



North Australian
Indigenous Land &
Sea Management
Alliance

Dugong and Marine Turtle Knowledge Handbook



Indigenous and scientific knowledge of dugong
and marine turtles in northern Australia

February 2006

ACKNOWLEDGEMENTS

The *Knowledge Handbook* was prepared by Dermot Smyth (Smyth and Bahrtd Consultants) with assistance and direction from the NAILSMA Dugong and Marine Turtle project team, NAILSMA Partners and members of the Dugong and Marine Turtle Technical Reference Group. Valuable comments on the draft document and additional contributions to the final text were provided by Helene Marsh and Mark Hamann (James Cook University), Miya Isherwood (Torres Strait Regional Authority), Jann Crase (North Australia Environment Alliance), Donna Kwan, Robyn Bromley, Rowan Wylie, Ilse Kiessling, and other staff at the Department of the Environment and Heritage, Kirstin Dobbs (Great Barrier Reef Marine Park Authority), Daryn Storch (Queensland Environment Protection Authority), Rod Kennett and David Garnett (NAILSMA). The considerable time and effort they contributed to this project is greatly appreciated. Rod Kennett also managed the Knowledge Handbook Project on behalf of NAILSMA and played a major role in editing the final document and preparing it for distribution.

The sources of all Figures (maps, photographs, diagrams and graphs) are acknowledged in footnotes throughout the document and we thank those individuals and organisations for allowing us to use their material.

WARNING: This document contains some names of deceased Indigenous people.

CONTENTS

Introduction	7
Part 1:	
INDIGENOUS VALUES, KNOWLEDGE AND USES OF DUGONGS AND MARINE TURTLES	8
Saltwater people, country, dugongs and marine turtles	8
Indigenous names	8
Creation stories	12
Totems	14
Identity	14
Seasonal use	16
Hunting techniques and protocols	18
Indigenous Knowledge	24
Increase ceremonies	28
Art	28
References	30
Part 2:	
SCIENTIFIC UNDERSTANDING OF DUGONGS & MARINE TURTLES	32
Scientific names and classification systems	32
Research and Monitoring	32
Aerial surveys	33
Satellite tracking	34
Tagging turtles	34
Counting turtle tracks	35
Aerial surveys of beaches	35
Egg and hatchling counts	35
Examinations of reproductive organs	36
Population genetics	36
Part 2a: DUGONGS	37
Origins of Dugongs and other Sirenids	40
Characteristics of Dugongs	41
Distribution and populations	41
Queensland East Coast	43
Torres Strait	43
Gulf of Carpentaria	44
Top End Coast	46
Western Australia	47
Life cycle and Breeding	48
Feeding	48
Indigenous harvest	51
Concerns	53
References	54

PART 2b: MARINE TURTLES	56
Introduction	56
Concerns	56
Biology of marine turtles	60
Names and Classification of Marine Turtles	64
Loggerhead Turtle	65
Green Turtle	69
Hawksbill Turtle	74
Olive Ridley Turtle	78
Flatback Turtle	82
Leatherback Turtle	86
References	89
Part 3:	
PROTECTING AND MANAGING DUGONGS AND MARINE TURTLES	91
Introduction	91
Indigenous initiatives in northern Australia	91
Agreement between neighbouring Traditional Owner groups	92
Strategic planning by Traditional Owners of sea country	93
Aboriginal land and sea management agencies	94
Government initiatives in dugong and turtle management	102
Legislation	102
Conservation Status of Dugongs	103
Conservation Status of Marine Turtles	103
Australian Government initiatives	105
Western Australian Government initiatives	111
Northern Territory Government initiatives	112
Queensland Government initiatives	115
Great Barrier Reef Region	120
Options for community management of marine turtles	128
Government agency recommendations	128
Other options	129
References	131
Combined references	132

Figures

Figure 1: Yanyuwa words associated with dugong butchering	11
Figure 2: Seasonal use of resources in south-west Gulf of Carpentaria	18
Figure 3: Dugong sculpture	28
Figure 4: Dugong decoration on Indigenous craft	29
Figure 5: Dugong aerial surveys	33
Figure 6: Dugong	37
Figure 7: West Indian Manatee	39
Figure 8: Amazonian Manatee	39
Figure 9: West African Manatee	40
Figure 10: Where Sirenians are found around the world	40
Figure 11: Distribution of Dugongs	42
Figure 12: Distribution of dugongs observed during 2001 survey in Torres Strait	44
Figure 13: Dugong sightings in the eastern Gulf of Carpentaria during the 1997 survey	45
Figure 14: Dugong sightings in the western Gulf of Carpentaria during the 1994 survey	46
Figure 15: Dugong sightings on north-west coast of Northern Territory in 1995	47
Figure 16a&b: Seagrass - <i>Halophila ovalis</i> and <i>Halodule uninervis</i>	49
Figure 17: Dugong feeding trails in a seagrass meadow	49
Figure 18: Numbers of nesting female Green turtles in Hawaii 1973 – 2002	59
Figure 19: Life cycle typical of marine turtle species	61
Figure 20: The numbers of nesting Green turtles on Heron Island, Queensland.	62
Figure 21: Distribution of marine turtles in Australia	63
Figure 22: Loggerhead turtle	65
Figure 23: Distribution of Loggerhead turtle nesting in Australia	66
Figure 24: Green turtle	69
Figure 25: Green turtle breeding populations & nesting locations of northern Australia	70
Figure 26: Hawksbill turtle	74
Figure 27: Hawksbill turtle nesting distribution in Australia	75
Figure 28: Migration of Hawksbill turtles from nesting beaches in north Queensland	76
Figure 29: Olive Ridley turtle	78
Figure 30: Nesting distribution of Olive Ridley turtles in Australia	79
Figure 31: Satellite tracking map of Olive Ridley turtles released in NE Arnhemland	81
Figure 32: Flatback turtle	82
Figure 33: Distribution of Flatback turtle nesting Australia	83
Figure 34: Foraging areas of Flatback turtles in north-eastern Australia	84
Figure 35: Leatherback turtle	86
Figure 36: World distribution of Leatherback nesting sites	87
Figure 37: Leatherback turtle nesting and foraging locations in northern Australia	88

Figure 38: Location of Aboriginal land and sea management agencies in the N.T.	95
Figure 39: The Dhimurru logo	96
Figure 40: Torres Strait Protected Area and Dugong Sanctuary	117
Figure 41: Movements of four Green turtles being tracked by satellite in Torres Strait	120
Figure 42: <i>Shoalwater Bay (Dugong) Plan of Management 1997</i> area	123
Figure 43: Great Barrier Reef Marine Park and Dugong Protected Areas	125

Tables

Table 1: Continuity and change in dugong hunting	19
Table 2: Differences between the six marine turtle species in Australia	64
Table 3: Estimates of female Green turtles nesting annually number in Australia	71
Table 4: Estimates of females Hawksbill turtles nesting annually in Australia	75
Table 5: Main nesting sites for Flatback turtles in Australia	83
Table 6: International and Australian protection of dugongs and turtles	102
Table 7: Conservation status of dugongs in Australia and internationally	103
Table 8: Conservation status of marine turtles in Australia and internationally	104
Table 9: Great Barrier Reef Marine Park <i>Turtle and Dugong Conservation Strategy</i>	122

Boxes

Box 1: <i>What happened to the Steller's Sea Cow?</i>	38
Box 2: Seagrass	50
Box 3: Case study: Hervey Bay seagrass and dugong	51
Box 4: Turtle Exclusion Device (TED)	58
Box 5: Light pollution and marine turtles	58

INTRODUCTION

Preparation of the *Handbook* is part of a program coordinated by the North Australian Indigenous Land and Sea Management Alliance (NAILSMA) to support Indigenous groups, communities and organisations across northern Australia in their management of dugong and marine turtles, including continued sustainable hunting.

The scope and content of the Handbook was broadly determined at the initial Dugong and Marine Turtle Management Project workshop in Darwin in February 2005. NAILSMA partners and the Technical Reference Group (TRG) agreed that the *Handbook* should comprise plain English summaries of the following information:

- Indigenous values and knowledge of dugongs and marine turtles;
- Knowledge and opinions derived from scientific research; and
- Management initiatives to protect and sustainably use dugong and marine turtle populations.

Part 1 is an introduction to the scope of Indigenous knowledge and values relating to dugong and marine turtles in Australia and provides examples from selected Indigenous groups across northern Australia. Information presented is limited to Indigenous knowledge and values that are already in the public domain, e.g. in publications and on web sites.

Parts 2 contains an introduction to the methods used by scientists to study dugongs and marine turtles. Part 2a and Part 2b include summaries of information derived from scientific research on dugongs and the six species of marine turtles living in Australian waters. Much of this information is derived from recently published technical literature reviews on dugongs and marine turtles.

Part 3 contains an overview of legislation, policy, conservation status and management initiatives relating to dugongs and marine turtles in Australia.

References to information sources

Key references are referred to in footnotes throughout the text and listed in full at the end of each chapter; the combined references from all chapters are provided at the end of the document.

Part 1

INDIGENOUS VALUES, KNOWLEDGE AND USES OF DUGONGS AND MARINE TURTLES

Saltwater people, country, dugongs and marine turtles

Dugongs and marine turtles are important to Aboriginal and Torres Strait Islander peoples because these animals belong to sea country, and hence are part of the complex cultural relationship between saltwater peoples and their coastal land and sea estates. This chapter explores several categories of values, knowledge and uses and provides examples from selected Aboriginal and Torres Strait Islander cultures across northern Australia. Further information and references to the literature on the broader relationship of saltwater people and sea country can be found in a recent literature review published by the National Oceans Office¹.

Indigenous names

The names and classification systems for Dugong and Marine Turtles are different in each of the more than 100 Aboriginal and Torres Strait Islander languages of northern Australia². Examples of some of these language names and classifications that have already been published in other documents are presented below. Other names and classification systems can be added to the *Knowledge Handbook* later if Indigenous groups choose to make this information publicly available.

Yanyuwa³

The Yanyuwa language is spoken by the Traditional Owners of the Sir Edward Pellew Islands and surrounding sea country in the south-western Gulf of Carpentaria:

General terms for dugongs

Walya - general term for both dugong and sea turtle

waliki/nhabal - general term for all dugong

¹ National Oceans Office (2004)

² Horton (1994)

³ Bradley (1988)

wudanyuka - general term for all sea turtle

li-waliki/&-waliki - a herd of dugong

Female dugongs

a-banthamu - old cow with small tusks visible

a-bayawiji - mature cow, capable of breeding (no tusks)

a-ngayiwunyarra/a-kulhakulhawiji - pregnant cow

a-lhumurrawiji - pregnant cow with a calf still following her

a-miramba - non-lactating cow, but with a large calf still following her

a-ngarninybala - cow with her calf riding on her back

a-wuduwu - young female dugong

li-milkamilarra - small group of cows with calves

nyankardu - dugong foetus

Male dugongs

bungkurl - very fat, small male dugong

jiyamirama/jiwarnarrila - male dugong which moves away during times of threat

mayili - bull dugong with small tusks

rangkarraku/rangkarrangu - bull dugong travelling by itself

wiriji - large old bull with a mottled hide, considered to be the offspring of the Rainbow Serpent

wirumantharra - bull dugong whistling, often said to be the leader of the herd

ngumba - very young dugong

Marine turtles

There are three species of turtle commonly found in the area of the Sir Edward Pellew Islands.

***Malurrba* – Green turtle**

warrikuliyangu/ngululurru – male green turtle

rra-tharra/lhathanka – female green turtle

wandangumara – very large female green turtle

bankiba – very large male green turtle

ngajilingajili – green turtle with a light coloured shell and a lot of yellow colouring on the underside

lijalijangulyanda – young green turtle not considered big enough to eat

limarrwurrirri – green turtle which is considered to have a big head

a-wathawayawiji – female green turtle containing eggs

yabalar,la – Green turtle hatchling

ngarrangarra – Green turtle which lacks a lot of body fat

wunakathangu – Green turtle ‘found with ulcerations’ in the stomach (is not eaten);

***Wirndiwirnde* – Flatback turtle**

jadawangarqi – male Flat-back turtle;

a-karninja – female Flat-back turtle;

Karrubu – Hawksbill turtle;

yibariwuna – male Hawksbill turtle;

a-ngurrin – female Hawksbill turtle;

General terms relating to turtles:-

ribankuja – mating turtles;

rujuru – turtle hatchling;

ngangkurruru – female on the beach laying eggs.

There are also Yanyuwa names for the internal organs of dugongs and marine turtles, and for the cuts used when butchering these animals in the proper manner (see Figure 1 for Yanyuwa names of parts of the dugong).

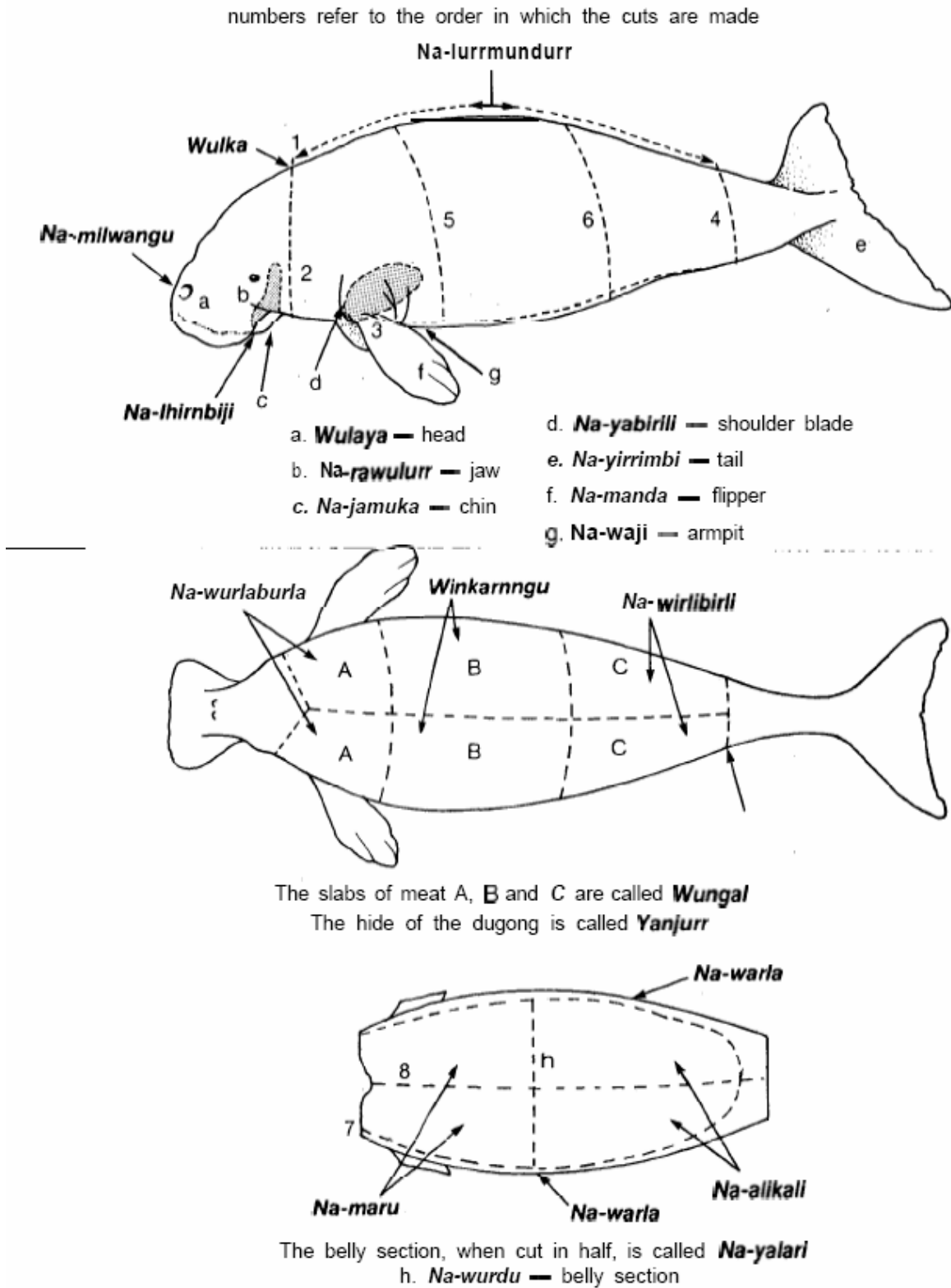


Figure 1: Yanyuwa words associated with dugong butchering⁴

⁴ Bradley (1988)

Yolngu⁵

In the Yolngu language of northeast Arnhem Land the word *miyapunu* is used by children up to 5 years of age to refer only to the Flatback turtle. From 6 to 10 years of age, children refer to all species of turtles as *miyapunu*. From ages 11 to 16, *miyapunu* refers to all turtles and dugongs. From ages 17 to 23, *miyapunu* becomes turtles, dugongs and dolphins. After 23 years of age whales are included as *miyapunu*, but only by men, as they become part of religious knowledge.

