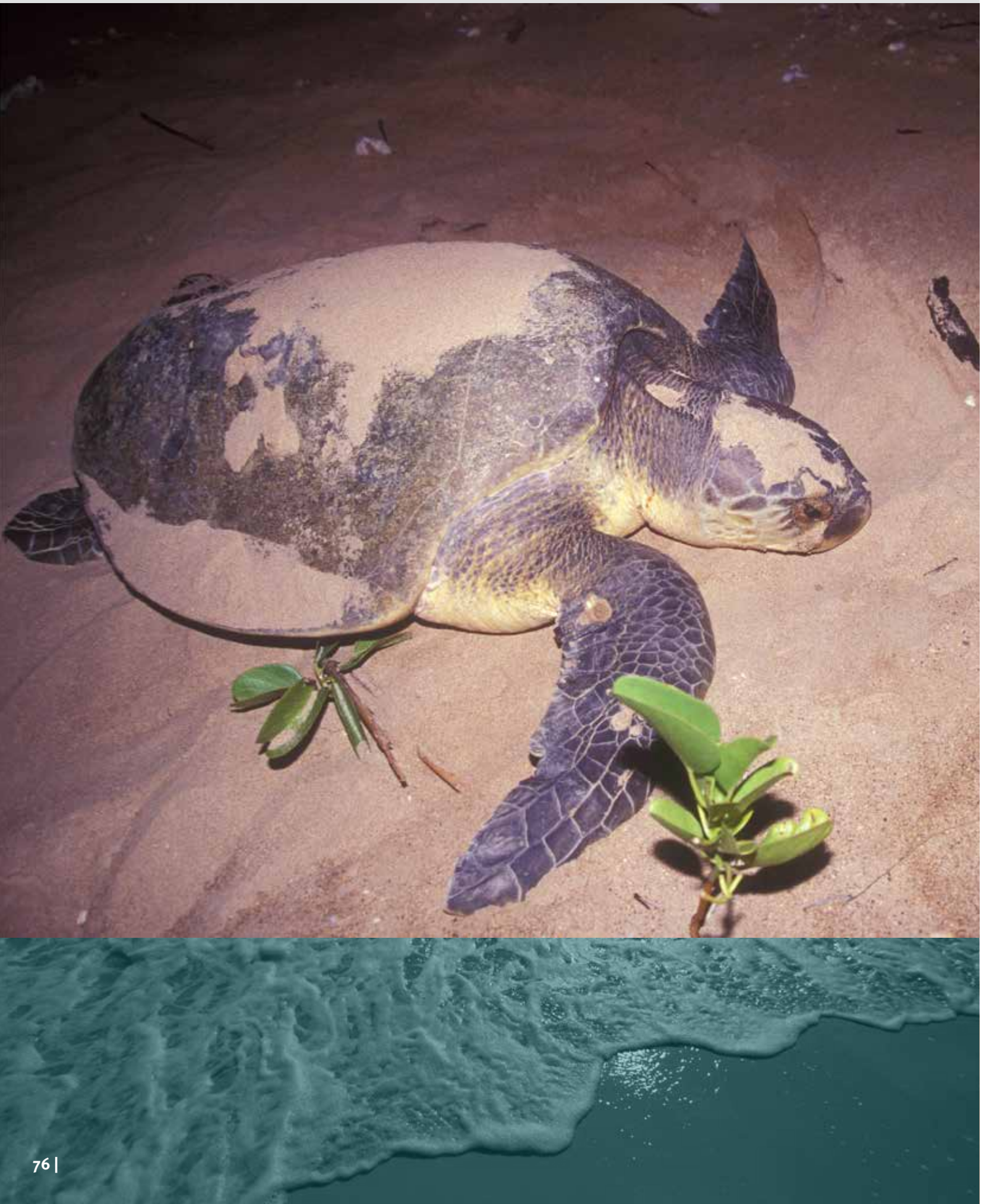
Reference	Targets	Action		
LH-swPac7 (see OA2.8)	1.1, 2.2	Work with port authorities, local governments and other partners to develop and implement measures outlined in the National Light Pollution Guidelines for existing and future developments adjacent to existing and potential refugial loggerhead turtle nesting beaches.	Priority:	High
			Lead:	DES (EPP)
			Support:	LGAs
			Timeframe:	Now
			Cost:	Low
LH-swPac8 (see OA3.6)	3.2, 4.2	Maintain and expand successful feral animal and predation control programs (including for native animals such as goannas) through existing and new partnerships and initiatives (e.g. Nests to Oceans program).	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	NGOs
			Timeframe:	Now
			Cost:	Medium
LH-swPac9 (see OA3.3)	2.4, 3.1, 3.2, 3.3, 4.1, 4.2	Collaborate with Traditional Owners, Indigenous Land and Sea Ranger groups, relevant government agencies and NGOs (e.g. Tangaroa Blue) to address the impacts of marine debris on turtle health (especially plastic ingestion and entanglement in discarded fishing gear).	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	DAWE
			Timeframe:	Ongoing
			Cost:	Medium



Loggerhead turtle hatchlings © Queensland Government

5.5 Olive ridley turtle

Lepidochelys olivacea



Species/stock: **Olive Ridley western Cape York Peninsula (O-nwCYP)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Endangered	Endangered	Severely depleted	Significant decline	Very poor	Medium (limited evidence)