Mabuiag Island, Torres Strait⁶

<i>Garka dangal</i>	male dugong
<i>Ipika dangal</i>	female dugong
<i>Kazi dangal</i>	young dugong
<i>Ngawaka dangal</i>	juvenile female
<i>Kaukuik dangal</i>	juvenile male
<i>Barakutau garka</i>	juvenile male that stays with mother
<i>Sabi gudad</i>	single male
<i>Puru dangalal</i>	mating dugongs
<i>Kazilaig</i>	pregnant dugong
<i>Nanaig</i>	nursing mother
<i>Gilab</i>	big, old dugong
<i>Tuarlaig</i>	herd leader
<i>Ulakal</i>	herd of 5 to 10 dugongs
<i>Dangalal buai</i>	family herd size (10 or more)
<i>Malu dangal</i>	far reef, sea dugong
<i>Wati dangal</i>	shallow water, island dugong, lean inedible dugong

Creation stories

Dugongs and marine turtles feature in the creation stories of Indigenous cultures across northern Australia. Versions of the following story, relating to the role of the dugong in the creation of Mer (Murray island), are recorded in several publications about Torres Strait mythology^{7 8}:

Long ago at Bulbul on the Eastern side of Mua (Moa Island), lived a young boy, Gelam, and his mother, Usar. As Gelam grew to an appropriate age his mother made him a bow, arrow and a water container to use to hunt goenaw (Torres Strait

⁵ Davis et al. (1982)

⁶ Nietschmann (1984)

⁷ Lawrie (1970)

⁸ www.aboriginalartprints.com.au/exhibition1.cfm

pigeon) for them. After returning from his hunting trip, Gelam kept all of the fat pigeons and gave all the lean ones to his mother. Each time when Usar cooked her bird she noticed that her fire flames were very small but Gelam's were big because of all the fat dripping on to the fire from his bird. Seeing this, Usar made a plan to punish him for the trick he was playing on his mother.

The next day when Gelam went out hunting to Gerain (tribal area of Mua), Usar covered herself in clay and waited behind a tree where he was hunting for the birds. As Gelam got closer, Usar jumped from behind a tree to scare him off. When he saw Usar he dropped his bow and arrow and started running back to bulbul. Usar took a shorter route back to the camp and washed the clay off her. As Gelam arrived, Usar who was already sitting near her fire and pretending she didn't know what had happened, asked Gelam for the birds. Gelam told her that he had seen a Dogai (ghost), so he dropped all his birds, bow and his arrow behind.

Usar continued to punish Gelam until one day when she asked him to clean her hair for head lice. As he was looking for head lice he noticed a patch of clay at the back of one of Usar's ears. Gelam thought to himself: "Ah, it was you who was playing these games on me. I'm going to punish you for what you have done to me."

The next day Gelam pretended to go hunting for birds. Instead he went to cut a tree and carved a dugong out of it. After a few days carving the dugong, he finally finished it. The next day he took the dugong down to the beach at Gerain and tried it in the water but found it was too light, so he sent the dugong to Mabuag Island.

The next day, he continued on another dugong but found it was too heavy so he sent it off to Badu Island. Then he tried a third time and again he found it off balance, so he sent it off to the mainland. That night while he was sleeping, his father came to him in a dream. In his dream his father showed him a special kind of leaf to find the right tree for his dugong.

The next day Gelam went off again and found the tree his father showed him in his dream. He carved a dugong out and tested it in the water. This time it was the right one for him. "Ena kian ne Gelaman dhangal" (now this is Gelam's dugong)," he said to himself. He then placed inside of it the best fruit and soil off the island and went back home to his mother.

The next day as Usar went fishing on the reef, Gelam went to where he had hidden his dugong. He took his dugong and as he placed it on a rock near the water, he left his nostril print on it. He then jumped in it and pushed off the rock and left his footprint behind. Usar, who was walking along the reef edge at Bulbul had a basket full of fish. Gelam swam to her and when she saw the dugong she called out to Gelam to come and catch it. Gelam e ngzu kazi ne melagier ulaik e, dhangal senu ngapa kengai a passia walmai emaik e. (Gelam my son, where are you? There's a dugong here swimming and spotting near the reef).

Gelam again swam towards her and opened the front part of the dugong. Usar saw Gelam in the dugong and he told her that he had found out about her tricks. He told her he was running away. Leaving his mother on the reef edge he then turned away and started swimming towards Naigi, but it was too close to her. This time he swam to Yam, to York and then to Darnley but again from all of these islands he could still see his mother standing there and crying at the edge of the reef.

From Darnley, he saw a little island to the east and thought to himself that this must be the right island. After he arrived, he turned around and he couldn't see his mother. "Ina lag nghat ngu mudth aimaik" (this is the place I will make my home). He lay down next to the little island facing toward the east but the sugerr gub (north-easterly

wind) was too strong and was choking him as it was rushing up into his nostrils. So he turned around lying southeast and sneezed out two seeds which formed the islands of Daur and Waier.

A stingray who was chased by sharks on the reef east of Mer, swam and found shelter near Gelam and formed Mer. Usar was left standing at the edge of the reef crying for Gelam until the tide came up and covered her. She turned into a rock which can still be seen today and she is still crying for Gelam. When the tide is low, fresh water flows from the centre of the rock, which is her crying tears for Gelam.

Totems

Each Aboriginal and Torres Strait Islander group is identified or represented by a “totem”, which is specific element of the natural world that has special cultural significance for that group, and represents the identity of that group. A totem may be an animal (including dugongs and marine turtles), a plant, a water current or other natural feature. *Gelam*, the dugong, for example, is the totem of the people from Moa in Torres Strait⁹.

Identity

In addition to totemic associations, individual Aboriginal and Torres Strait Islander people can associate their personal identity with their role as dugong or turtle hunters. The following quote describes the significance of dugong hunting to the identity of Yanyuwa people from the south-west Gulf of Carpentaria¹⁰:

The marine emphasis of Yanyuwa life is highlighted by the fact that despite now living inland Yanyuwa male identity is still intimately tied to their prowess as marine hunters. Many Yanyuwa men proudly told me how they, like their fathers and grandfathers before them, are “dugong hunters number one”. This marine mammal is still highly prized by the Yanyuwa who particularly value its fatty flesh. Yanyuwa hunting of this animal and sea turtles is guided by the detailed knowledge the Yanyuwa have of their behaviour (in particular the seasonal migration patterns of these animals).

As elsewhere in Australia, there is a strong cultural divide in the area between “salt water” people and “fresh water” people. Despite a long period of co-residence in Borroloola these differences have survived, with Yanyuwa people heading seaward in their weekend hunting trips and the fresh water people heading inland. As Tim Rakuwurlma puts it:

⁹ <http://www.aboriginalartprints.com.au/exhibition1.cfm>

¹⁰ http://sres.anu.edu.au/people/richard_baker/research/yanyuwa/land_use.html

My father no more savvy kangaroo, he dugong hunter number one like me too, I no more savvy spearing kangaroo . . . blackfellas long this country [the Borrooloola area] hunt kangaroo, no more salt water people.

This cultural division has a mythological expression as well. A major dreaming path through the Sir Edward Pellew Islands and nearby mainland areas involves a hunting contest between the Dugong Killers and the Mullet Killers. On winning the contest the Dugong Killers banish the Mullet Killers inland to a life of hunting emu and kangaroo.

The identity of Yanyuwa people as dugong hunters is also expressed in song, such as *Wirndalbirnda*¹¹ or “Dugong Hunter”

Yanyuwa song text	Translation
Wirndalbirndal Ngambala-wada Ndi-ngambala li-wurralngu li-maramaranja	Our hair is strong And thickly oiled We are inhabitants of the sea We are dugong hunters of excellence

Anthropologist/sociologist Nonie Sharpe describes¹² the significance of dugong hunting for the Sandbeach People of north-eastern Cape York Peninsula:

The sandbeach people of northern Cape York Peninsula are related through intermarriage to the Kaurareg Aboriginal people of the islands. They were known as ‘fisherfolk, dugong hunters and often great seafarers’. In the days before white settlement, they spent the whole of their lives in and out of their double outrigger canoes obtaining food supplied from the sea and the surrounding sandbeach country. Their territories extended from Princess Charlotte Bay around Cape York to Port Musgrave on the west coast.

Their seafaring prowess is connected to their warrior status and they have been described as ‘great adventurers and great fighters’. Their prowess in hunting dugong and turtle was the peak of honour and the title dugong man meaning ‘belonging to the dugong’ was a prized one. Hunting dugong was dangerous, requiring skill and courage.

The dugong man was not only the best hunter and harpooner. The extent of his knowledge of the dugong, the rhythm of the tides, the movement of the stars the signs of the seasons, the elements and the atmosphere were integral to his skill with the harpoon. He must prepare himself to create the right kind of feeling in mind and

¹¹ <http://www.deakin.edu.au/arts/diwurruwurru/yanyuwa/Resources/Waterrats.htm>

¹² Sharpe (1992)

body, to become imbued with that same power of the gods which steels the heart as warrior. In so doing he becomes 'matched' with the dugong, and when he 'sings' the dugong, 'the dugong must die'.

Seasonal use

Each Indigenous group across northern Australian has their own pattern of seasonal use of dugongs and marine turtles. The following quote describes the seasonal use of dugongs, turtles and other marine resources by the Bardi people from the One Arm Point Community north of Broome in the Kimberley region of Western Australia¹³:

Older Bardi reveal an acute awareness of environmental factors which may affect the procurement of marine species. There is an understanding of the tides, the times of resource availability and the characteristics of the species being hunted. One example of Bardi environmental awareness is reflected in how they divide up their seasons, which relate closely to prime times for exploiting particular marine resources, for example:

Barlgana alubur: March-April when the south-east wind starts and marks the beginning of the dry season.

Niyarda,barlgaqa: May-August, the middle of the south-east wind when strong winds occur and the Dugong season starts in *Mangala* (July).

Djalalay: August-September, the south-east wind finishes and the westerlies start, the dugong season ends.

Lalin: October-December; westerly winds become strong. The weather becomes hot, married turtle time and ceremonies start.

Djandjala Balburgin: December, rain clouds come from the north.

Ungulgul: December-February, north-west wind blows, rainy season, married turtle season ends in January.

The knowledge of the seasons reflects the type of resources available for exploitation. The case of the green turtle, the main species hunted at One Arm Point, is one example concerning this knowledge. The most productive period for hunting *kulkil* (turtle) is at low tide, at the beginning of *Lalin*, or at married turtle time. This is the time when turtles are mating and are found floating on the surface of the water and they tend to be quiet and not easily disturbed. They are also referred to as being 'fat' at this time, although turtles are generally hunted all year round.

Only men hunt turtles due to the ritual connotations associated with the procurement of this marine reptile; women and children often catch small turtles at low tide on the

¹³ Green (1988)

exposed reefs, in the tidal channels and lagoons. Once a turtle has been harpooned, there are rites concerned with the butchering and distribution of the meat. Each anatomical feature of the turtle has a specific name, and some of these names also have ritual connotations. 'Fat' turtles are highly prized and are commonly hunted in specific locations offshore. Ritual places on the land are used both as viewing platforms to observe turtles prior to hunting, and also as increase centres where rituals are performed to ensure an adequate supply. Despite the abundance, of turtles in the area, people generally take only enough to satisfy their immediate family requirements. Different locations provide different marine resources. For example, *Wanburura* is a stand of mangroves on the east side of King Sound. This is one location where the Bardi people collect wood for rafts. The nearby island *Djanutian* is used for constructing the rafts as it is a good camp and also provides turtle eggs in season. *Mayunlambuli* is a dugong hunting area.

Seasonal use of resources in the southwestern Gulf of Carpentaria is summarised diagrammatically in Figure 2.

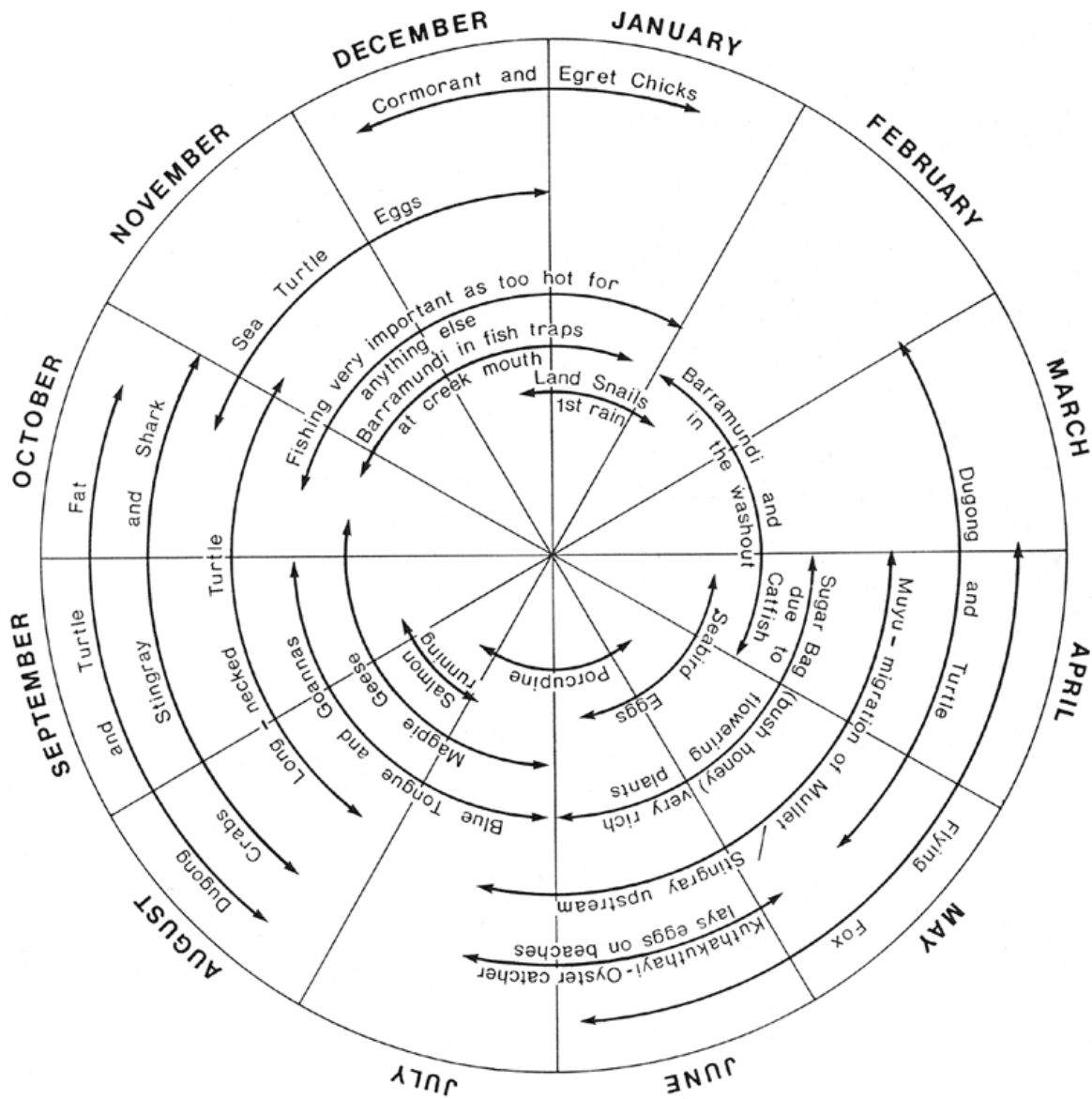


Figure 2: Seasonal use of resources in south-west Gulf of Carpentaria¹⁴

Hunting techniques and protocols

Indigenous hunting of dugongs and marine turtles requires skills and knowledge, and is traditionally governed by strict protocols relating to who can hunt, where and how they hunt, and how the animal is killed, butchered and shared.

The following discussion on the hunting of dugongs and marine turtles by Yanyuwa people in the southwestern Gulf of Carpentaria is based on observations by

¹⁴ http://sres.anu.edu.au/people/richard_baker/research/yanyuwa/images/figure_04.gif

Anthropologist John Bradley¹⁵. The technology and practices associated with dugong and turtle hunting provide examples of both cultural change and cultural continuity associated with the usage of marine resources, as indicated in Table 1.

Table 1: Continuity and change in dugong hunting¹⁶

Hunting practice	Before	Now
Who hunts?	Men only	Men only
Equipment	Wooden spear with wooden tip Rope attached to harpoon made from pandanus bark	Wooden spear with metal tip Rope made from nylon or hemp
Hunting platform	Bark or dugout canoe	Aluminium dinghy
	Wooden float attached to rope and always used	Wooden float always carried but only used if outboard motor fails
Harpoon strikes	~ Two harpoon strikes on each animal	~ Two harpoon strikes on each animal
Hunting rule	~ Must be silent, not break sticks, not touch greasy food	~ Must be silent, not break sticks, not touch greasy food
Selection of dugong	~ Preferred target animals are young males; pregnant females, females with calf, and older males are avoided	~ Preferred target animals are young males; pregnant females, females with calf, and older males are avoided

A Yanyuwa hunt proceeds as follows:

When the hunters reach the area in which they wish to hunt, they scan the water for dugong surfacing to breathe, for muddy water which has been caused by these animals feeding, or for broken pieces of floating seagrass and excreta. It is these signs which make visible and meaningful tracks to the hunter.

When the animal is located, the skill of the boat's 'driver' (*wuliyi/wungkayi*) is crucial. He has to follow the hand signals given by the harpooner and manoeuvre him within range to spear the animal. This is often difficult as he must keep pace with the dugong which can swim at speeds of 10-12 knots for short periods..... In shallow

¹⁵ Bradley (1991)

¹⁶ Based on Bradley (1991)

water the dugong can be tracked by the wake which is caused by the upward and downward movement of the tail, producing a series of flat circles on the surface of the water.

When a dugong has been speared once it usually tires quickly; it is then brought into range once more and speared again. The hunter usually tries to place one harpoon in the region of the neck and another in the lower back region. After the animal has been speared twice the dugong is pulled alongside the boat. In Yanyuwa this action is called *Ihungkayarra*. The dugong is grabbed by the tail and a noose is placed around it, just below the flukes. The animal is turned around so its stomach is facing outwards. Its tail is braced against the gunwale, forcing its head under the water and drowning it.

In past times when Yanyuwa hunted dugong from bark canoes, the dugong was not drowned alongside the canoe for fear that the struggling animal would damage the frail craft. Instead the dugong was brought within a short distance of the canoe and then the hunter swam out to the dugong and plugged the dugong's nostrils with paperbark or even his own fingers, and he stayed with the dugong until it drowned.

From the moment a dugong is speared until it is drowned no talking takes place. It is believed that talking while the dugong is dying is a sign of great disrespect, and if someone does talk while the dugong is being pulled alongside the boat, the spirits who guard the dugong will come and remove the harpoon points.....

When a dugong is brought back to land for butchering, its head must be faced back in the direction of the sea. This is to enable the spirit of the dugong to return to the sea. This is an act of great importance to the Yanyuwa people and is called *ki-maramnngku*, which can be literally translated as "returning the one belonging to the sea-grass".

Sea turtles are hunted in a similar manner, but some of the characteristics of turtles makes them more difficult prey:

Sea-turtles can at times prove more difficult though due to the animals' keen eyesight and the length of time they can remain submerged. The harpooned sea-turtle will often swim under the boat, making it harder for the driver of the boat to place the harpooner in an ideal position to harpoon it for a second time. When the sea-turtle has been harpooned twice it is pulled alongside the boat and taken hold of by the front flippers. If the sea-turtle is relatively small it is pulled directly into the boat; if it is

very large and heavy it is tied to the side of the boat by the front flippers with its head above the water line. This is to ensure that the sea-turtle does not drown. The Yanyuwa believe that if they let the sea-turtle drown they will have great difficulty in finding and catching them when they go hunting again. With the sea-turtle secured either in or alongside the boat it is taken back to land for killing, cooking and butchering.

Dugongs are butchered prior to cooking, while turtles are cooked whole and then butchered once the animal has cooled. The methods of butchering both animals, and the distribution of meat are strictly laid down by Yanyuwa tradition, which are followed to a greater or lesser extent today. The ability to store meat for long periods in refrigerators has led to some apparent breakdown of these traditional rules regarding distribution.

Traditional Owners Graeme Friday and Johnson Timothy from Borroloola made the following comments about dugong and turtle hunting in the southwestern Gulf of Carpentaria¹⁷:

Turtle eggs are sought in September, October and December. The community also hunts dugongs and turtle. Only men may catch dugongs, although a woman may take the helm of a boat used to hunt. If dugongs cannot be caught during the day the community catches them at night, but in the latter instance the animal is not butchered until the following day. There are clear and definite rules for the treatment of captured dugongs. The animal must face seaward when being brought ashore, and a specific method of butchering must be used. All parts of the dugong's anatomy have specific names. The community has seventeen different names for dugongs which refer to their behaviour in their habitat occasionally many dugongs are observed. One hundred and thirty were washed up during Cyclone Kathy.

Flatback, Hawksbill and Green turtles occur in the area, but the community eats only Green turtles. Hawksbill is considered poisonous. Turtles are caught using a harpoon and two ropes. All turtle eggs are eaten. Species may be determined by the relative size of their eggs: loggerhead eggs are the biggest, Green turtle eggs are smaller, and Hawksbill eggs smaller still, though this last species is considered the most palatable.

¹⁷ Friday and Timothy (1988)

Dugong and turtle hunting at the Lockhart River Community on the east coast of Cape York Peninsula in Queensland was described by Traditional Owner Isaac Hobson as follows¹⁸:

Turtles (both Green and Hawksbill) are seen in the area, and are plentiful at Lockhart River. Turtles are caught in the stretches of shallow water at the old mission site, but the prevailing south-east wind causes problems at the new site.

Turtles may be hunted at anytime of year. The community favours Green turtles, and Hawksbill are rarely eaten because some believe they are poisonous. Loggerhead turtles are not hunted because they are too stringy to eat. Turtles are more easily caught than dugongs, and the latter tend to be caught mainly for festivals and feasts, when a specific effort is made.

The move to the new mission site has made hunting difficult, especially for dugongs, because of reduced accessibility to good hunting areas. There used to be plenty of dugongs, at the old mission site, but nowadays hunting in this location calls for a two person expedition which entails camping out even in good weather. Therefore Lockhart River residents now catch dugongs near the seven mile long Cape Direction sandbar, although few have been seen in this area of late, possibly because of a shortage of feed.

Nowadays dugongs are cut up immediately after catching, on the nearest sandbar. Previously, however, hunters making a catch at night would leave it until the following day; or, if making catch in the morning, would leave it until the afternoon, as the meat is easier to cut if the carcass has been left for a few hours.

Across northern Australia dugong and turtle hunting is traditionally only carried out by men. For example, anthropologist Athol Chase reported that there were strong cultural protocols preventing the involvement of women in dugong hunting and butchering on Cape York Peninsula¹⁹:

[I]n parts of Cape York dugongs could be approached, killed and eaten only by older initiated men. For women, youths and children even to be in contact with water which had dugong grease floating on it meant that they would become very ill. People in these categories could not even touch equipment to be used in hunting dugongs for fear that illness and misfortune would result.

¹⁸ Hobson (1988)

¹⁹ Chase (1981)

Traditional Owner Lester Rosendale described dugong hunting by members of the Hopevale Community on eastern Cape York Peninsula as follows²⁰:

Dugongs are hunted at Christmas when the community goes to the coast. This seems to be the only time when community members come together at the coast, and it is possible to organise hunting parties of three or four.

The old hunters these days 'manage' a hunt, giving instructions to the younger members of the community, and most younger hunters-acquire expertise from going out on expeditions with older members. There is no record of successful past hunting trips because of counting methods: 'one', 'two', 'three', then 'big mob'. Information on hunting has been handed down only to those who are interested. However, a series of strokes cut into the sandstone of the rocks near Cape Flattery provide a record of the number of dugongs caught by older community residents. The community still hunts for dugongs along most of the coastline between the Starcke River and Cape Bedford and the islands and reefs near the coast. The catch does not exceed consumption by the community, which remains undecided about the extent of restrictions entailed by the policy of allowing it to take 20 dugongs per year by permit.

Traditional Owner Bryce Barlow²¹ described dugong and turtle hunting at Yarrabah Community, located just south of Cairns:

Dugongs, turtles, turtle eggs, clams and other shells and shellfish are taken by the community. People used also to collect seabirds' eggs in spring. Both dugout canoes with outriggers and sailing boats are used.

Turtles are hunted in October, November and December, and dugongs in April, May and June. Between December and March dugongs stay out at the reefs, following the colder water, and return to the coast only when the coastal water cools. Dugong hunting takes place at night, and hunters locate the animals by listening for their cough. Aluminium boats are considered too noisy for hunting dugongs.

A comparative study of literature describing hunting practices in four Aboriginal communities across northern Australia indicates that cultural protocols differ with regards to the age and gender of dugongs being hunted²²:

²⁰ Rosendale (1988)

²¹ Barlow (1988)

²² Berson (2004)

The Bardi avoid hunting pregnant females and will only pursue the older calf if a mother and two calves are encountered. The Yanyuwa prefer young male dugongs and avoid all female dugongs, especially pregnant females, as well as very old dugongs. Mabuiag Islanders similarly avoid large old dugongs, but contrary to the Yanyuwa, prefer female dugongs, particularly pregnant females.

In Torres Strait, Dugongs used to be hunted from stationary platforms erected over seagrass beds showing evidence of recent grazing by dugongs, as described here by Nonie Sharp²³:

On moonlight nights towards the end of the southeast season the reefs are covered at high tide and the dugong come in to feed on patches of 'dugong grass'. The late Wees Nawia, a Kaurareg man and Islander leader in the Torres Strait, was a great dugong hunter. He explained to me that '*The dugong leaves a mark on the sand where it had been feeding on seagrass*'. After observing these marks he knew the dugong was likely to return on the evening tide to eat again. He and his sons built a dugong platform over the seagrass bed, a structure unique to Torres Strait. It is made of six bamboo poles lashed together on top of which rests a canoe centerboard. As a harpooner finds his mark – the dugong's head – he leaps down upon the dugong and revolves the hardwood spear shaft while someone throws a rope. The harpooner flings himself backwards away from the rope so as not to become entangled.

Indigenous Knowledge

As a consequence of their long association and cultural and economic dependence on dugongs and marine turtles, Indigenous peoples of northern Australia hold a great deal of knowledge about the biology and behaviour of these animals.

Published examples of this knowledge are given below.

In the extract below²⁴, Mabuiag Islander and Torres Strait cultural researcher Ephraim Bani explains how dugong hunters in Torres Strait distinguish between male and female dugongs and use feeding trails to track the movement of dugongs:

Selection techniques for hunting dugongs include differentiation between the sexes and recognition of pregnant females and herd leaders. Professional hunters differentiate between male and female dugongs by the length of their faces; the face of a male is longer. In addition, the first in a line of swimming dugongs will be a

²³ Sharp (2002)

²⁴ Bani (1988)

female and the second a male. A pregnant dugong is distinguished by the tail thrown high when diving into the water.

During darkness the sexes are distinguished by the sounds they make. The male makes a loud sound and the female a softer sound, like a whisper. These two sounds made in succession signify a male and female dugong swimming together, where the male is the fully-grown calf. Two sounds made simultaneously signify a mother and a young calf. Herd leaders make a whistling sound. An aid to the aural tracking methods employed at night is provided by the 'luminous trail' which issues from the mouth of feeding dugongs. The Torres Strait Islanders have given this a name similar to that for the Milky Way.

Feeding trails usually take the form of lines across the seagrass patch, their direction depending partly on its size and shape. The hunter can estimate the position of a dugong by assessing the effect of the tide, wind and currents, on the feeding trail. Thus it is essential that he understand the movement of the stars and the different oceanographic and weather conditions. The hunter watches the surface and pattern of the trail to predict the dugong's movements, but does not pick up the harpoon until the animal is within range. Having harpooned the dugong, he drowns it.

In a discussion about Indigenous knowledge of dugongs at a workshop hosted by the Great Barrier Reef Marine Park Authority in 1985²⁵ Indigenous participants from across northern Australia made the following observations about dugongs:

- Individual dugongs return to specific areas over long periods;
- Stonefish are dangerous to feedings dugongs;
- Baby dugongs shed tears when caught and killed.

Eddie Mabo from Mer (Murray Island in Torres Strait) provided the following account²⁶ of marine turtles in eastern Torres Strait:

Mer is a known breeding area for Green turtles; other sites include Bramble Cay and Darnley Islands. A large number of turtles come up to lay eggs in the mating season. One night in 1985, 120 tracks led down to the beach after one tide. Such large numbers led Murray Islanders to question the restrictions on turtle hunting.

²⁵ Gray and Zann (1988)

²⁶ Mabo 1988)

Out of the breeding season turtles are rarely hunted, but turtle oil is stored and roasted with mashed banana or yams to keep up the fat content in the community's diet. Nowadays bottles are used instead of coconut shells to store fat.

Torres Strait Islander Joe Davey provided the following information²⁷ about dugongs and turtles in the Buccaneer Archipelago area of northwest Western Australia:

Dugongs are most readily seen and caught during the hunting season. It is thought that these dugong move away from the community outside this season, but it is understood that they can be found in some of the other areas throughout the year. The seagrass eaten by dugongs and turtles grows on the small island reefs of the Buccaneer Archipelago. Sharks can catch turtles and possibly dugongs. Dugongs breed in August and September and dugongs may be born in shallow waters, such as those around the Montgomery Islands. Green and flatback turtles nest inside King Sound.

Traditional knowledge is being lost. Some that has been recorded has not come back to the community. In early times this knowledge was passed from father to son (and from mother to daughter), and from groups of old people to the young. Special stories and the like were the responsibility of particular people.

Biologist Andrew Smith²⁸ documented extensive Aboriginal knowledge of dugongs on eastern Cape York Peninsula, here summarised by another researcher²⁹:

Hunters (at Lockhart River) believed that dugongs feed on seagrasses belonging to the *Halodule* and *Halophila* genera. They also state that herds of dugongs comprise mostly of females with their calves, young males and one or a few dominant males. These dominant males are thought to be very strong and dangerous to kill and are believed to control the herd movements through whistling. Single animals are believed to be usually males that have been chased away by a dominant male. Hunters suspect a diffusely seasonal breeding season, and it is believed that cows can calf annually as they are often seen with two calves.

Anthropologist John Cordell provides the following description³⁰ of how the Kaurareg people from Prince of Wales Island (Muralag) in the Torres Strait combine their

²⁷ Davey (1988)

²⁸ Smith (1987)

²⁹ Berson (2004)

³⁰ Cordell (1995)

spiritual beliefs and knowledge of sea country to use and manage dugongs, turtles and other marine resources.

Kaurareg use of their marine resources is governed by their (religious) beliefs about ancestral spirits and supernatural order. Mythology establishes the extent of land and sea country for the Kaurareg. While the sea country belonged to all, Elders had responsibility to 'call up' dugong and allocate the number to be hunted by each community. Over-hunting was punished as there was a strong ethic of taking from the sea only what was required to satisfy immediate needs. A principle of Kaurareg marine lore is that one can only fish successfully when one is hungry.

'Calling up' marine resources such as turtle and dugong serves to control access to those resources. It is still said today that only those people who know how to 'talk to country' are able to fish successfully in a given place.

Traditional marine knowledge was passed down from elders to young men. "These people studied the water and tide, ...they know which place to go to in which time, that's why they study them two, for that sort of thing. They lived on the water! Their life that was their food, in the water." (Kuarareg tribal Elder).

Young men were instructed to go out and catch certain species from certain places at certain times of the year. The young men would always find what they had been told to catch - such was the knowledge of the elders who taught them. However they had to bring back the exact number or quantity of the species which the old men had specified or face punishment.

Kaurareg people distinguish at least 6 kinds of tides in the Torres Strait where the tides are complex, pronounced, unusual and unpredictable. Kaurareg people used their detailed knowledge of the tides to hunt turtle and dugong and to catch fish, knowing where to hunt and fish in which kinds of currents.

Kaurareg people know two seasons. Northwest (wind) time when people concentrate on dugong and avoid eating fish (which feed on jellyfish during this time and, if eaten, cause the skin to swell and become itchy) until certain stars appear in the sky which signals that the jellyfish are gone and fish are safe to eat again. Southeast (wind) time indicated by another constellation of stars, is a time of plenty when fish, crabs, mussels and bailer shells are 'fat', and the water is clear for spearing. When the winds abate towards the end of this season, the turtles are breeding and are easy to hunt until a certain constellation disappears and the monsoon begins.

Increase ceremonies

It is common in Aboriginal and Torres Strait Islander cultures to undertake ceremonies or rituals to ensure the well-being of culturally important animals. Anthropologists Donald Thompson documented³¹ a ceremony performed by Kuuku Ya'o people on eastern Cape York Peninsula for the purpose of increasing the number of dugongs. The ceremony took place at a “dugong totem centre”, which is marked by a special “dugong stone”. Men of the “dugong clan” walk around the stone, striking it with bunches of leaves, while saying “*Ampimbo! Amp! Amp! Amp!*” (meaning, “Come plenty! Come plenty! Come plenty!”). The ceremony was undertaken when people noticed that dugong numbers were decreasing.

Art

Because of their cultural and spiritual significance, images of dugongs and marine turtles appear in the art of many coastal communities across northern Australia, some examples of which are shown in Figures 3 and 4.



Figure 3: Dugong sculpture³²

³¹ Thompson (1933 and 1935)

³² Photographs courtesy of the Great Barrier Reef Marine Park Authority



Figure 4: Dugong decoration on Indigenous craft³³

Art is also being used as a form of political expression, to inform the wider Australian community about Indigenous peoples' interests and concerns about their marine environments and resources, including dugongs and marine turtles. Traditional Owners from northeast Arnhem Land created a special collection of 80 art works, titled *Saltwater – Yirrkala Bark Paintings of Sea Country*, which were exhibited in Canberra, Perth, Sydney, Melbourne and Alice Springs from 1999 to 2001 to help politicians and the general public understand Traditional Owners' rights and responsibilities to sea country³⁴.

Indigenous Art is also being used to strengthen links between Australia and Indonesia to celebrate the significance of marine turtles to communities in both countries. The project *Green Turtle Dreaming* involved collecting stories, songs and artworks on Green turtles from communities in Eastern Indonesia and Northern Australia, between which Green turtles migrate each year. The project has resulted in an exhibition that celebrates the significance of Green turtles to communities in eastern Indonesia and northern Australia and reflects their understanding of the need for Green turtles to be conserved. The project includes an education kit, a CD, and a bilingual book of stories. The exhibition is being shown in several locations in Australia and Indonesia during 2005 and 2006³⁵.

³³ Photographs courtesy of the Great Barrier Reef Marine Park Authority

³⁴ Buku-Larrngay Mulka Centre (1999)

³⁵ www.greenturtledreaming.com.

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+PART 2

SCIENTIFIC UNDERSTANDING OF DUGONGS AND MARINE TURTLES

Scientific names and classification systems

Scientists use a system of naming and classifying animals and plants that provides a name for each species that is recognised worldwide. The classification system is based on scientists' knowledge of each species, and on how similar or different they are to other species. This system was started about 270 years ago in Sweden by a scientist called Carl Linnaeus who collected plants in northern Sweden (where he worked with the Indigenous Sami people) and later studied collections of plants brought back from many parts of the world. This scientific naming system is called the Linnaean system, or the "bi-nomial" system because the name of each species is made up of two parts. For example, the scientific name for Dugong is *Dugong dugon* and the scientific name for Green Turtle is *Chelonia mydas*. The first part of the name refers to the "genus" or closely related group to which the animal belongs; the second part of the name identifies the particular species within that group.