Overall Queensland priority (for additional investment): **HIGH**

Stock description (Figure 17)

This stock is a small aggregation that is genetically distinct from olive ridley turtles nesting in the Northern Territory and neighbouring countries. The main nesting concentration is between the Indigenous communities of Aurukun and Pormpuraaw, with low-density nesting occurring between the Mitchell River and Jardine River. This stock is interpreted as severely depleted based on the very small annual nesting population, decades of regular capture in Northern Prawn Fishery trawls prior to the regulated use of TEDs in 2001, at least two decades of excessive egg loss to terrestrial predators (estimated to occur in more than 90% of nests) and an annual recruitment into the adult breeding population approaching zero. An additional threat to this stock is frequent entanglement in ghost nets.

There is limited monitoring at nesting beaches and currently no long-term monitoring occurring at foraging grounds. Indigenous ranger groups and communities undertake management, with support through collaborations with industry and government. The Nest to Oceans program, jointly funded by Commonwealth and Queensland governments, has supported the rangers to undertake nest protection (pig management and monitoring) which resulted in significant decreases in clutch predation. Predator control efforts must be resourced on an ongoing basis to successfully address nest predation and for the stock to have any prospects of recovery.

The Gulf of Carpentaria is considered to be a ghost net hotspot with estimates that each year between 2,043 and 6,132 olive ridley turtles are captured in ghost nets. Many of these are from international stocks, rather than the O-nwCYP stock, and forage in Australian waters. While olive ridley turtles are the least frequently reported species in gill-net fishery logbooks, there is also a large proportion of unidentified turtles, which could include olive ridley turtles. This, combined with the small size of the stock, means that fisheries interaction may be affecting the viability of the stock. Satellite telemetry work indicates that at least one-third of the olive ridley population are exposed to the impacts of trawl and longline fisheries of Indonesia and the Arafura Sea.

Almost 100% of the nesting habitat for this stock is either under exploration for sandmining or under active sandmining leases, with potential catastrophic impacts on habitat that is essential to survival of the stock. The potential impacts of mining around high-density nesting areas, such as Boyd Point, need to be actively managed through habitat protection and appropriate development approval conditions and ongoing operations. The overall impact of vessel traffic, port activity and associated light pollution are likely significant.

The Commonwealth Gulf of Carpentaria Marine Park protects 23,771 km² of important marine habitats adjacent to the Wellesley Islands. The area is culturally important for the Lardil, Yangkaal, Kaiadlit and Gangalidda people who have responsibilities for sea country, including the Thuwatha/Bujimulla Indigenous Protected Area which overlaps with the Commonwealth Marine Park.

There are no marine-protected areas over Queensland waters and important nesting beaches are not included in the Queensland protected area estate. Consequently, compared to the east coast of Queensland, the capacity to manage marine turtles at the stock level is very limited in the Gulf of Carpentaria. Establishing effective conservation management arrangements and protection of habitats that are critical to survival of the stock remains a very high priority in the Gulf of Carpentaria.

The utilisation of marine turtles as a food resource and other customary practices by Aboriginal peoples is totally dependent on an abundance of nesting turtles. A reduction in the O-nwCYP genetic stock will impact significantly on the cultural fabric and Indigenous way of life across the region. While the impact of Indigenous take over recent decades has not been quantified, given other growing threats, traditional management practices may need to be reconsidered (e.g. targeting doomed clutches and following local traditional practice of taking only 10 eggs from a nest, where relevant).

It is not known the extent to which olive ridley turtles will be able to adapt to environmental changes associated with climate change; however, the small size and limited region in which this stock nests makes them susceptible to sea level rise, increased extreme weather and changes in sand and water temperature. The projected impact of sea level rise for the primary nesting beaches in the Pormpuraaw area and southern part of western Cape York is very high. Given the assumed long-term decline in this stock, it is important to establish long-term monitoring to assess the efficacy of management actions and to track recovery of the stock. The current outlook for this stock is *very poor*, with only several hundred nesting females per year estimated to nest on mainland beaches along the Gulf coastline. Major intervention is required to avoid catastrophic collapse of this very small population, including through adequately resourcing Indigenous Land and Sea Ranger groups to address key threats, such as terrestrial predation.

Important nesting locations

- Major: Pormpuraaw to Aurukun
- Minor: Low-density nesting occurs on western Cape York Peninsula between Mitchell River and Jardine River including Flinders Beach Mapoon
- Index beaches monitored: Flinders Beach (Mapoon) and Pormpuraaw

Inter-nesting buffer: 20 km

Seasons

- Mating: February–September
- Nesting: March–October (peak: July)
- Hatching: May–December

Important foraging and courtship areas (and monitoring sites)

- Sub-tidal waters of the Arafura Sea and Gulf of Carpentaria in Australian and Indonesian waters
- Index foraging sites currently monitored: None

Primary threats (updated Queensland assessment)

- Climate change and variability (sand temperature, limited range and small population, sea level rise) **VERY HIGH**
- Sand mining (nesting habitat) **VERY HIGH**
- Light pollution (Boyd Point and Skardon River) **VERY HIGH**
- Terrestrial predation (pig, dog and goanna) **VERY HIGH**
- Fisheries bycatch—international (longline and trawl) **VERY HIGH**
- Habitat modification—infrastructure/coastal development (ports—cumulative) **VERY HIGH**
- Marine debris—entanglement **VERY HIGH**
- Fisheries bycatch—domestic (trawl and net—cumulative all fisheries) **HIGH**
- Indigenous take (eggs)* **REQUIRES FURTHER ASSESSMENT**

Primary management objectives

The primary management objectives for this stock are:

- increasing protection of mainland nesting beaches
- increased data sharing and management collaboration
- reducing impacts of threatening processes identified as *very high* and *high*.