The scientific classification system places all living things into the following hierarchy of groups:

Phylum
Class
Order
Family
Genus
Species

Research and Monitoring

Researchers use a variety of methods to learn about how many dugongs and marine turtles are living in northern Australian waters, where they breed, where and on what they feed, and what are the threats to their long term survival. These methods include aerial surveys, satellite tracking, tagging turtles and counting turtle tracks on beaches. Information on each of these methods is provided below³⁶.

³⁶ A more detailed description of turtle monitoring methods can be found in Eckert et al (1999)

Aerial surveys

Aerial surveys have been used to estimate the population of dugongs in several regions of Australia since the 1970s³⁷. The same procedure is used for each survey so that the population estimates can be compared over time. Dugongs are counted by two observers who each watch a 200 metre-wide strip of sea on either side of the aircraft (Figure 6). The plane flies at a constant height (137 metres above sea level) and speed (185 km/h) along pre-arranged paths which are perpendicular to the coast.

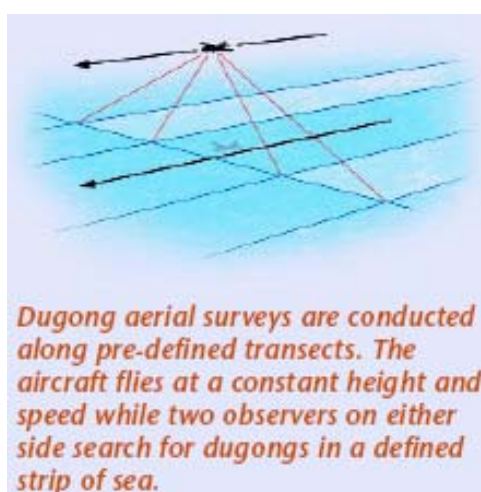


Figure 5: Dugong aerial surveys³⁸

The dugong counts are then used to estimate population sizes, taking into account various factors that can influence the number of dugongs seen by the observers. For example, when the water is turbid (not clear), dugongs are difficult to see unless they are near the surface. Fibreglass models of dugongs have been used to measure the depths at which dugongs can be seen from the air in waters of different turbidity and sea condition. Miniature computers have been attached to the tails of 15 dugongs to measure the depths and times of 40,000 dives. This allows researchers to estimate how much time dugongs are likely to be available to observers during aerial surveys in waters of different turbidities, depths and sea conditions.

³⁷ CRC Reef Research Centre (2002)

³⁸ http://www.reef.crc.org.au/publications/brochures/dugong_2002.pdf

Marine turtles can also be counted during aerial surveys. However, as it is difficult to identify particular turtle species from the air this method is of limited use for turtle research and management.

Satellite tracking³⁹

Satellite tracking is a technique for following the movements of individual dugongs or turtles over long distances over several months. A specially designed instrument, which plots the animal's location and depth beneath the water transmits this information to the researcher's computer via a satellite. On a dugong, the satellite transmitter is attached to the tail by a long rope. The rope is padded so that it does not damage the tail and a weak link is installed in the rope so that it will break free if it gets tangled. A timing device is also installed to automatically release the instrument after a set period of time. Satellite tracking devices can also be attached to marine turtles, but they are either glued directly onto their shells, or attached to their shells by a short towing line⁴⁰.

Tagging turtles

A reliable way to get information about the movement of turtles over long periods of time is to attach a numbered metal or plastic tag to one of the front flippers, or to insert a tiny microchip tag under turtle's skin (like vets do with dogs). Female turtles can be tagged during or immediately after laying their eggs; turtles can be tagged by capturing them "rodeo-style" while they are swimming. Hatchling turtles are too small to carry a metal tag so researchers have instead marked them by snipping pieces from the edge of the turtle's shell. When turtles are tagged, information such as the date, location and carapace length is recorded; this information can then be compared when the turtle is captured again, perhaps years later. Indigenous hunters and members of the public are encouraged to contact researchers if a tagged turtle is found. In Queensland some nesting populations of marine turtles have been tagged and monitored each year for over 30 years. For example, some female loggerhead turtles that were tagged as hatchlings in 1975 returned to lay their eggs on Mon Repos beach 29 years later⁴¹. Some researchers also use turtle tags to tag dugongs caught at several places on the Queensland coast.

³⁹ <http://www.abc.net.au/science/scribblygum/august2004/default.htm>

⁴⁰ http://www.epa.qld.gov.au/nature_conservation/wildlife/watching_wildlife/turtles/turtle_tracking/

⁴¹ http://www.epa.qld.gov.au/nature_conservation/wildlife/watching_wildlife/turtles/turtle_tracking/

Counting turtle tracks⁴²

The tracks of turtles on beaches can be counted to estimate the number of nesting turtles. However, this method is only reliable when there are small numbers of turtles using a beach. If there are large numbers of turtles, the tracks of individual turtles become too hard to count. If more than one turtle species is using the same beach for nesting, the tracks of one species can cover the track of other species.

Turtle tracks are also useful for indicating which beaches are most important as turtle nesting beaches, which is important information to help protect nests from the impact of tourism or other developments.

Aerial surveys of beaches⁴³

Aerial surveys are sometimes used to monitor turtle nesting beaches, particularly in remote mainland or island beaches that are difficult or impossible to reach on foot or by vehicle. Photographs taken from the air can be studied later to enable the number of turtle tracks to be counted, and sometimes the turtle species can also be identified from the tracks. Aerial surveys are also used to help decide which areas should be monitored in more detail on the ground.

Egg and hatchling counts⁴⁴

Researchers gather information about turtle populations by counting the number of eggs in each nest, and the number of clutches laid by each female in a breeding season. In addition to the total number of eggs laid, researchers may count the number of eggs without yolks and number of eggs with more than one yolk. Eggs can also be weighed and measured to determine the average egg size for each clutch.

The number of hatchlings that emerge from each nest can also be counted. The “emergence success” of a clutch is calculated as the number of hatchlings that successfully reach the beach surface divided by the total number of yolked eggs laid

⁴² Carter (2003)

⁴³ Carter (2003)

⁴⁴ http://www.earthwatch.org/expeditions/bell/bell_04.pdf

in the clutch. This value does not include live and dead hatchlings found in the egg chamber when the nest is excavated.

Examinations of reproductive organs⁴⁵

Researchers sometimes examine the reproductive organs of turtles to determine the sex of hatchlings, the sexual maturity and breeding condition of adults. This is done using an instrument called a laparoscope, which is inserted through a small cut in the skin and which enables the male or female reproductive organs to be visually inspected. Laparoscopic examinations enable researchers to determine whether adults are mature enough to breed, and whether females have previously produced eggs. Studies in Queensland over many years have shown that turtles that have undergone laparoscopic examination breed just as successfully as those that have not been subjected to this procedure.

Population genetics⁴⁶

Population genetics refers to studies undertaken to find out how animals of one species are related, and can be grouped into separate breeding populations (also called stocks). The most common way researchers determine breeding populations is by examining small tissue samples (e.g. a very small piece of skin) for particular genetic material (molecules) that are passed on through the female line (usually mitochondrial DNA). Individuals that belong to a particular breeding population have the same molecules; and these molecules are different to equivalent molecules from the same species but which belong to a different breeding population. So when members of different breeding populations come together to feed it is still possible to identify which individuals belong to which breeding population, and for turtles which area they will breed. This can be very important information for making management decisions to support the survival of particular species – for example to ensure that nesting beaches used by each breeding stock of a turtle species are protected.

⁴⁵ http://www.earthwatch.org/expeditions/bell/bell_04.pdf

⁴⁶ Marsh et al (2002); Moritz et al. (2002)

Part 2a: Dugongs

Knowledge and concerns about dugongs based on scientific research

English name: Dugong, Sea Cow

English classification: Marine mammal

Scientific name: *Dugong dugon*

Scientific classification: Class Mammalia; Order Sirenia; Family Dugongidae

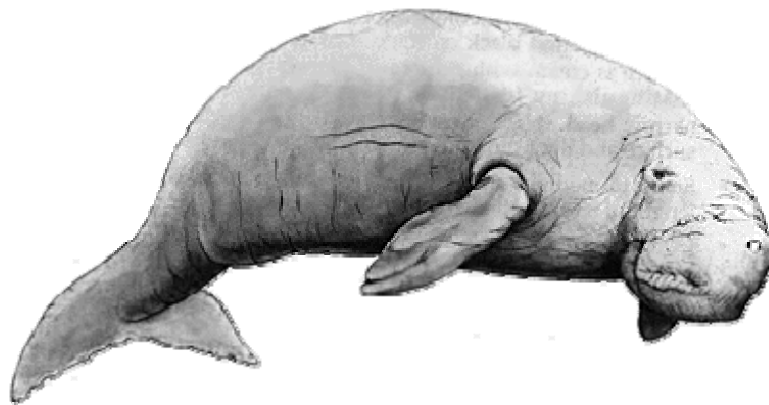


Figure 6: Dugong⁴⁷

The following information on dugong biology and management is derived from recently published technical literature reviews on dugongs⁴⁸ and other sources identified with footnotes throughout the text.

Dugongs are classified as mammals because they:

- Maintain a warm body temperature;
- Feed their young with milk;
- Have sparse hair on their bodies.

⁴⁷ Photo source: http://www.gbrmpa.gov.au/corp_site/info_services/publications/dugong/

⁴⁸ Saafeld and Marsh (2004) and Marsh et al. (2002)

Dugongs are classified in the Order Sirenia. They share the following characteristics with other species in this Order:

- Spend all their lives in water;
- Eat aquatic plants almost exclusively;
- Heavy, fish-like bodies with a horizontally flattened tail fin;
- No hind limbs;
- Forelegs are modified into flippers;
- Female has a pair of mammary glands, one near the base of each flipper.

Dugongs are the only living species in the Family Dugongidae. Another member of this family, Steller's Sea Cow (*Hydrodamalis gigas*), is now extinct (see Box 1)

Box 1: What happened to the Steller's Sea Cow?⁴⁹



The Steller's Sea Cow, which grew up to 10 metres in length and weighed up to 6,000 kg, used to live in the cold waters of the Bering Sea between Alaska and Russia. The species became extinct due to over-hunting by European sealers in 1768, less than 30 years after being discovered by Russian sealers. Previous populations had occurred along the Pacific Rim from Mexico to Japan but had gradually become more restricted. Steller's Sea Cow fed on kelp and became so well adapted to shallow waters that it could no longer dive, making it easy prey for hunters. It was the first marine mammal recorded as becoming extinct in recent times.

The only other living species of the order Sirenia belong to the Family Trichechidae, which includes three species of Manatees (also known as Sea Cows). Instead of a forked tail like the dugong, manatees have a paddle-shaped tail.

The **West Indian Manatee** (*Trichechus manatus*) (Figure 7) grows to about 3.3 metres long and lives in coastal areas of the southeastern United States, eastern Mexico, Central America, the Greater Antilles (West Indies), and along the northern

⁴⁹ http://www.gbrmpa.gov.au/corp_site/info_services/publications/turtle_conservation/ip_biological_notes.html

and eastern coasts of South America. These animals live in salt, fresh or brackish waters and feed on marine, estuarine and freshwater plants.



Figure 7: West Indian Manatee⁵⁰

The **Amazonian Manatee** (*Trichechus inunguis*) (Figure 8) lives in the freshwater of the Amazon River and its tributaries in South America. This is the smallest member of the family Trichechidae (up to 2.8 metres in length), has smooth skin, no nails on its flippers and feeds on freshwater vegetation. It feeds on aquatic plants floating on the water surface (e.g. water lilies) and aquatic grasses near the water's edge⁵¹.



Figure 8: Amazonian Manatee⁵²

West African Manatee (*Trichechus senegalensis*) (Figure 9) lives in coastal marine waters, estuaries and rivers of West Africa and grows to between three and four metres long. They eat overhanging vegetations such as mangroves rather than aquatic plants⁵³.

⁵⁰ <http://www.savethemanatee.org/manfacts.htm>

⁵¹ <http://www.animalinfo.org/species/tricinun.htm#data>

⁵² <http://www.brazilianfauna.com/amazonianmanatee.php>

⁵³ <http://www.animalinfo.org/species/tricsene.htm>



Figure 9: West African Manatee⁵⁴

Figure 10 shows the approximate distribution of five species of Sirenians described above.



Figure 10: Where Sirenians are found around the world⁵⁵

Origins of Dugongs and other Sirenids

Scientists believe dugongs and other the Sirenian species evolved from early plant-eating mammals living in coastal swamps in the African region about 45 million years ago, during what is known as the Eocene Period. Elephants are the closest land

⁵⁴ <http://www.scienceinafrica.co.za/2005/january/manatee.htm>

⁵⁵ <http://www.sirenian.org/images/distribution.jpg>

relative of dugongs today. Fossil Sirenians are found in many parts of the world that no longer support living species, indicating that Sirenians used to have a much greater distribution than they do today. In addition, there used to be many more species of Sirenia than there are today.

Characteristics of Dugongs⁵⁶

Size and weight

Dugongs are about 112 cm long and weigh about 30 kg when they are born. They grow to about 3 metres long and can weigh up to about 450kg.

Distribution and populations

Dugongs live in tropical and sub-tropical, shallow coastal waters in the western Pacific, Australia, south-east Asia, India and the east coast of Africa in the Red Sea, which includes the coastal waters of 48 countries (see Figure 11). Published information about populations of dugongs over much of this range is limited to reports of dugongs that have drowned accidentally in fishing nets, observations from fishers and other incidental sightings. More detailed information for limited coastal areas of some countries is available, but systematic aerial surveys have only been carried out in the Arabian Gulf region, New Caledonia and northern Australia. It is therefore not possible to give an accurate estimate of the total world dugong population or the status of dugong populations in particular regions. Estimates of regional dugong populations are complicated by the large scale movements of dugongs that occur from time to time, for example as a result of changes in availability of food.

From the information that is available, however, researchers have concluded that over much of the known international range of dugongs only small, isolated populations of dugongs remain, separated by large areas where they are close to extinction or are already extinct. Because dugongs are slow to reproduce and are dependent for food on seagrass that grows mostly in shallow coastal water, these animals are particularly vulnerable to human impacts, which include:

- Damage to seagrass beds from trawling or build-up of silt caused by mining, poor catchment management or coastal development;

⁵⁶ Information in this section is based largely on reviews of dugongs by Saalfeld and Marsh (2004) and Marsh et al. (2002); additional information indicated by footnotes.

- Vessel strikes;
- Harvesting for food, meat, oil, medicaments, magical charms and other products;
- Entanglement in fishing lines and nets.

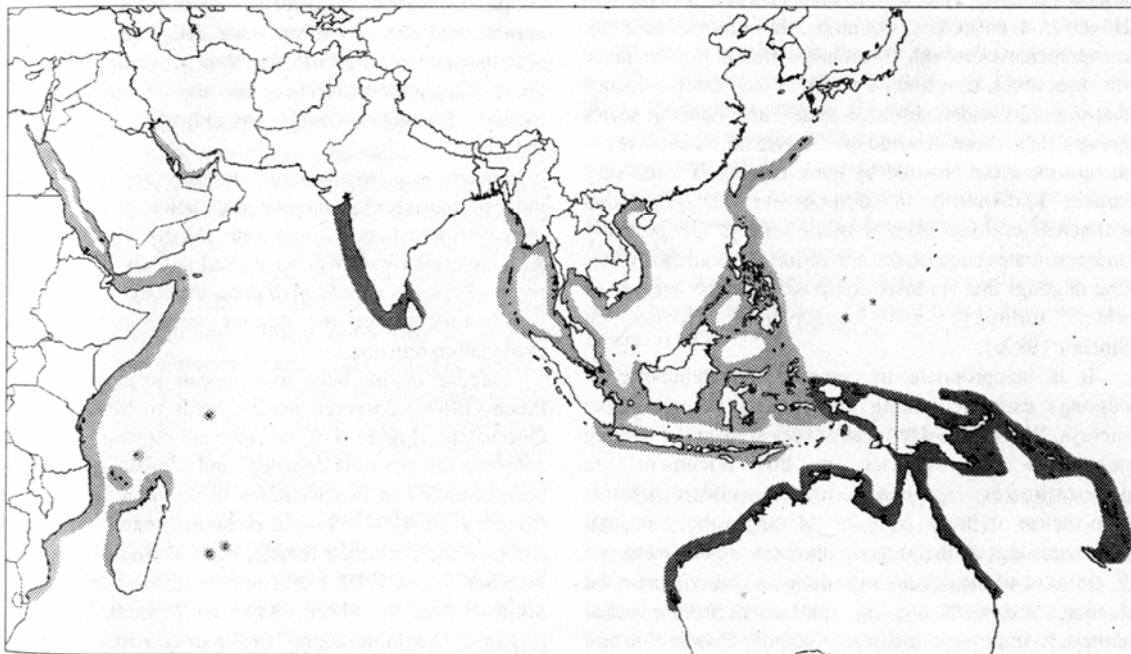


Figure 11: Distribution of Dugongs⁵⁷

The total number of dugongs living in Australian waters is estimated to be more than 80,000, though accurate population surveys have not been carried out in all coastal regions of Australia where dugongs are known to live. Most dugongs live in shallow coastal waters from Moreton Bay in south-east Queensland, around the northern coast of Australia, including Torres Strait, to Shark Bay in Western Australia. Small numbers of dugongs are regularly sighted in New South Wales coastal waters north of about Newcastle in summer. Stranded dugongs have been recorded on the far south coast of New South Wales, dugong bones have been found in Aboriginal middens in Botany Bay near Sydney and dugongs have been seen in estuaries on the central New South Wales coast. Dugongs have also been seen in deeper water far from the coast – for example 58 km from the North Queensland coast in water 37 metres deep, and at Ashmore Reef about 840km west of Darwin.

⁵⁷ Saalfeld and Marsh (2004)

Queensland East Coast

Along the east coast of Queensland, dugongs are found in shallow waters where seagrass grows. Throughout this range there is on average less than one dugong for every square kilometre, but large herds of dugongs are seen in Moreton Bay, Hervey Bay, Great Sandy Strait, Shoalwater Bay, Upstart Bay, Cleveland Bay, near Hinchinbrook Island, near the mouth of the Starke River, Princess Charlotte Bay and Shelburne Bay. Research on the impacts of a cyclone and flooding in Hervey Bay in 1992 indicates that these severe weather events can cause the destruction of large areas of seagrass. As a result, dugong populations may take years to recover from these extreme weather events⁵⁸.

Four aerial surveys of the northern Great Barrier Reef (Hunter Point to Cape Bedford near Cooktown), between 1985 and 2000, produced estimates of minimum dugong populations between about 8,000 and 10,500 during this period, suggesting a relatively stable population in this region.

South of Cooktown, however, records of dugongs caught accidentally in shark nets, set to keep sharks away from beaches, indicates that dugong numbers may have declined drastically to only about 3% of the population that was living in this region in the 1960s. However, this assessment is based on the untested assumptions that dugongs have not learned to avoid the shark nets, or do not avoid coming near beaches where nets have been deployed due to increased human use. Aerial surveys undertaken in the southern Great Barrier Reef between 1986/7 and 1999 indicate the dugong population fluctuating between about 1,700 and 3,500 over this period. This estimated more than doubling of dugong numbers between 1994 to 1999 cannot be explained by natural increase in the population, suggesting large scale movement of dugongs in and out of the region occurs.

South of the Great Barrier Reef region, one to two hundred dugongs live in Hervey Bay and several hundred dugongs live in Moreton Bay.

Torres Strait

The shallow waters of Torres Strait support a large number of dugongs in a relatively small area, making it one of the most important dugong habitats in the world. Five

⁵⁸ Preen and Marsh (1995)

aerial surveys of Torres Strait between 1987 and 2001 produced estimates of dugong populations of between 13,000 and 28,000 over the 14 year period. The researchers who conducted the aerial surveys suggest that the large differences in population estimates between surveys can be explained by large scale movements of dugong in and out of the survey area. These movements are believed to be associated with periodic dieback of seagrass in the Torres Strait region.

The surveys also indicate a movement of dugongs within the Torres Strait region. For example, in 1987, 1991 and 1996 the Orman Reef area had the most dugongs in Torres Strait, while the 2001 survey the western region of Torres Strait had the most dugongs. Figure 12 shows the distribution of dugongs during the November 2001 survey of Torres Strait.

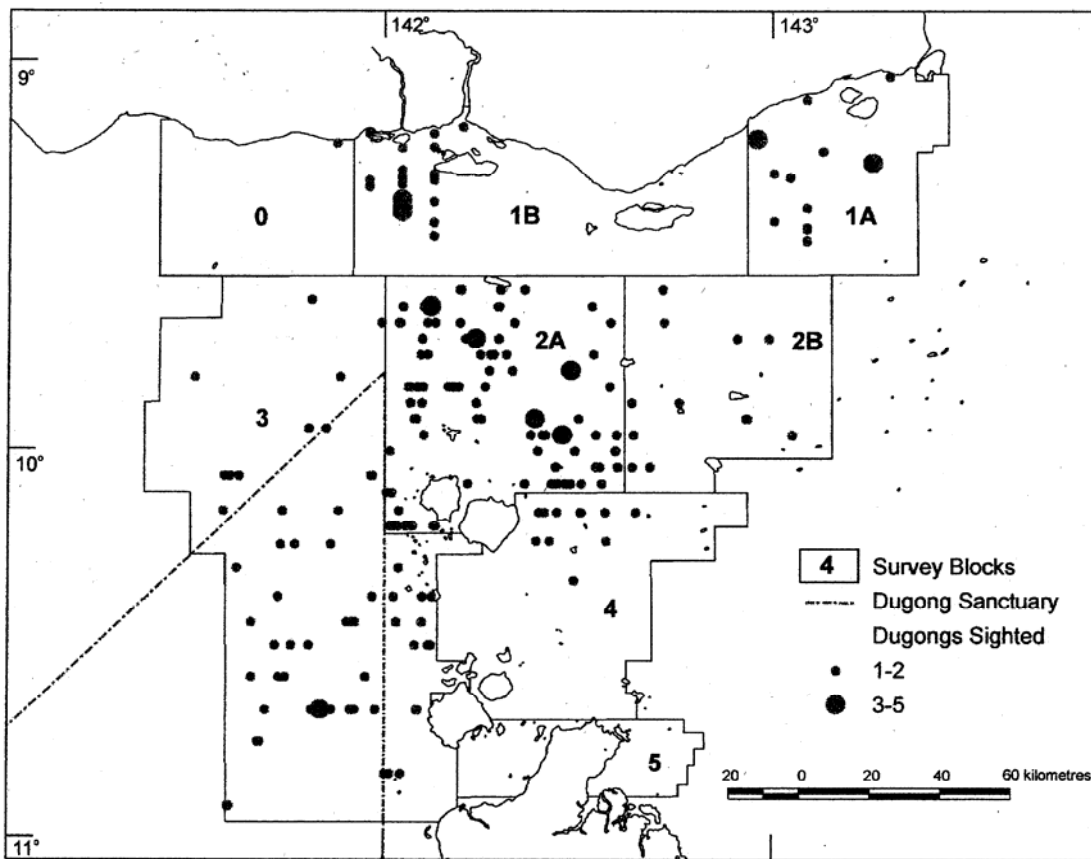


Figure 12: Distribution of dugongs observed during 2001 survey in Torres Strait⁵⁹

Gulf of Carpentaria

In the Gulf of Carpentaria, most dugongs are found in the shallow waters around the Wellesley Islands in Queensland and from the Sir Edward Pellew Islands to Blue

⁵⁹ Saalfeld and Marsh (2004)

Mud Bay in the Northern Territory. Aerial surveys of the Queensland coast of the Gulf in 1997 and the Northern Territory coast of the Gulf in 1985 and 1994 indicate that the total number of dugongs in the Gulf of Carpentaria is in the range 20,000 to 30,000. The surveys indicate that the northern half of Blue Mud Bay, the mouth of the Limmen Bight River, the Sir Edward Pellew Group and the Wellesley Islands are particularly important areas of dugong habitat (see Figures 13 and 14).

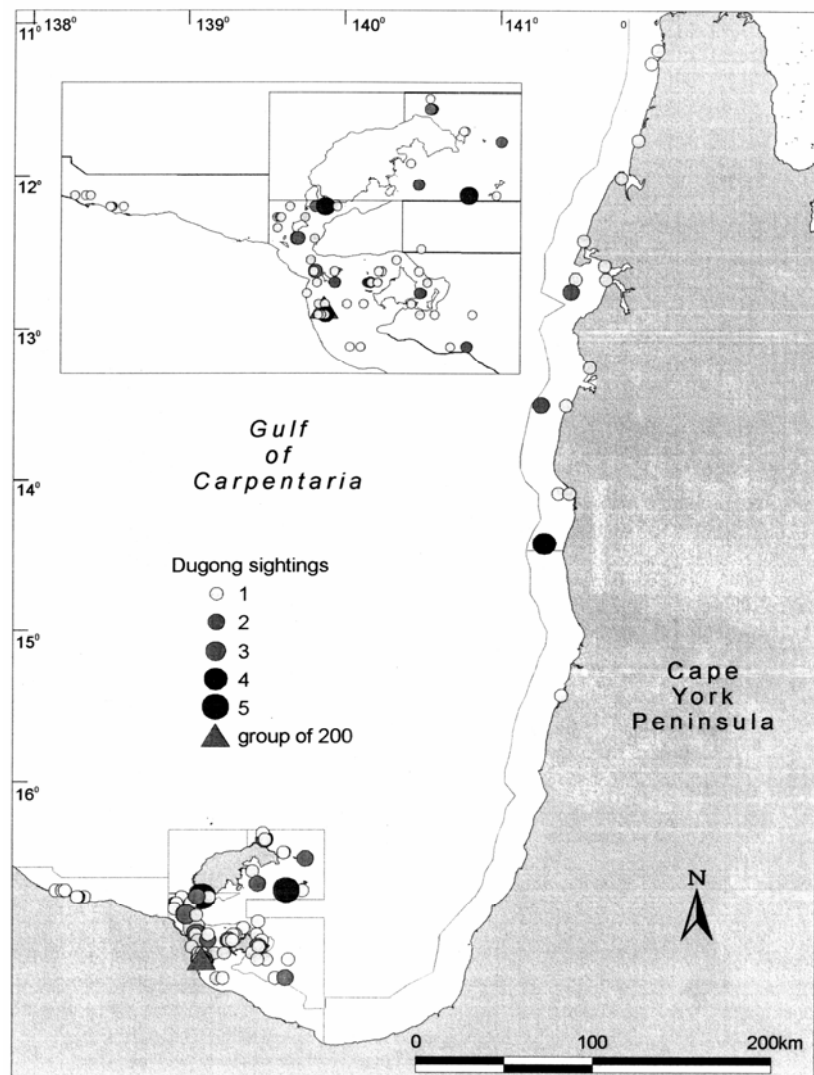


Figure 13: Dugong sightings in the eastern Gulf of Carpentaria during the 1997 survey⁶⁰

⁶⁰ Saalfeld and Marsh (2004)

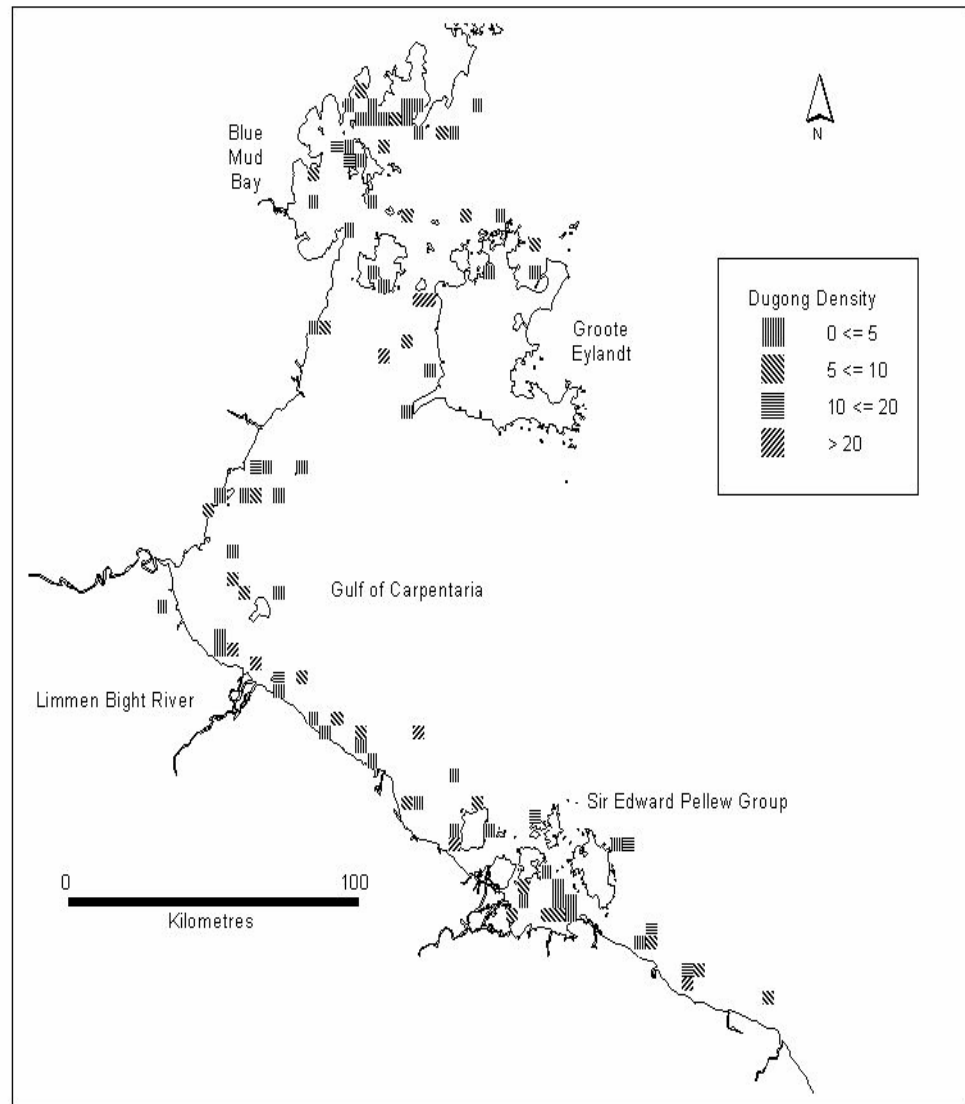


Figure 14: Dugong sightings in the western Gulf of Carpentaria during the 1994 survey⁶¹

Top End Coast

Along the northern coast of the Northern Territory, most dugongs are found around the Tiwi Islands, Cobourg Peninsula (Garig Gunak Barlu National Park), and Croker Island, with smaller numbers near Maningrida. Two aerial surveys along this stretch of coast undertaken 12 years apart, in 1983⁶² and 1995⁶³, indicate that there is a population of between about 10,500 and 16,500 dugongs. Figure 15 shows the distribution of dugong sightings during the 1995 survey.

⁶¹ Saalfeld and Marsh (2004)

⁶² Bayliss and Freeland (1989)

⁶³ Saalfeld (2000)

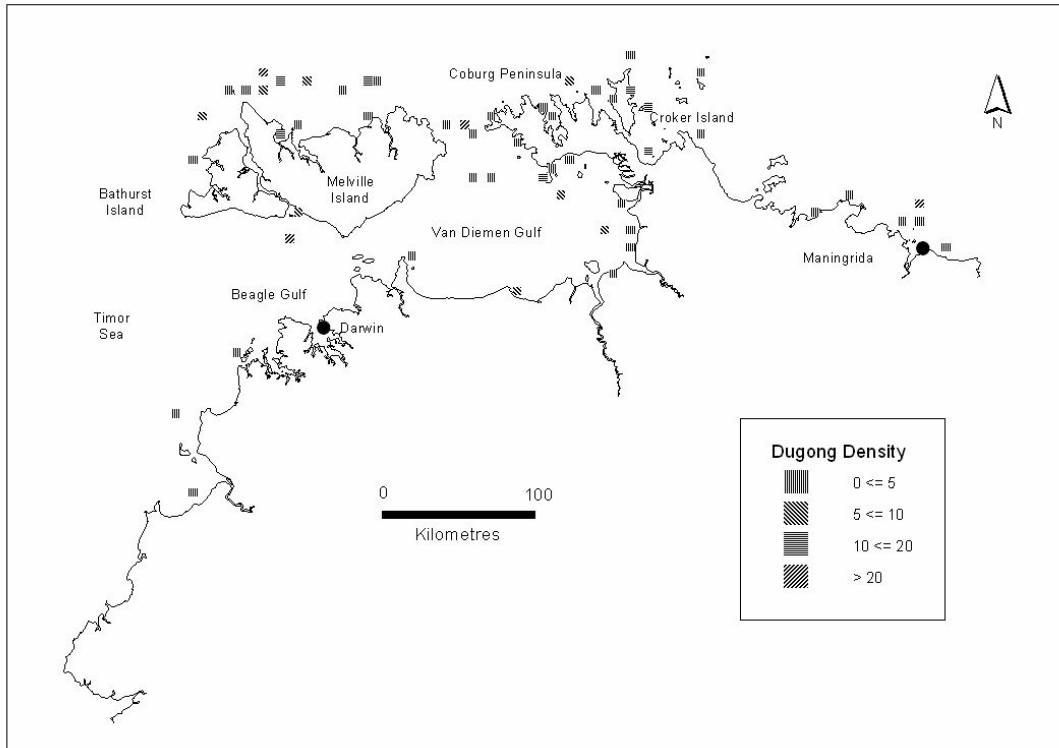


Figure 15: Dugong sightings on north-west coast of Northern Territory in 1995⁶⁴

Western Australia

Along the coast of Western Australian, aerial surveys indicate that the greatest number of dugongs live in Shark Bay; there are also significant numbers of dugongs in the Ningaloo Marine Park / Exmouth Gulf region, and on the Pilbara coast. No systematic aerial surveys have been conducted along the Kimberley coast.

Surveys in Shark Bay in 1989, 1994 and 1999 indicated a dugong population of between about 10,000 and 14,000 in that region, with significant seasonal variation within the Bay due to changing water temperatures.

Surveys of Ningaloo Marine Park and Exmouth Gulf in the winters of 1989 and 1994 recorded populations of about 1,000 dugongs on both occasions (though covering slightly different areas). A subsequent survey in winter 1999 estimated the number of dugongs in the region to be less than 350 – a population decline thought to be the result of the destruction of seagrass beds caused by cyclone Vance in March 1999.

⁶⁴ Saalfeld and Marsh (2004)

One aerial survey of the Pilbara Coast (Exmouth Gulf to De Grey River) in April 2000⁶⁵ estimated a dugong population of about 2,000 in this region.

Life cycle and Breeding

Dugongs can live more than 70 years, but have a low reproductive rate and a long interval between generations. Research indicates that females do not bear their first calf until they are at least 6 years old and may not commence breeding until they are up to 17 years old. Researchers believe that the delay in onset of breeding may be linked to the availability of seagrass; when dugongs do not have enough to eat they delay breeding. Pregnancy lasts for between 13 and 15 months, and usually only one calf results from each pregnancy. Mothers suckle their calves for between 14 and 18 months, and the time between pregnancies varies between two and a half years and seven years. Young dugongs start eating seagrasses soon after birth, while they are still receiving milk from their mothers.