National recovery plan actions specifically required to recover O-nwCYP

1. Support ongoing implementation of terrestrial predation management programs.
2. Liaise at a regional scale to address and reduce the source of marine debris in Australian waters.
3. Maintain and expand partnership arrangements for the collection of marine debris (both onshore and offshore).
4. Support collection of tissue samples from stranded marine turtles.
5. Devise innovative methods for the early identification and intervention of ghost nets entering the Gulf of Carpentaria.
6. Quantify and model how changes in ambient temperatures (sand and water), sea level, frequency of extreme weather events, ocean circulation and acidification affect marine turtle nesting, sex ratios, hatching success, habitats, food availability and their ability to adapt to these changes.
7. Identify and protect areas likely to provide refugia and range expansion.
8. Support and expand research collaborations with commercial fishers.
9. Establish long-term monitoring at index beach to assess trends in nesting abundance and efficacy of terrestrial predator control programs.

* Assessment of this threat requires broader consultation with stakeholders

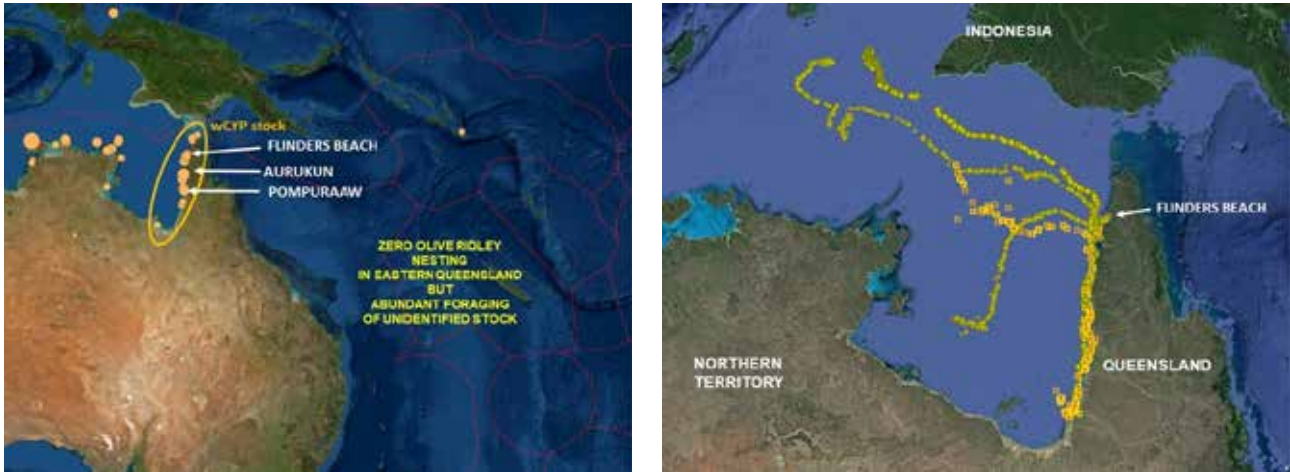


Figure 17 Nesting (a) and migration and foraging areas (b) of O-nwCYP genetic stock

Queensland actions to support the national Recovery Plan to recover O-nwCYP

Reference	Targets	Action		
O-nwCYP1 (see OA1.7, OA3.2)	1.1, 5.1, 5.2	Develop feasible management techniques that can be applied at an ecologically-meaningful scale to increase climate change resilience for nesting and foraging populations (including in relation to sand temperature, limited range and small population, sea level rise), including through: <ul style="list-style-type: none"> • addressing knowledge gaps. • undertaking geospatial mapping of key index sites and potential refugial areas. • developing data recording methods to detect if climate-induced changes to nesting habitat are negatively impacting nesting or hatching success. 	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	PA DAWE
			Timeframe:	Next
O-nwCYP2 (see OA1.2, OA1.6, OA4.2)	1.1, 1.2, 1.3, 2.4, 4.1	Subject to Traditional Owner consultation and support, secure resources to identify and develop additional index sites for nesting and foraging (including Aurukun), and build local capacity to undertake monitoring.	Priority:	High
			Lead:	DES
			Support:	DNRME
			Timeframe:	Now
O-nwCYP3 (see OA2.7)	2.1, 2.2	Ensure that the impacts of silica sand and mineral sand mining on marine turtles and their nesting habitat are adequately addressed in Environmental Impact Statement (EIS) processes and appropriate conditions are included in environmental authorities (EAs) issued under the <i>Environmental Protection Act 1994</i> (Qld) and resource tenements granted under the <i>Mineral Resources Act 1989</i> (Qld).	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	PA DAWE GBRMPA RJFMP
			Timeframe:	Now
O-nwCYP4 (see OA2.8)	1.1, 2.2	Work with port authorities, local governments and other partners to develop and implement measures outlined in national Light Pollution Guidelines for existing and future developments adjacent to existing and potential refugial olive ridley turtle nesting beaches (including at Boyd Point and Skardong River), and to minimise other impacts on foraging and nesting habitat from port infrastructure and coastal development.	Priority:	High
			Lead:	DES (EPP)
			Support:	LGA TMR (Ports) DNRME
			Timeframe:	Now
			Cost:	Low

Reference	Targets	Action		
O-nwCYP5 (see OA3.6, OA4.2)	2.4, 3.1, 3.2, 4.1	Resource and support Indigenous Land and Sea Ranger groups to undertake effective, on-ground management actions to protect nesting habitat from predation (including from pigs, dogs and goannas) to ensure at least 70% of all clutches survive, including through: <ul style="list-style-type: none"> • continuation of the Nest to Ocean program and predator control efforts (focusing on main olive ridley nesting beaches from Mapoon to Pormpuraaw). • capacity building with local Indigenous Ranger Groups. • trials of broad-scale, cost-effective predator control methods (e.g. baiting) where local communities are supportive of these methods. 	Priority:	High
			Lead:	QILSR
			Support:	DAWE NTRBs RNTBCs FNPs NPARC Indigenous councils
			Timeframe:	Now/ongoing
O-nwCYP6 (see OA2.4, OA4.2)	1.2, 2.4, 3.1, 4.1, 4.2	Explore and support expanded Indigenous-led and other conservation management arrangements for the Gulf of Carpentaria, including establishing a network of protected areas (e.g. Sea Country IPAs, broad-scale MPAs, or national parks) or ILUAs. Develop joint management and funding arrangements to deliver marine turtle conservation through genuine partnerships with Indigenous communities.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	PA NTRBs RNTBCs FNPs
			Timeframe:	Now/ongoing
O-nwCYP7 (see OA2.10)	2.1, 3.3	Liaise with the Australian Government in relation to international mitigation measures to reduce the impact of longline and trawl fisheries on olive ridley turtles.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DAWE
			Timeframe:	Now/ongoing
O-nwCYP8 (see OA3.3)	2.4, 3.1, 3.2, 4.1, 4.2	Collaborate with Indigenous Land and Sea Ranger Groups and NGOs (e.g. Tangaroa Blue) to address the impacts of marine debris on turtle health (especially plastic ingestion and entanglement in discarded fishing gear). Support the continuation and expansion of ghost nets management initiatives in the Gulf of Carpentaria and Arafura Sea (with a focus on prevention at international source hotspots and removal from key foraging and nesting habitats).	Priority:	Medium
			Lead:	DES (QPWS&P)
			Support:	DAWE QILSR
			Timeframe:	Ongoing
O-nwCYP9 (see OA1.1, 2.4)	1.1, 1.3, 5.1, 5.2	Improve understanding of the foraging range of olive ridley turtles and identify important foraging habitat areas for protection.	Priority:	Medium
			Lead:	RJFMP
			Support:	DES (QPWS&P)
			Timeframe:	Now/next
O-nwCYP10 (see OA2.6)	2.1, 2.2, 3.3	Continue working with and supporting fisheries managers to reduce residual risks associated with negative olive ridley turtle interactions with all fisheries operating in the Gulf of Carpentaria and Arafura Sea. Where necessary, advocate for better reporting and stronger regulations and compliance efforts to minimise the impact of domestic bycatch on marine turtles (cumulative impacts of all fisheries).	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DAWE PA QDAF AFMA
			Timeframe:	Now
			Cost:	Medium

5.6 Leatherback turtle

Dermochelys coriacea



Species/stock: **Leatherback nesting in Australia (LB-nesting)**

Status EPBC	Status NCA	Stock condition	Trend	Stock outlook	Confidence
Endangered	Endangered	Severely depleted	Significant decline	Very poor	High (adequate)

Overall Queensland priority (for additional investment): **HIGH**

Stock description

A small, declining leatherback nesting population was found nesting in eastern Queensland in 1970; however, leatherback turtles have not been recorded nesting on the east coast of Australia since 1996. The genetic stock identity of this eastern Australian population has not been determined. While this eastern Australian population may be approaching extinction, it could also be an outlying portion of the north-west Pacific leatherback genetic stock that breeds across northern Papua (Indonesia and Papua New Guinea) and the Solomon Islands. The small nesting population in the Northern Territory is expected to be derived from an Indian Ocean stock. The last recorded nesting attempt in the Northern Territory was observed in the western Gulf of Carpentaria in 2016. Leatherback turtles nesting in winter in Papua migrate through east Australian waters and there is a foraging hotspot between Australia and New Zealand. It is likely that turtles foraging in waters adjacent to Queensland are part of this stock.