Researchers have observed several types of mating behaviour. Along the Queensland coast, male dugongs have been observed violently competing for oestrous females (on heat). In contrast, dugongs in Shark Bay in Western Australia have been observed to engage in what is known as a “lekking” mating behaviour, in which individual males carry out special behaviour to attract females who then approach the male to mate.

Feeding

Dugongs specialise in eating seagrasses, uprooting whole plants when they are accessible, but feeding only on leaves when the whole plant cannot be uprooted. Dugongs prefer to eat seagrasses that belong to the genera *Halophila* (Figure 16a) and *Halodule* (Figure 16b). The most frequently selected species are lowest in fibre, highest in available nitrogen and starch, and easiest to digest. Research indicates that grazing by dugongs has the effect of encouraging the growth of seagrass species that dugongs prefer, so it can be said that dugongs actually farm seagrasses. Feeding dugongs leave behind identifiable grazing trails, indicating where seagrass has been removed (Figure 17). For further information on seagrasses see Box 2 below.

⁶⁵ Prince et al. (2001)



Figure 16a: Seagrass - *Halophila ovalis*⁶⁶

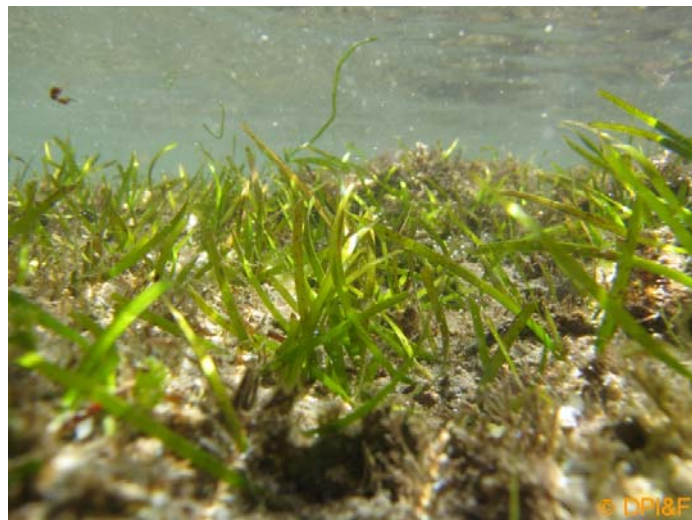


Figure 16b: Seagrass – *Halodule uninervis*⁶⁶



Figure 17: Dugong feeding trails in a seagrass meadow⁶⁷

⁶⁶ Copyright Queensland DPI&F (Len J. McKenzie)

⁶⁷ Photo courtesy Anthony Roeloffs Queensland DPI&F

Box 2: Seagrass⁶⁸

Seagrasses are flowering marine plants with the same basic structure as terrestrial (land) plants. They have tiny flowers and strap-like or oval leaves. Seagrasses form meadows in estuaries and shallow coastal waters with sandy or muddy bottoms. Most closely related to lilies, they are quite different from seaweeds, which are algae. 14 species of seagrasses occur in the coastal waters of northern Australia, making it one of the most important areas for seagrasses in the world.

Why seagrass isn't seaweed!

Algae (seaweed) also grows in the sea, but seagrasses are different from algae in several ways.

- Seagrasses produce flowers, fruit and seeds — algae produce spores.
- Seagrasses, like terrestrial grasses, have separate roots, leaves and underground stems called rhizomes, which can form an extensive network below the surface. Algae rarely have 'roots' below the surface.
- Unlike algae, seagrasses are vascular plants — they have a network of veins to move nutrients and dissolved gases around the plant.

How seagrass grows

To grow, seagrasses need nutrients, often obtained from nearby mangroves, and good light, which means clear water. Seagrasses cannot grow easily in areas where they dry out at low tide. They therefore thrive in shallow coastal waters where there is shelter (such as a sand bar) from drying winds and from wave action and strong currents which could create turbulent muddy water. Although normally found in shallow water seagrasses can grow at depths of 32m and have been found in clear water at 68m.

Flowering generally takes place in winter or early spring. The flowers are very small. Water carries the pollen from the male to the separate female flowers. The resulting fruit are often carried some distance from the parent plant before the seeds are released. Flowering, however, is not common for most tropical species and the spread of seagrasses is largely through vegetative propagation by the growth and branching of rhizomes.

Ecological value

Seagrasses are central to a web of life. Only a few animals — dugongs, Green turtles, sea urchins and some fish — have the ability to digest cellulose and feed directly on the leaves themselves. However, the usefulness of seagrasses does not end there. The leaves support an array of attached seaweeds and tiny filter-feeding animals like bryozoans, sponges, and hydroids as well as the eggs of ascidians (sea squirts) and molluscs. These provide food for small fish which feed the larger fish.

While living seagrasses might not be a popular item on the menu, dead seagrasses are a sought-after delicacy, forming the basis of lengthy food chains. Detritus from bacterial decomposition of dead seagrass plants provides food for worms, sea cucumbers, crabs and filter feeders such as anemones and ascidians.

Further decomposition releases nutrients (nitrogen, phosphorus) which, dissolved in water, are re-used by seagrasses and phyto(plant)plankton. Plankton, both plant and animal, is a food source for juvenile prawns and fish, as well as other filter feeders.

For further information on seagrass, go to the Seagrass Watch website:
www.seagrasswatch.org

⁶⁸ Adapted from: http://www.epa.qld.gov.au/nature_conservation/habitats/marine_habitats/seagrass/

Fluctuation is the availability of seagrass, due to natural events, such as cyclones and floods, or as a result of human impacts, such as trawling, is known to impact on the size of local dugong populations (see Box 3)

Box 3: Case study: Hervey Bay seagrass and dugong⁶⁹

In mid-1992, fishers in the Hervey Bay area began to report large numbers of dead dugongs in the area. Researchers set out to check on the seagrass beds but found that where in 1988 there had been 1000km² of this dugong food, now there was none.

In March 1992, the adjacent Mary River had flooded twice, carrying loads of silt into the sea. Following this event, a cyclone caused a suspension of the sediment. This extended period of clouded water, it is now assumed, killed the seagrasses by cutting out sunlight. Without food the dugongs disappeared. This event probably also led to a chain of disasters for numerous, less obvious, animals.

As this experience showed, seagrasses are vulnerable. With or without human impact, they come and go seasonally but certain human activities put them at greater risk. Urban, industrial and agricultural runoff can have detrimental effects on seagrasses and the communities they support.

Repeated trawling and outboard motors may damage the meadows while destruction of mangroves may disrupt the supply of nutrients.

The removal of sandbanks can expose the plants to sediment-stirring waves and may cause the beds to drain and dry out at low tide.

Now that the value of the marine grasslands has been recognised, care is needed to ensure that coastal development takes this precious resource into account.

Hervey Bay Marine Park protects extensive seagrass beds growing in the shallow waters of eastern and southern Hervey Bay.

Dugongs also eat marine algae, but this is believed to occur only when seagrass is scarce. There is evidence to suggest that dugongs also forage for large invertebrates in southern waters in both western and eastern Australia, apparently not in tropical waters.

Indigenous harvest

Biologists and anthropologists have recorded the numbers of dugongs hunted at various times and locations, however there is little reliable information available to indicate the current level of Indigenous dugong harvest across northern Australia.

⁶⁹ http://www.epa.qld.gov.au/nature_conservation/habitats/marine_habitats/seagrass/

The following estimates are based on recently published summaries of the available information⁷⁰.

Western Australia

The Kimberley coast is the only part of Western Australia where there are currently large coastal Aboriginal communities which have a tradition of using marine resources, including dugong hunting. Twelve dugongs were reported to have been taken by the One Arm Point Community in 1998. Dugong tusks are highly prized among Kimberley people, and in the past they were traded to be used as cigarette holders and other artifacts.

Northern Territory

The only information on dugong harvest is from the Numbulwar and Borroloola regions of the Gulf of Carpentaria. Dugong harvest at Numbulwar was estimated to be an average of 62 per year during the 1960s, which reduced to approximately 10 per year during the 1980s⁷¹. In Yanyuwa country, around the Sir Edward Pellew Islands, the dugong harvest is estimated to have reduced from about 450 per year in the 1920s, to 135 per year in the 1950s, to 48 per year in the 1970s and to about 14 per year in the 1990s⁷². Anecdotal evidence suggests that dugongs have disappeared altogether from waters around Groote Eylandt, and that people now regularly hunt dugongs in waters off the nearby mainland to bring meat back to the island⁷³.

Queensland, Gulf of Carpentaria

Several surveys during the 1970s suggested that the dugong harvest around the Wellesley Islands was in the order of 40 to 100 per year⁷⁴. There is little suitable dugong habitat along most of the west coast of Cape York Peninsula, and hence little or no dugong hunting by Aboriginal communities along this coast. Close to the tip of the peninsula, however, communities of the Northern Peninsula Area (NPA), some of whom are culturally and historically from Torres Strait, participate in the harvest of the Torres Strait dugong population.

⁷⁰ Saalfeld and Marsh (2004) and Marsh et al. (2002)

⁷¹ Bayliss and Freeland 1989

⁷² Bradley (1997); Coates (2002)

⁷³ Reported in Marsh et al. (2002)

⁷⁴ Marsh et al. (2002)

Queensland, Torres Strait

People from the Eastern Islands of Torres Strait, where the relatively deep water provides little suitable dugong habitat, have little or no involvement in dugong hunting. Small numbers of dugongs are hunted by people from the Central Islands of Torres Strait. However, most dugong hunting is carried out by people from the Western Islands (particularly Mabuiag and Badu), Top Western Islands (especially Boigu) and the Inner Islands Group. A survey undertaken by CSIRO⁷⁵ concluded that the average catch for the Protected Zone during the period 1991 to 1993 was 645kg of dugongs per day, which is equivalent to 1,226 dugongs per year. Based on this and other surveys undertaken between 1973 and 2001, researchers have concluded that the annual average Indigenous harvest in Torres Strait approaches or exceeds 1000 dugongs per year, not including dugongs taken by Indigenous communities in the Inner Islands, the NPA or on the nearby coast of Papua New Guinea⁷⁶.

Concerns

From their understanding of the life cycle of dugongs, researchers have estimated that, even in areas where no hunting takes place and there are no dugongs killed by boat strikes or other human causes, dugong populations only increase by about 5% per year. Researchers are therefore concerned that a population of dugongs will decline if more than about 2% of adult females in a population is killed each year.

Researchers have expressed particular concern about the future of dugong populations in Torres Strait and off eastern Cape York Peninsula, due to apparently unsustainable levels of harvesting⁷⁷. Current research indicates that dugongs could become extinct in Torres Strait sometime between 40 and 120 years from now if current levels of dugong harvesting continues⁷⁸.

⁷⁵ Harris et al. (1994)

⁷⁶ Marsh et al. (2003)

⁷⁷ Heinsohn et al. (2004); Marsh et al. (2004).

⁷⁸ Heinsohn et al. (2004)

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PART 2b: MARINE TURTLES

Knowledge and concerns about marine turtles based on scientific research

Introduction

Six of the world's seven species of marine turtles live in northern Australia. This section summarises current scientific knowledge of these species, beginning with a general introduction, followed by more detailed information on each species.

Information provided below is based on a recent literature review published by the Australian Government's National Oceans Office⁷⁹ and information on websites of the Great Barrier Reef Marine Parks Authority⁸⁰ and the Department of Environment and Heritage⁸¹. Other references are identified by footnotes throughout the text.

Marine turtles have lived in the oceans for over 100 million years. All species migrate long distances between their feeding grounds and nesting sites. They have a large shell (called a carapace), four strong, paddle-like flippers and, like all reptiles, they have lungs for breathing air. Their characteristic beak-like mouth is used to shear or crush food.

Concerns

During their life cycles, individual marine turtles are subjected to numerous natural dangers, particularly while developing in their eggs, as hatchlings and as free-swimming juveniles. Goannas are known to dig up turtle nests and eat the eggs. Some hatchlings are eaten by birds and crabs as they make their way to the water. Juvenile turtles are eaten by sharks and fish. While these natural predators kill significant numbers of individuals each year, their existence in the world's oceans for tens of millions of years indicates that the survival of marine turtle species is not threatened by these pressures alone. Scientists are concerned, however, that the activities of humans are bringing unsustainable pressures on marine turtles that are

⁷⁹ Limpus and Chatto (2004)

⁸⁰ http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/turtles/

⁸¹ <http://www.deh.gov.au/coasts/species/turtles/>

currently causing severe population declines and may lead to species extinctions if not addressed. The main threats from human activities, which vary from location to location and which have differing impacts on different species, are death and injury to marine turtles caused by:

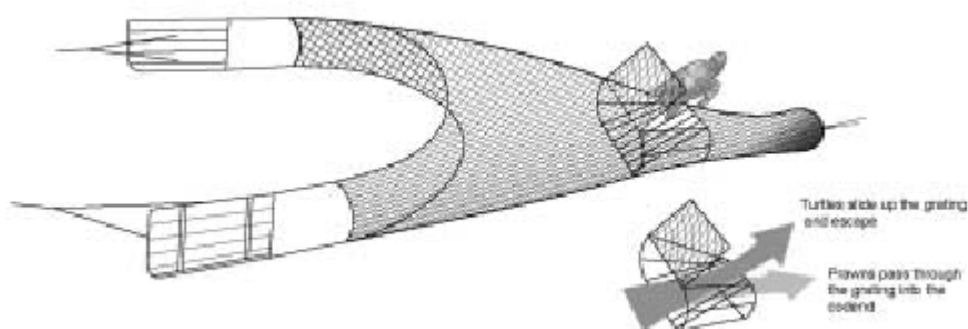
- **Fisheries bycatch** - accidental capture of marine turtles by commercial fisheries;
- **Direct fisheries pressure** – direct harvest for commercial reasons in neighboring countries;
- **Marine debris** – discarded fishing nets, plastic bags and other waste material in the sea and on nesting beaches;
- **Shark nets** – set around popular swimming beaches to protect people from shark attacks;
- **Boat Strikes** – hulls and propellers of ships accidentally striking turtles;
- **Light Pollution** – artificial lighting on or near the coast that disorients nesting females or emerging hatchlings;
- **Vehicles and other recreational activities on nesting beaches** – destroying nests, and/or disturbing nesting females and hatchlings;
- **Predation of eggs and hatchlings by feral animals** – especially foxes, pigs and dogs;
- **Coastal development, aquaculture and other changes to coastal land and sea environments** – habitat changes that reduce nesting opportunities and food supplies (including loss of seagrass);
- **Oil spills and other threats to water quality;**
- **Noise pollution** – disrupting nesting behaviours and disorienting hatchlings;
- **Unsustainable harvest** – turtles and eggs have been harvested by coastal people around the world for thousands of years but in recent times in some places such harvests (both commercial and subsistence) are no longer sustainable.
- **Diseases** – such as fibropapilloma (a wart like disease that occurs on turtles and is caused by an unknown virus)

The accidental catch of marine turtles in the northern prawn trawl fishery has been greatly reduced since the recent introduction of Turtle Exclusion Devices (TEDs) (see Box 4 on the following page). Other threats, such as light pollution (see Box 5 on the following page) are a greater problem in more settled areas of Australia, but have the potential to become more serious in the north as remote communities become more developed.

Based on the ongoing threats and recorded declines in numbers, marine turtles are generally listed as endangered, threatened or vulnerable by Australian and

international conservation agencies. However these listings are based on national or global assessments of each species as a whole. They do not take into account the fact that some populations in some areas may not be in decline or that there is not enough information to determine their conservation status. Measures aimed at addressing each of these concerns or threats are proposed in the Australian Government's *Recovery Plan for Marine Turtles in Australia*⁸², discussed in Part 3 of this *Handbook*.

Box 4: Turtle Exclusion Device (TED)⁸³



TEDs are a device sewn into trawl nets to separate large unwanted animals, generally sea turtles but also other large organisms like sharks and rays, from the smaller target species, generally prawns or fish. They enable large animals to exit the net before reaching the cod-end. There are many designs, although most commonly they consist of a grid (or grating) that directs the turtle towards a hole in the net.

Box 5: Light pollution and marine turtles⁸⁴

Artificial lights on land and sea attract both nesting turtles and hatchlings. As a result, female turtles seeking a nesting beach get attracted to coastal areas unsuitable for nesting or to brightly lit boats or oil rigs in the water. Hatchlings instinctively head for the brightest area, which under natural conditions is usually the sea. However, street lights and other lights on land can attract hatchlings inland so that they never reach the sea. It will be important for communities across northern Australia to consider the possible impact of light pollution on marine turtles when considering development proposals in the years ahead. Options to address the problem include establishing light-free coastal zones near important nesting beaches, using light frequencies less attractive to turtles (e.g. low pressure sodium lights [LPS] reduce Loggerhead turtle disorientation – note not all species react the same to LPS lights) and installing shields to prevent light reaching critical coastal areas.

⁸² <http://www.deh.gov.au/coasts/publications/turtle-recovery/>

⁸³ <http://www.affa.gov.au/content/publications.cfm?ObjectID=26A9E754-A7F8-4368-8861A9BA4D5F5663>

⁸⁴ <http://www.deh.gov.au/coasts/publications/turtle-recovery/>

In many parts of the world, turtle populations have declined to low numbers or even disappeared entirely. There are only a few large nesting populations of the Green, Hawksbill and Loggerhead turtles left in the world. Australia has some of the largest marine turtle nesting areas in the Indo-Pacific region and large (globally significant) nesting populations of Green, Hawksbill and Loggerhead turtles, as well as the only nesting populations of the Flatback turtle.