Leatherbacks are primarily pelagic and deeper water feeders, although in the southern Gulf of Carpentaria and Moreton Bay, juvenile and adult leatherbacks are seen in shallow waters. Leatherback turtles are found foraging in waters over Australia’s continental shelf and are most frequently captured as bycatch in longline fisheries where they are often released alive and entangled in the float-lined to fish, lobster and crab traps. All Australian longline vessels are required to carry de-hookers and line cutters to facilitate quick release of turtles caught on longlines. Leatherback turtles were commonly captured in the Queensland shark control program, but mortalities were generally low, and they have been rarely captured since 1992. Leatherback turtles may also be captured in net and trawl fisheries, particularly in the southern Gulf of Carpentaria. Due to their dietary preference for soft bodied animals, such as jellyfish, leatherback turtles are at risk from plastic ingestion. Many of the major threats to leatherback turtles occur outside Australia’s jurisdiction and therefore require international collaboration to address and manage threats.

Given the lack of recorded nesting and genetic uncertainties, for practical purposes, the Queensland stock of leatherbacks is considered to include any leatherback foraging or migrating through Queensland and adjacent Australian waters. While there are no specific leatherback management programs, actions to protect other marine turtle stock are likely to be beneficial. International experience suggests that even well-managed isolated nesting can have a long-term positive impact on a severely depleted stock.

The outlook for the leatherback stock in Queensland is *very poor*, primarily because of international threats, including climate change.

Important nesting locations

- Major: None known
- Minor: None known
- Historic: Wreck Rock, Moore Park, Mon Repos (Queensland) and Ballina (New South Wales)
- Index beaches monitored: Wreck Rock monitored since 1978

Inter-nesting buffer: 20 km

Seasons

- Mating: Unknown
- Nesting: December–January
- Hatching: February–March

Important foraging and courtship areas (and monitoring sites)

- Unknown

Primary threats (updated Queensland assessment)

- International climate change and variability (extreme weather, sand temp) **VERY HIGH**
- International take—outside Australia’s jurisdiction (eggs and meat) **VERY HIGH**
- Fisheries bycatch—international (longline, net, and purse seine) **VERY HIGH**
- Fisheries bycatch—domestic (longline) **VERY HIGH**
- Vessel disturbance (strike) **HIGH**
- Marine debris—ingestion **HIGH**

Primary management objectives (and measure) over the short, medium and long term

The primary management objectives for this stock are:

- increasing protection and management efforts in the southern Gulf of Carpentaria
- protecting and maximising the output from any reported nesting activity
- reducing impacts of threatening processes identified as *very high* and *high*.

National recovery plan actions specifically required to recover LB-nesting

1. Liaise at a regional scale to address and reduce the source of marine debris.
2. Promote best practice bycatch mitigation and innovation in all Australian fisheries and continue to meet international obligations, including conservation management measures under regional fisheries management organisations.
3. Determine genetic affiliations of leatherback turtles nesting in Australia.

Queensland actions to support the national Recovery Plan to recover LB-nesting

Reference	Targets	Action		
LB1	2.2, 3.2, 4.2, 4.3	<p>If isolated incidents of leatherback turtle nesting are observed in Queensland, immediately undertake appropriate direct management efforts to maximise the prospects of hatching success, including through:</p> <ul style="list-style-type: none"> • developing an agreed, coordinated response in circumstances where leatherbacks are found in Queensland’s jurisdiction. • developing a communications strategy to promote wider community understanding and reporting of sightings (community eyes and ears). • enhanced information sharing and reporting. 	Priority:	High
			Lead:	DES (QPWS&P)
			Timeframe:	Now
			Cost:	Low
LB2 (see OA2.10)	2.1, 4.2	Liaise with the Australian Government to reduce unsustainable international harvest of leatherbacks (eggs and meat), including through partnership initiatives with NGOs to support local communities to reduce turtle consumption of leatherback turtles and eggs, raise awareness, and train local rangers to protect turtles from poaching and patrol nesting beaches.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DAWE
			Timeframe:	Now
LB3 (see OA2.10)	2.1, 3.3	Liaise with the Australian Government in relation to international mitigation measures to reduce the impact of longline, net and purse seine fisheries on leatherback turtles.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DAWE
			Timeframe:	Now
LB4 (see OA2.6)	2.1, 2.2, 3.3	Continue working with and supporting fisheries managers and the fisheries sector to reduce residual risks associated with negative leatherback turtle interactions with all fisheries operating in Queensland waters. Where necessary, advocate for better reporting and stronger regulations and compliance efforts to minimise the impact of <i>domestic bycatch</i> on marine turtles (cumulative impacts of all fisheries but especially longline and trawl fisheries operating in the southern Gulf of Carpentaria).	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	DAWE PA QDAF AFMA
			Timeframe:	Now
LB5	2.1, 2.2, 3.3	Continue to investigate and implement new methods that reduce the impact of shark control programs (especially shark nets) on threatened and non-target marine species.	Priority:	High
			Lead:	DES (QPWS&P)
			Support:	QDAF
			Timeframe:	Now
			Cost:	Low/medium