Whilst marine turtles are in trouble in many parts of the world, recent evidence from long term monitoring studies is showing that with good management, such as by protecting habitat, reducing turtle deaths in fisheries and ensuring that harvests of eggs and turtles are sustainable, turtle populations can recover. One of the best examples comes from Green turtles in Hawaii, where the number of nesting females per year has increased from less than 100 to almost 500 over the last 40 years (Figure18).

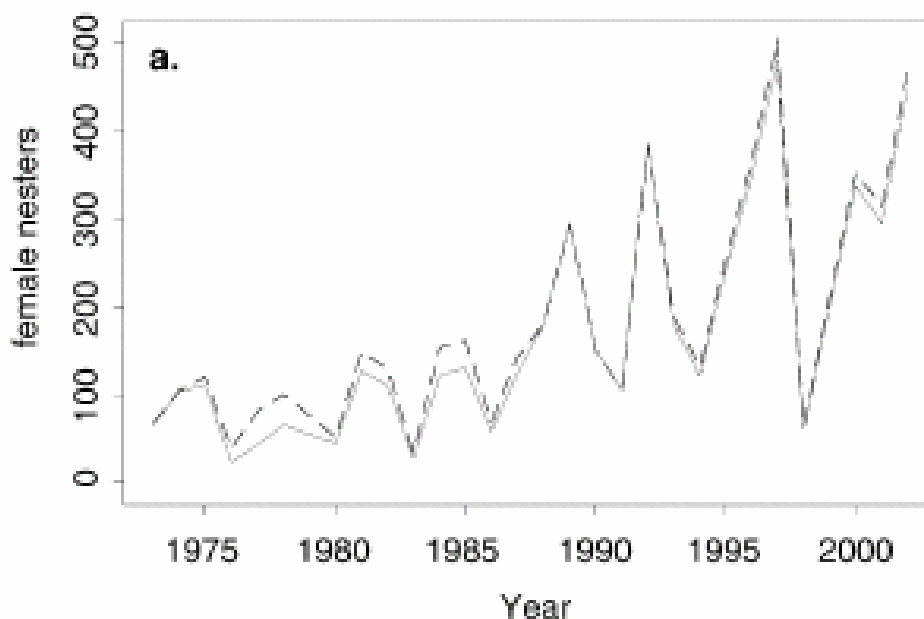


Figure 18: Numbers of nesting female Green turtles in Hawaii 1973 - 2002⁸⁵

⁸⁵ Balazs and Chaloupka (2004)

Biology of marine turtles

The following extract from the Great Barrier Reef Marine Park Authority's website⁸⁶ provides a general summary of the biology of marine turtles. Further information is provided in the sections on each species below.

All species of marine turtles have the same general life cycle (see Figure 19). They grow slowly and take decades to reach sexual maturity. As immature turtles, they may drift on ocean currents for many years or live for years in the one place before maturing and making a long breeding migration of up to 3000 km from the feeding ground to a nesting beach. At an unknown age (believed to be between 20 and 50 years) male and female turtles migrate to a nesting area located in the region of their birth. Both male and female turtles mate with a number of partners. The females store sperm in their bodies to fertilise the three to seven clutches of eggs that are laid during the season.

Mating generally takes place offshore a month or two prior to the turtle's first nesting attempt for the season, which is usually in summer.

Male turtles generally return to their foraging areas once the females commence their fortnightly trips to the beach to lay eggs. When ready, a female turtle crawls out of the sea and uses her front flippers to drag herself up the beach to a nest site. She digs out a body pit with her front flippers and then excavates a vertical egg chamber (between 30 and 60 cm deep) with her hind flippers. If the sand is too dry and unsuitable for nesting, the turtle moves on to another site.

For most turtles, digging the nest takes about 45 minutes. Another 10 to 20 minutes are then spent laying the clutch of leathery-shelled eggs. Each clutch contains about 120 eggs, ranging in size from the golf ball-sized egg of the hawksbill to the billiard ball-sized egg of the flatback.

After laying, the turtle fills the egg chamber with sand using her hind flippers, and then fills the body pit using all four flippers. The turtle finally crawls back to the sea about one to two hours after emerging, entering the surf exhausted. In this offshore area she begins to make the next clutch of eggs, fertilising them from her sperm store. After the nesting season, females return to their distant foraging areas and may not nest again for two to eight years.

The temperature of the nest during incubation determines the sex of hatchlings. Warm, dark sand produces mostly females. Eggs laid in cool, white sand result mostly in males and generally take longer to hatch.

⁸⁶ (http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/turtles/lifecycles.html)
Adapted from Lanyon et al. (1989)

After about 7-12 weeks the eggs hatch. The hatchlings take two or more days to reach the surface where they emerge as a group, usually at night. To find the sea, hatchlings orient towards the brightest direction and use the topography of the surrounding horizon line. Once in the sea, hatchlings use a combination of cues (wave direction, current, and magnetic fields) to orient themselves to deeper offshore areas. Crossing the beach and swimming away is believed to imprint the hatchlings with the cues necessary to find their way back when they are ready to breed.

Once in the ocean, hatchlings are believed to enter regions where ocean currents meet. There they associate with floating seaweed mats and other flotsam caught up in ocean currents. Here they feed on tiny sea animals. These young turtles are rarely seen again until their shell length is 20-40 cm, which may be five or ten years after hatching. At this time, the young, free-swimming turtles migrate back to inshore foraging areas. They remain in these areas until they are ready to breed and the cycle begins again.

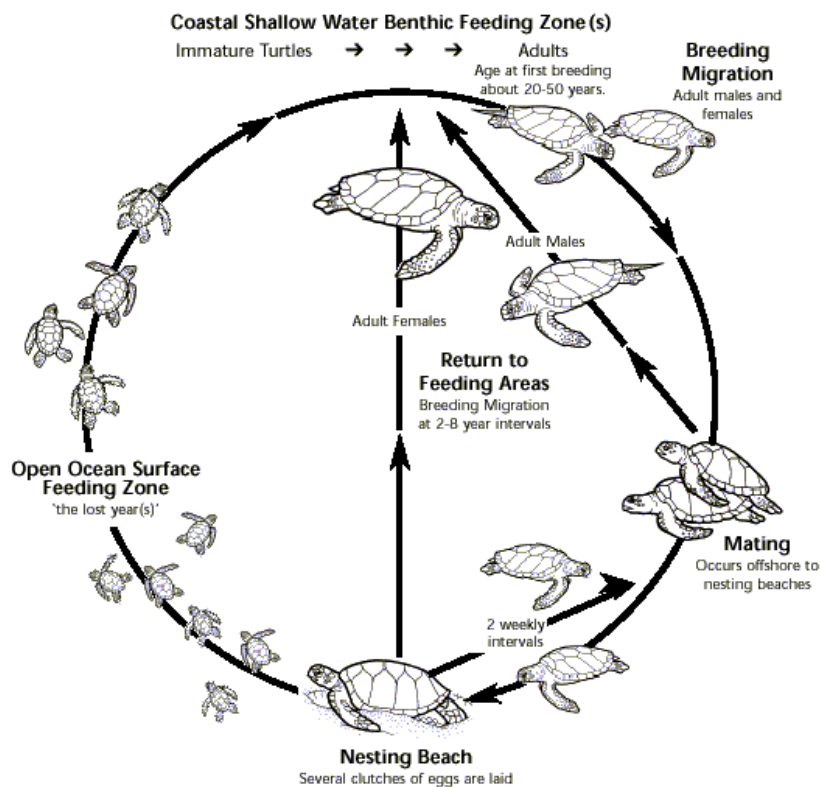


Figure 19: Life cycle typical of marine turtle species⁸⁷.

It is important to remember that individual marine turtles do not migrate and nest every year. Instead they take a break of at least one and sometimes several years

⁸⁷ (http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/turtles/lifecycles.html)

between nesting migrations. They need this break because it takes a long time to gather the energy (stored as fat) to make several clutches of eggs and to fuel the turtle as it swims hundreds, sometimes thousands, of kilometres to a nesting location (and then back again). It may also be risky for a turtle to travel a long distance (e.g. it may get lost or attacked by sharks), so turtles save their energy for many years so they can lay several clutches of eggs in one trip rather than make many trips each year. For these reasons there are often large differences in numbers of nesting turtles each year, and usually a year with many nesting turtles is followed by a year of fewer nesting turtles. This is why at least ten years of turtle nesting information is required to determine long term changes in population size. Records of Green turtles nesting on Heron Island, in the southern Great Barrier Reef, provides a good example of these annual fluctuations in numbers (Figure 20).

***Chelonia mydas* HERON ISLAND, AUSTRALIA**
TOTAL ANNUAL NESTING POPULATION

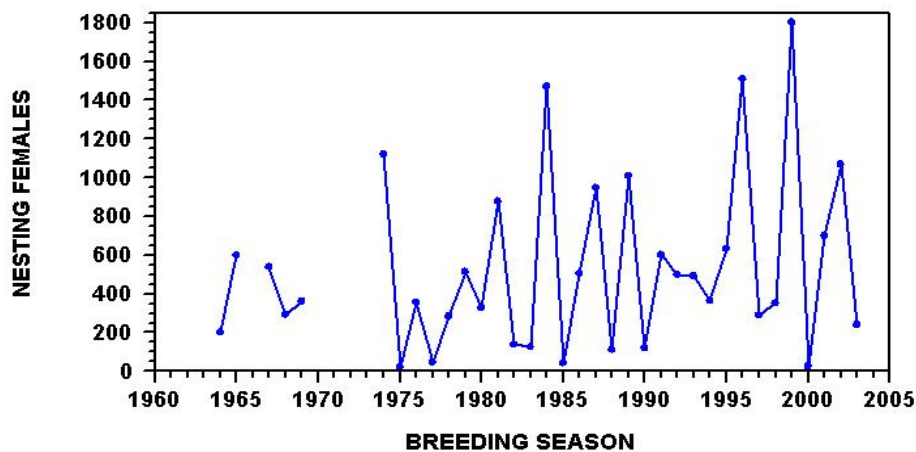


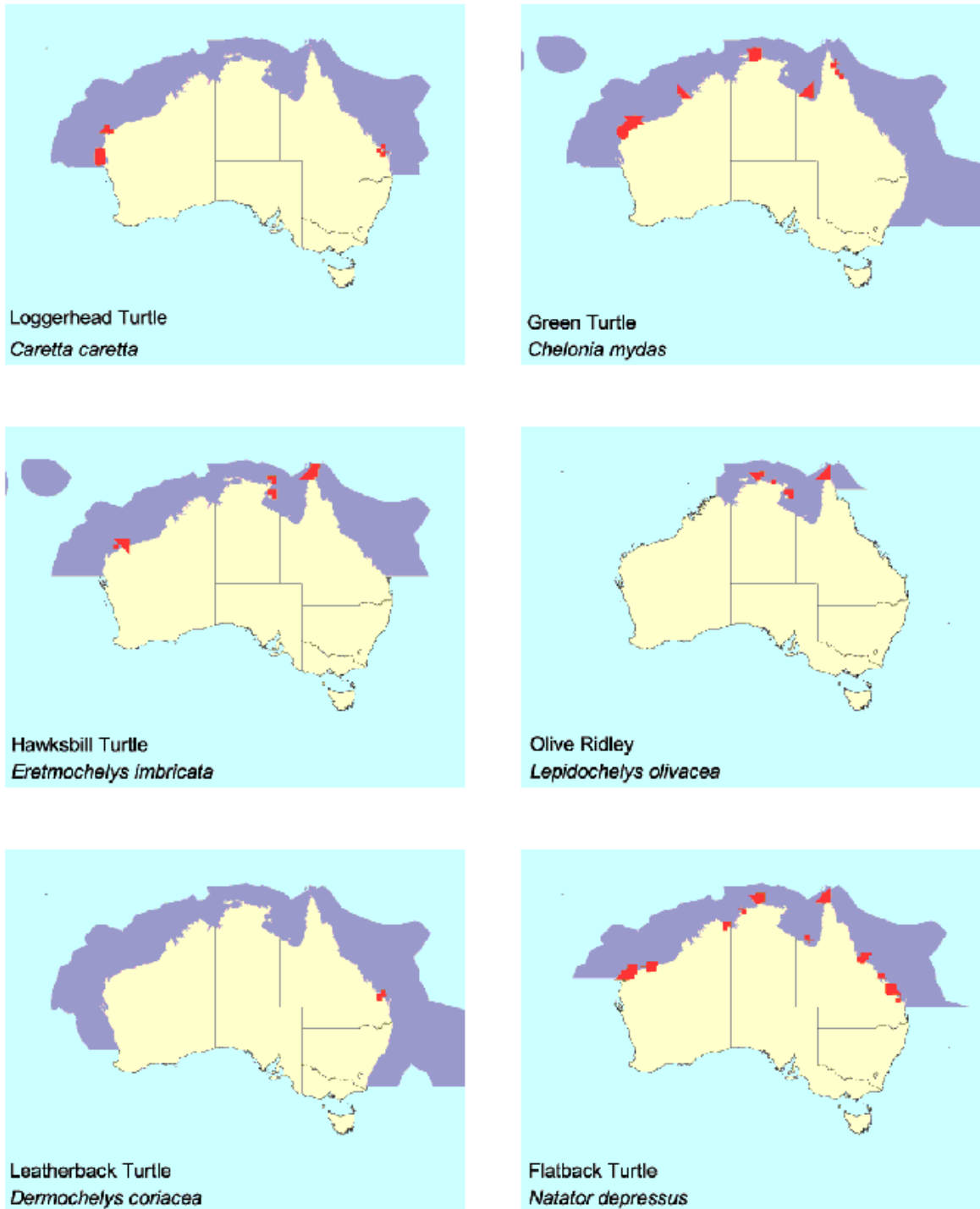
Figure 20: The numbers of nesting green turtles on Heron Island, Queensland⁸⁸.

The distribution of marine turtles in Australia is shown in Figure 21. Note that these maps are incomplete and should include:

- Leatherback turtles occur around the entire coast of Australia and nest on Cobourg Peninsula, NT and in northern NSW;
- Green turtle nesting in the southern Great Barrier Reef and on Groote Eylandt and the north east Arnhem Land coast in the NT;
- Hawksbill turtle nesting on the Kimberly coast, WA.

⁸⁸ Col Limpus, unpublished data

Distribution of Australian Marine Turtles



Source: General distribution as indicated in Cogger, H. (1996). Reptiles and Amphibians of Australia. Reed. Breeding (rookery) distribution based on areas defined by Limpus, C.J. (1995) Conservation of marine turtles in the Indo-Pacific. Draft: 1 October 1995. Report to Australian Nature Conservation Agency; and Wildlife Management Section, Environment Australia and Marine Turtle Recovery Team (1998) Draft Recovery Plan for Marine Turtles in Australia.

Coastline 100K is © Commonwealth of Australia, Geoscience Australia 1990

■ Recorded Breeding Sites
 Distribution within Australian Waters

Projection: Geographics

Map produced by ERIN, Environment Australia, Canberra, July 2003. © Commonwealth of Australia 2003

Figure 21: Distribution of marine turtles in Australia⁸⁹

⁸⁹ <http://www.deh.gov.au/coasts/publications/turtle-recovery/>

Names and Classification of Marine Turtles

Marine turtles belong to two families of reptiles. The scientific classification of marine turtles is as follows:

Class: Reptilia (reptiles)

Order: Testudines

Family: Chelonidae

Species: *Caretta caretta* (Loggerhead turtle)

Chelonia mydas (Green turtle)

Eretmochelys imbricata (Hawksbill turtle)

Lepidochelys olivacea (Olive Ridley turtle)

Natator depressus (Flatback turtle)

Family: Dermochelyidae

Species: *Dermochelys coriacea* (Leatherback turtle)

Differences between the two families of marine turtles are summarised in Table 2.

Table 2: Differences between the six marine turtle species in Australia

Feature	Family Chelonidae	Family: Dermochelyidae
Flippers	Large paddle-like flippers with one or two claws	Large paddle-like flippers without claws
Scutes (horny scales)	Scutes on head, flippers, carapace (back) and plastron (belly)	Scutes only on hatchlings, not on adults
Ribs and bony covering	Ribs are fused (joined) to the bones that form the carapace	Ribs are separate, with a mosaic of polygonal (many-sided) small bones covering the body
Carapace	Flat or rounded without ridges	With pronounced ridges
Upper jaw	No cusps (pointed parts) on upper jaw	Pronounced cusps on upper jaw
Head	Head can be partially withdrawn beneath the carapace	Head cannot be withdrawn beneath the carapace

LOGGERHEAD TURTLE

Description

Loggerhead turtles have a heart-shaped shell (carapace) that is dark brown with reddish and darker brown patches above and has five pairs of scutes (plates) between the centre and outer edge. The underside (plastron) is white, cream or yellow.

Hatchlings are dark brown, with a shell length of 4.4 cm and weigh approximately 19g. The length of an adult carapace is about 92 cm and average adult weights about 113 kg.



Figure 22: Loggerhead turtle⁹⁰

Distribution and populations

Loggerhead turtles live in all tropical, sub-tropical and temperate oceans, including the waters around eastern, northern and western Australia. In Australia, there are two separate breeding populations of Loggerhead turtles. One breeding population nests on beaches on the central coast of Western Australia; the other breeding population nests mostly on beaches in southern Queensland, but some turtles from this population nest on the Swains Reefs about 300km offshore from Queensland in the southern Great Barrier Reef and on beaches on the north coast of New South Wales (see Figure 23). Research studies, in which hatchlings were tagged and then recaptured later as adults, indicate that Loggerhead turtles mature to become nesting adults after about 30 years. Tag recoveries from Loggerhead turtles indicate

⁹⁰ http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/turtles/facts.html

that foraging turtles in the Gulf of Carpentaria belong to the eastern Australian Loggerhead breeding population, while those that are foraging along the Arnhem Land coast belong to the Western Australian Loggerhead breeding population.