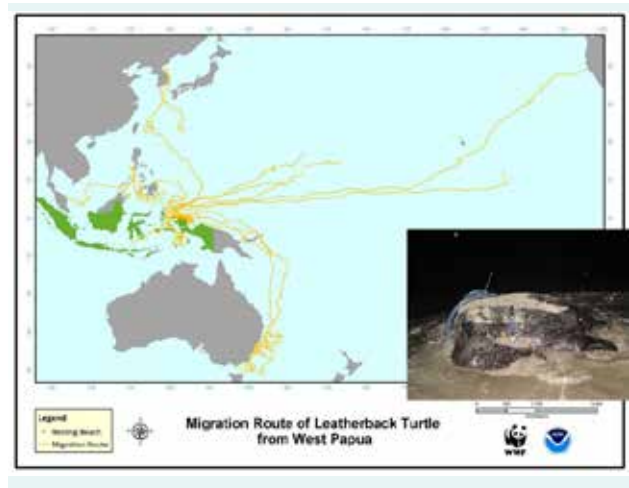
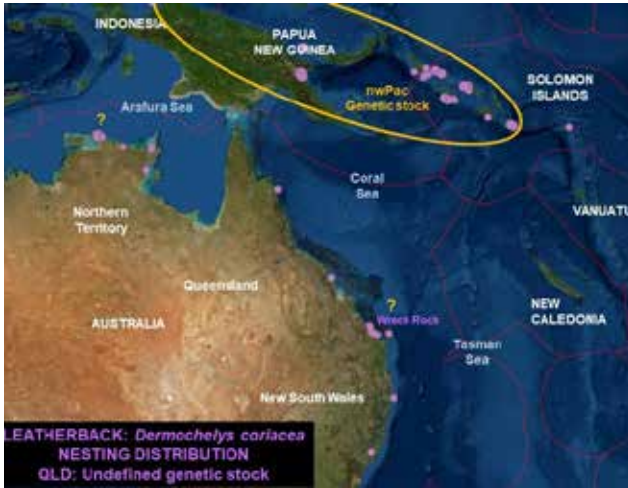


Figure 18 Nesting (a), migration and foraging (b) distribution of leatherback turtles in eastern Australia

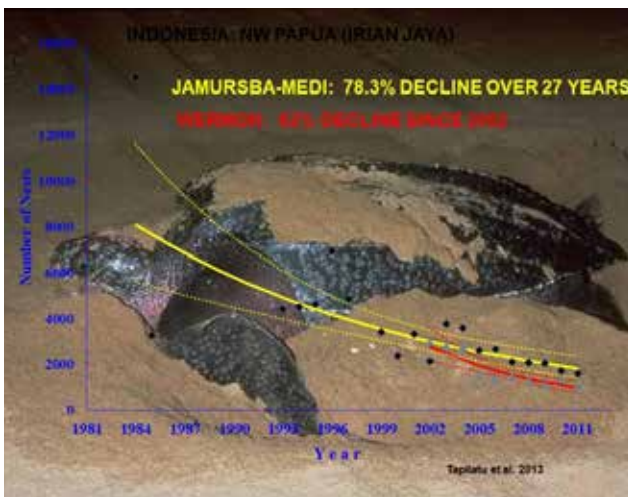


Figure 19 Declining trends in nwPac genetic stock nesting populations in north-western Papua, Indonesia

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Appendix A: Threat prioritisation framework

Each of the 16 threat categories identified in the national Recovery Plan were reassessed by a panel of Queensland marine turtle experts using a risk matrix approach Table A-1 below. The risk assessment was applied to each of the 10 recognised Queensland turtle stocks and was used to evaluate the likelihood of a threat occurring and the consequences of that threat for the stock.

Threat risk assessments were undertaken for each stock separately to account for the differences in exposure to threats and the stock’s ability to withstand impacts. Threats were considered in terms of the life stage they affect and the duration of the threat. Threats were also considered in the context of the current management regimes in place. The impact of that threat has been assessed assuming that existing management measures continue to be applied. The threat is then considered, taking into account:

- knowledge of effectiveness of the mitigation/management measure
- the coverage of the mitigation/management measure
- the scope of the mitigation/management measure.

The risk matrix and ranking of threats was based on assessment undertaken for the national Recovery Plan, together with contemporary information in the peer reviewed literature and expert opinion. Definitions used for the risk assessment are:

Likelihood of threat occurring is defined as follows:

- Almost certain—expected to occur every year.
- Likely—expected to occur at least once every five years.
- Possible—might occur at some time.
- Unlikely—such events are known to have occurred on a worldwide basis but only a few times.
- Unknown—it is currently unknown how often the incident will occur.

Consequences of threats are defined as follows:

- No long-term effect—no long-term effect on individuals or stock.
- Minor—individuals are affected, but no effect at stock level.
- Moderate—stock recovery stalls or reduces.
- Major—stock declines.
- Catastrophic—stock at risk of extinction.

Table A-1: Risk assessment matrix framework

Likelihood of occurrence (relevant to species)	Consequences				
	No long-term effect	Minor	Moderate	Major	Catastrophic
Almost certain	Low	Moderate	Very high	Very high	Very high
Likely	Low	Moderate	High	Very high	Very high
Possible	Low	Moderate	High	Very high	Very high
Unlikely	Low	Low	Moderate	High	Very high
Unknown	Low	Low	Moderate	High	Very high

Levels of risk and the associated priority for action are defined as follows:

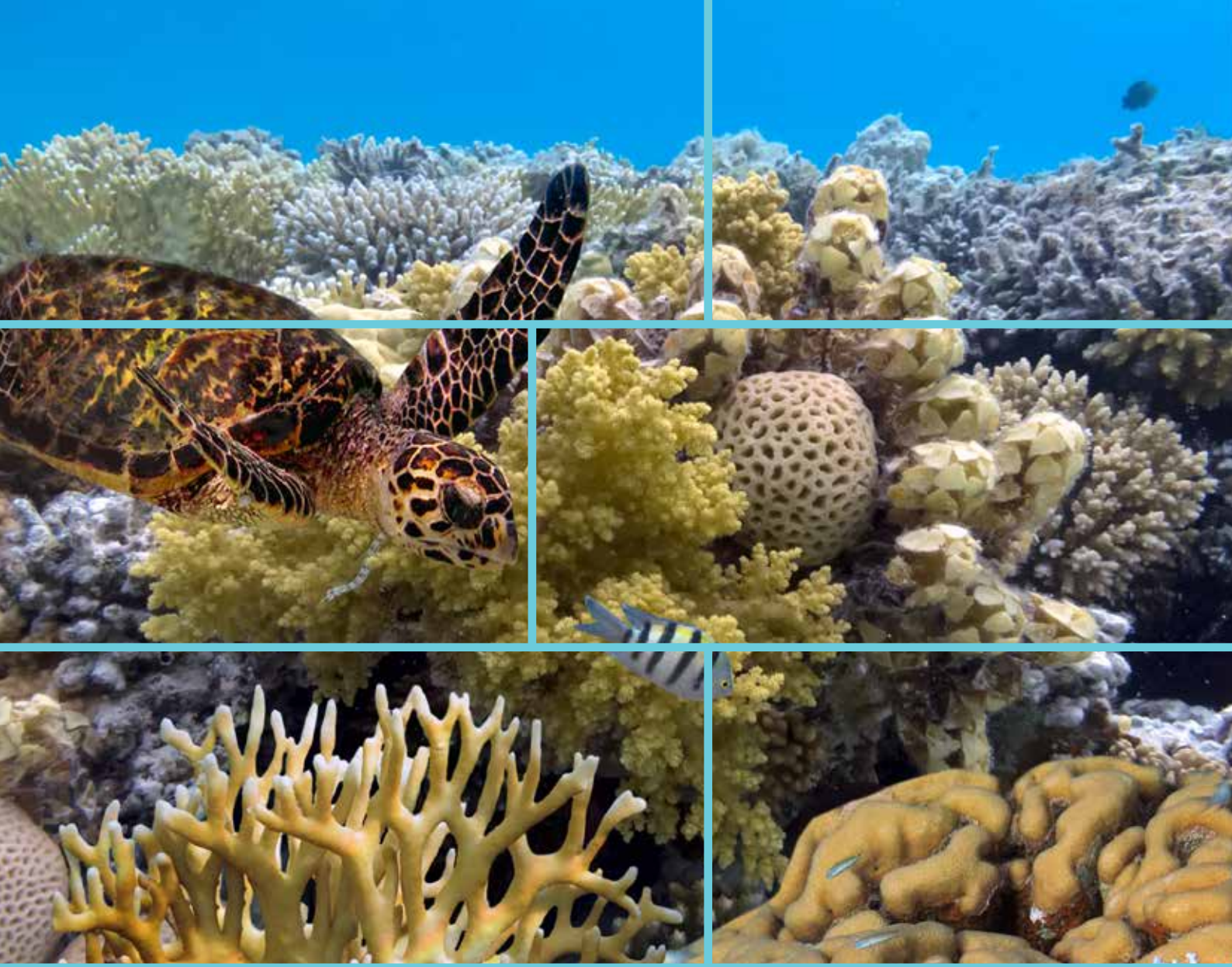
- Very high—immediate additional mitigation action required.
- High—additional mitigation action and an adaptive management plan required, the precautionary principle should be applied.
- Moderate—obtain additional information, and where multiple threats receive a moderate rating, develop additional mitigation action if required.
- Low—monitor the threat occurrence and reassess threat level if likelihood or consequences change.

The risk assessment process was used to determine the priority for conservation and/or management actions. Priority actions have been developed for any threat for which the risk to any stock was deemed to be *high* or *very high*. For threats with an *unknown* risk outcome, their status will be reassessed as part of future reviews of the strategy.

Appendix B: Roles and responsibilities (acronyms)

Acronyms	Entity/group	Potential roles and responsibilities
AFMA	Australian Fisheries Management Authority	The Australian Government agency responsible for the efficient management and sustainable use of Commonwealth fish resources on behalf of the Australian community
AMSA	Australian Marine Safety Authority	Australia's national regulatory body promoting the safety and protection of our marine environment and combat ship-sourced pollution. Provide the infrastructure for safety of navigation in Australian waters, and maintain a national search and rescue service for the maritime and aviation sectors
DAWE	Commonwealth Department of Agriculture, Water and the Environment	Oversight of the implementation of the Recovery Plan for Marine Turtles in Australia, including through collaborative governance and operational delivery mechanisms with State and Territory governments. Engages through international agreements and forum for species protection. Responsible for co-administering (with NIAA) the Indigenous Protected Areas (IPA) Program on a national level
DES (QPWS&P, EPP, QILSR, OGBR)	Queensland Department of Environment and Science	Coordinates the delivery of the Threatened Species Program, including in relation to legislation, policy and governance, planning and management, science and knowledge, communication, monitoring, evaluation, reporting and improvement. Also responsible for management of protected areas, biodiversity offsets, nature refuges and grants, and the Indigenous Land and Sea Ranger program. Includes the following divisions of relevance to marine turtle conservation: Queensland Parks and Wildlife Service and Partnerships (QPWS&P) Environmental Policy and Programs (EPP) Queensland Indigenous Land and Sea Ranger Program (QILSR) Office of the Great Barrier Reef (OGBR)
DFAT	Department of Foreign Affairs and Trade	Promotes and protects Australia's international interests by working with international partners and other countries to tackle global challenges, increase trade and investment opportunities, protect international rules, keep our region stable and help Australians overseas
DNRME	Queensland Department of Natural Resources, Mines and Energy	Manage the Natural Resources Investment Program (2018–2022) to ensure the state's natural land and water resources are sustainably managed, including dedicated funds for Great Barrier Reef catchments, funds for regional NRM bodies, and state-wide strategic projects. Also responsible for issuing resource authorities for mining and associated regulatory and compliance measures
DSDILGP	Queensland State Development, Infrastructure, Local Government and Planning	Work with business, industry and local government to support infrastructure and development through planning frameworks that account for infrastructure needs and sustainability
FNP	Traditional Owner communities/First Nations peoples	Oversee, lead and undertake marine turtle protection efforts within local estates, often as part of integrated land and sea country management arrangements, Ranger programs, Traditional Use of Marine Resources Agreements (TUMRAs), Indigenous Land Use Agreements (ILUAs) and Indigenous Protected Areas (IPAs), and other governance frameworks from local to international levels
GBRMPA	Great Barrier Reef Marine Park Authority	Leading and supporting marine turtle conservation in the Great Barrier Reef World Heritage Area (GBRWHA), including the protection of marine turtles within GBRWHA, through legislation, zoning, issuing of permits and implementation of Plans of Management that collectively enable management of human activities. Facilitates the negotiation of TUMRAs and supports their implementation
Land holders	Land holders	Undertake local on-ground actions to protect turtle nesting habitat, improve hatchling success rates, mitigate direct threats and support monitoring efforts

Acronyms	Entity/group	Potential roles and responsibilities
LGA	Local government areas /regional councils	Land use planning and development, including lighting and potential impacts near important nesting sites
NGO	NGOs, community-based groups, individual volunteers	Undertake local on-ground actions to protect turtle nesting habitat, improve hatchling success rates, mitigate direct threats and support monitoring efforts. May also play important advocacy, sponsorship, fund-raising and awareness-raising roles
NIAA	National Indigenous Australians Agency	Responsible for administering the Indigenous Ranger Program and co-administering (with DAWE) the Indigenous Protected Areas (IPA) Program on a national level
NRM	Local NRM groups (catchment and landcare groups, etc.)	Undertake local on-ground actions to protect turtle nesting habitat, improve hatchling success rates, mitigate direct threats, and support monitoring efforts, often in partnership with regional NRM bodies
NRM bodies	Regional NRM Bodies (those working in the coastal catchments)	Coastal NRM bodies work with land and sea managers, Traditional Owners, landholders, researchers, all levels of government and other partners to care for key natural and cultural values within their respective regions, including marine turtles. NRM bodies often play a key role in coordinating on-ground efforts to protect threatened species, including marine turtles, through feral pig control and coastal habitat protection initiatives
NTRB	Native Title representative bodies	Facilitates the delivery of regional land and sea management initiatives by supporting and assisting native title claimants and holders
PA	Parks Australia	Parks Australia (part of DAWE) has management responsibility for the Gulf of Carpentaria Marine Park, West Cape York Marine Park and Coral Sea Marine Park (includes 57 islands)
QDAF	Queensland Department of Agriculture and Fisheries	Management of the impacts of commercial, recreational and traditional fishing on marine turtles, protection of fish habitat and marine plants, such as seagrasses, that are important to the survival of marine turtles
QILSR	Queensland Indigenous Land and Sea Ranger Groups (with sea country)	Operational delivery of local priority cultural and natural resource management activities, often to reflect cultural aspirations and obligations contained in country-based plans, IPA Plans of Management, TUMRAs and similar documents (many of which have a marine turtle management component). Indigenous ranger groups across Queensland have diverse governance arrangements, administrative structures, funding streams and capacity to deliver land and sea management initiatives
QMTWG	Queensland Marine Turtle Working Group	Proposed working group to guide and coordinate implementation of this strategy
Research partners	Universities and research institutions	Lead research to address key knowledge gaps, including in relation to the impacts of climate change on marine turtle population biology and appropriate responses to build resilience and support recovery efforts
RJFMP	Reef Joint Field Management Program	Joint management arrangements between the Australian and Queensland Governments for day-to-day management of the Great Barrier Reef World Heritage Area
RNTBC	Registered Native Title Body Corporates	Corporation established by Traditional Owners with native title determination to undertake functions prescribed under the <i>Native Title Act 1993</i>
TMR	Queensland Department of Transport and Main Roads	Undertake the management and regulation of Queensland ports
TSRA	Torres Strait Regional Authority	Facilitates the delivery of regional land and sea management initiatives in the Torres Strait, including through supporting community-based management arrangements for marine turtles and dugong and brokering partnerships with researchers and sponsors



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