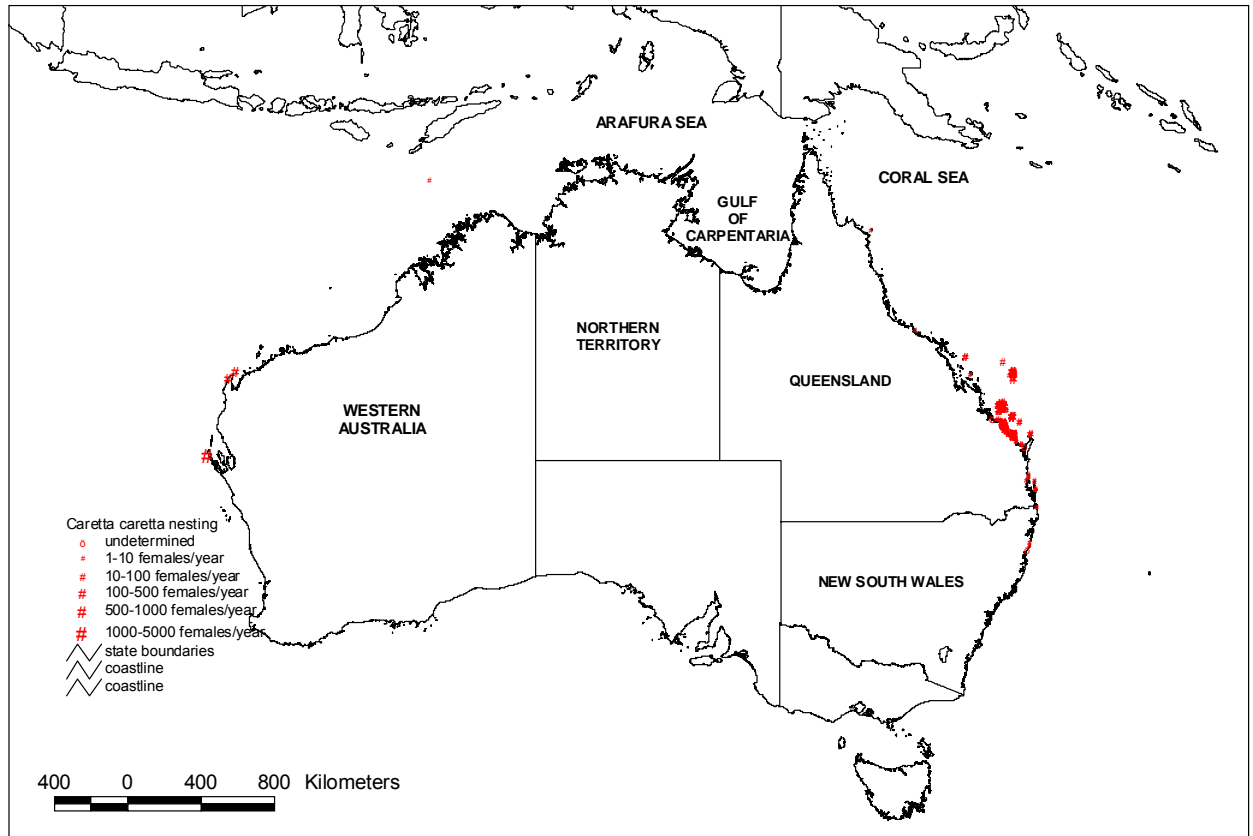


Figure 23: Distribution of Loggerhead turtle nesting in Australia⁹¹

Breeding and life cycle

After entering the water, the hatchlings swim for several days directly out to sea, where they are often found among seaweed and other floating objects. Loggerhead turtles spend about 15 years in the open ocean before they return to Australian waters to feed among soft habitats on the sea floor up to 40m deep. They share their foraging habitats with Olive Ridley turtles and Flatback turtles.

When Loggerhead turtles are ready to breed they return to coastal waters near the beach where they hatched. Mating begins in October and nesting occurs between

⁹¹ Limpus and Chatto (2004)

October and February, with most nesting occurring during December. Hatchlings emerge from nests from December to April.

Females lay approximately three clutches of 125 eggs for the season. Eggs are white and shaped like a ball of about 4 cm diameter and weighing about 36.5 g. The incubation period varies significantly between seasons and is between 45 and 70 days. The time between laying each clutch is about two weeks, during which the females stay within about 10 km of the nesting beach. The period between each nesting season varies from 2 to about 10 years; individual Loggerhead turtles can migrate up to 2,600 km between their foraging areas and their nesting areas, but most travel less than 1000km. Migrations from southern Queensland rookeries to the Northern Territory, Torres Strait, Papua New Guinea, Solomon Islands, New Caledonia and Vanuatu have been recorded.

Feeding

Loggerhead turtles remain carnivorous (eating other animals) throughout their life. Adult Loggerheads feed on a variety of invertebrate animals, such as crabs, shellfish, starfish, and sea cucumbers living on the sea floor. They can burrow into the soft sea floor to find their food.

Indigenous harvest

A small number of large Loggerhead turtles are harvested each year in Torres Strait and along the Papuan coast.

Concerns

For many years, the greatest threat to Loggerhead turtles came from being caught as bycatch in prawn nets. However, since Turtle Excluding Devices (TEDs) were made compulsory on northern Australian prawn vessels, prawn nets are no longer likely to be a significant threat to Loggerhead turtles.

Extensive baiting along the southern Queensland coast over the last 10 years is thought to have reduced the predation by foxes on Loggerhead turtle nests. However, increased coastal development, increased vehicle traffic on nesting

beaches and increased risk from boat strikes are now the major threats to Loggerhead turtles.

The eastern Australian population of Loggerhead turtles has been surveyed for the last 35 years. The number of nesting females has fallen from about 3,500 to about 500 over that time, representing a population decline of about 86%. It is because of this big population decline in just one generation that Loggerhead turtles are listed under the Australian *Environment Protection and Biodiversity Conservation Act* as “endangered”.

Although insufficient information is available to make an accurate assessment of the Western Australian Loggerhead population, researchers have expressed concern about the long term stability of this population. This is because the Western Australian Loggerhead population has been subjected to similar threatening processes as has occurred in eastern Australia, such as bycatch in trawl nets, eggs being eaten by foxes, vehicles driving on nesting beaches and increasing coastal development impacting on nesting beaches.

GREEN TURTLE

Scientific name: *Chelonia mydas* (Family Cheloniidae)

Description

The oval to heart-shaped carapace (shell) of Green turtles is up to 1 metre long, and coloured olive-green, with a mixture of brown, reddish-brown and black. The plastron (belly) is whitish or cream. The carapace has four pairs of scutes (plates) between the centre and outer margin of the shell. Hatchlings are shiny black above, and white below.



Figure 24: Green Turtle⁹²

Distribution and population

Green turtles live in tropical and sub-tropical oceans around the world, and are the most numerous marine turtle in Australian waters. There are seven separate breeding populations of Green turtle in Australia, nesting from the southern Great

⁹² <http://www.cbrentacar.com/Green%20Turtle.jpg>

Barrier Reef in Queensland around the northern Australian coast to Ningaloo in Western Australia (see Figure 25).

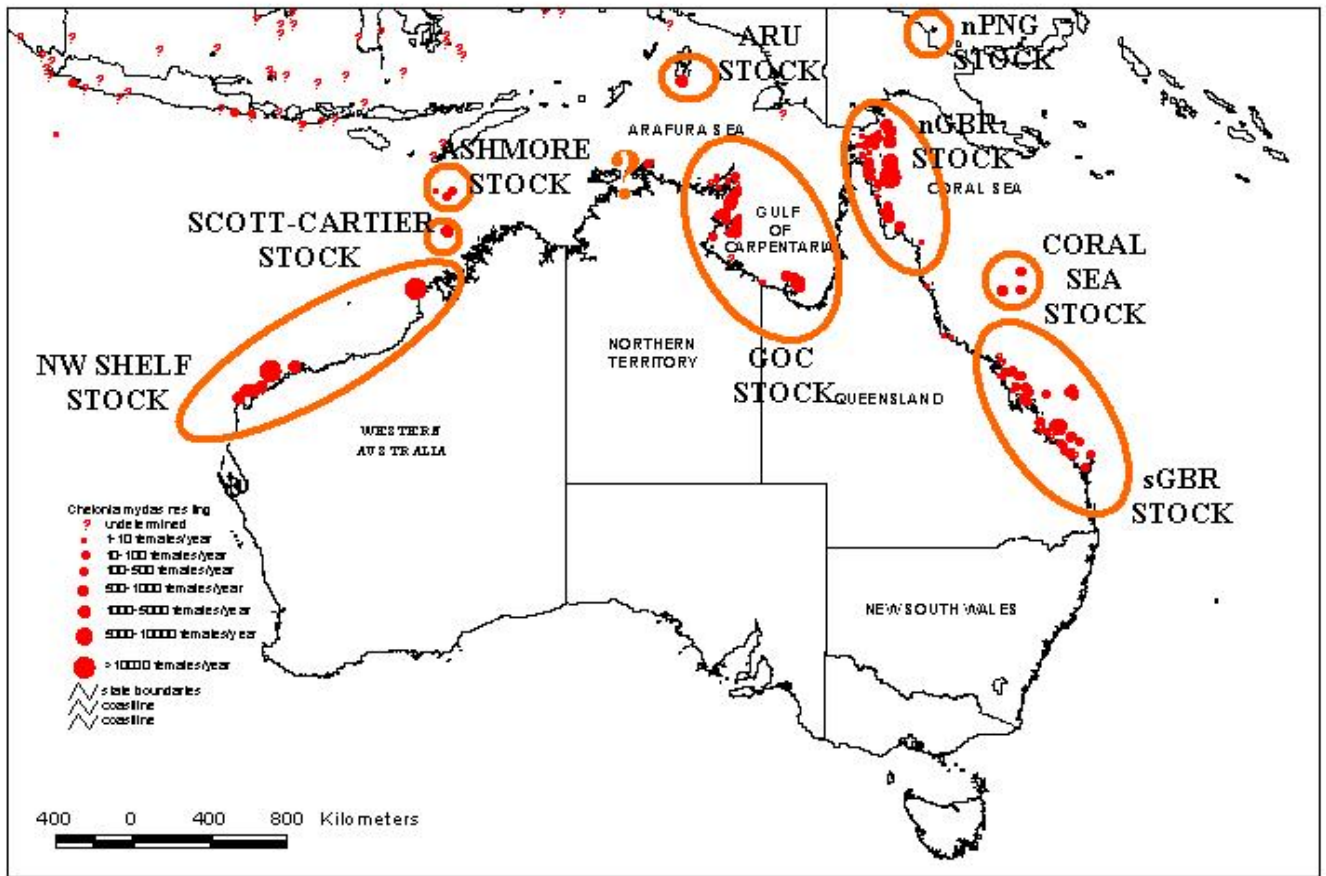


Figure 25: Green turtles breeding populations and nesting locations around northern Australia⁹³

On the east coast of Queensland there are 13 major nesting sites in the southern Great Barrier Reef, including North West Island, Wreck Island, Hoskyn Island, Heron Island, where nesting occurs between late November and January.

The Coral Sea cays host the Coral Sea Islands Territory green turtle stock, with major nesting sites including North East Herald Cay. Nesting occurs between late November and January.

⁹³ Limpus and Chatto (2004)

The northern Great Barrier Reef has five major nesting sites, including Raine Island and nearby cays, as well as Bramble Cay and Murray Island in the Torres Strait. Green turtles from several different breeding populations migrate through Torres Strait at different stages of their lives, making it a critically important habitat for these animals, however the majority of turtles are from the northern Great Barrier Reef breeding stock.

In the southern Gulf of Carpentaria there are three major Green turtle nesting sites within the Wellesley Islands. All these turtles belong to the one breeding population or stock. The large areas of sea grass around the south-west coast of the Gulf of Carpentaria, especially around the Sir Edward Pellew Islands, support large numbers of foraging Green turtles. Tag returns show that some of these turtles travel as far away as southern Queensland and Western Australia to nest, while others nest within the Gulf of Carpentaria. Research undertaken by the Dhimurru Land Management Aboriginal Corporation in Nhulunbuy, in which turtles were fitted with satellite tracking devices, indicate that most (and possibly all) of the Green turtles that nest in north east Arnhem Land remain in the Gulf to feed.⁹⁴

There are Green turtle nesting sites on the north west shelf of Western Australia at the Lacepede Islands, sites north of Broome, and Barrow and the Monte Bello Islands to the south. Green turtles nesting along the Western Australian coast migrate from feeding grounds in Indonesia, western Cape York Peninsula, Northern Territory and Western Australia.

The estimated populations of Green turtles in Australia are summarised in Table 3 below.

Table 3: Estimates of the number of female Green turtles nesting in Australia each year⁹⁵

Breeding area	Estimated annual average number of nesting females
Southern Great Barrier Reef	8,000
Northern Great Barrier Reef	30,000
Southern Gulf of Carpentaria	5,000
Western Australia	20,000

⁹⁴ Kennett et al. (1998)

⁹⁵ <http://www.deh.gov.au/coasts/species/turtles/>

Breeding and life cycle

Female Green turtles lay an average of 5 clutches of eggs per season. Each clutch, laid at intervals of about 14 days, contains about 115 eggs. Green turtle eggs are white balls about 4.4 cm in diameter and weigh approximately 47g. Hatchlings weigh about 25g and have a carapace length of about 5cm.

After leaving their nests, Green turtle hatchlings swim out to sea for at least 24 hours, swimming by day and resting at night. Small juvenile turtles live in the surface waters of the open ocean, but spend less time among seaweed and other floating material than Loggerhead or Hawksbill turtles. Once they grow to between 30 and 40 cm (curved carapace length), which takes about 5 to 7 years, Green turtles begin foraging on the sea floor among habitats containing seagrass or seaweed. These habitats include coral and rocky reefs and seagrass beds close to the coast.

Green turtles take 40-50 years to become mature adults and commence breeding. The timing of the breeding season depends on the nesting location. In the southern Great Barrier Reef, mating begins in October and nesting takes place between October and March, with most nesting occurring in January. A similar nesting season occurs in the northern Great Barrier Reef, but may start earlier and finish later. In the southern Gulf of Carpentaria, nesting occurs all year round with a peak in June and July. In Western Australia, nesting occurs during the summer months.

Green turtles migrate back to their nesting area to breed every 1 to 9 years (average 4 to 6 years), and hence numbers of Green turtles nesting on particular Australian beaches varies considerably from year to year. Figure 20 (page 62) shows the numbers of nesting Green turtles at Heron Island each year over about 40 years.

Migrations between breeding seasons can be up to 2,600 km but average about 400 km. These breeding migrations are linked to the changes in air pressure and water temperature in the Pacific Ocean (measured as the Southern Oscillation Index).

Feeding

Like the other marine turtles, Green turtles feed on small marine animals when they are young, but once they move to their adult foraging grounds Green turtles mainly eat seagrass and seaweed (algae). They also feed on mangrove fruit, jellyfish and sponges.

Indigenous harvest

There are more Green turtles harvested in waters of northern Australia, eastern Indonesia and Papua New Guinea than any other region of the world. There are no accurate counts of the number of Green turtles harvested in this region, but it is estimated to be many tens of thousands, possible as much as 100,000, per year. In Australian waters, many thousands of Green turtles are harvested each year in Torres Strait, the Gulf of Carpentaria, the Top End of the Northern Territory, along the Kimberley coast and along the Queensland east coast (particularly north of Cooktown).

Concerns

Surveys of the two eastern Australian populations of Green turtle since 1974 show that the average size of females nesting for the first time is decreasing, suggesting that these populations may be declining. At Raine Island in the northern Great Barrier Reef, which has the world's largest number of breeding Green turtles in the world, the success of nesting is less than 10% and may have failed completely in recent years because of flooding of the nests. As a result of this nesting failure, populations of Green turtles in northern Great Barrier Reef and Torres Strait can be expected to continue to decline over the next few decades.

There is no long term survey information about the breeding populations of Green turtles in the Gulf of Carpentaria, Northern Territory and Western Australia, however some Traditional Owners in north-east Arnhem Land have expressed concern about a reduction in turtle numbers.

HAWKSBILL TURTLE

Scientific name: *Eretmochelys imbricata*

Description

Hawksbill turtle hatchlings are brown to black on top and light coloured below. They are about four cm long (carapace length) and weigh around 13 - 14g. Adult Hawksbill turtles have an olive-green or brown shell (carapace) with reddish brown, brown or black markings. The shell is high-domed, heart-shaped with overlapping scales. The underside (plastron) is cream to yellowish. Adult female Hawksbill turtles weigh about 50 kg and have a curved carapace length of about 82 cm.



Figure 26: Hawksbill turtle⁹⁶

Distribution and population

Hawksbill turtles live in tropical, subtropical and temperate oceans around the world, though nesting mostly takes place only on tropical beaches. There are probably three separate breeding populations of Hawksbill turtles in Australia (see Figure 27). One population nests on beaches in the northern Great Barrier Reef and in Torres

⁹⁶ Copyright Caroline Rogers 2005

Strait; another population nests on the western side of the Gulf of Carpentaria and a third populations nests along the Arnhem Land coast. The other breeding population nests on islands on the north-west shelf of Western Australia.

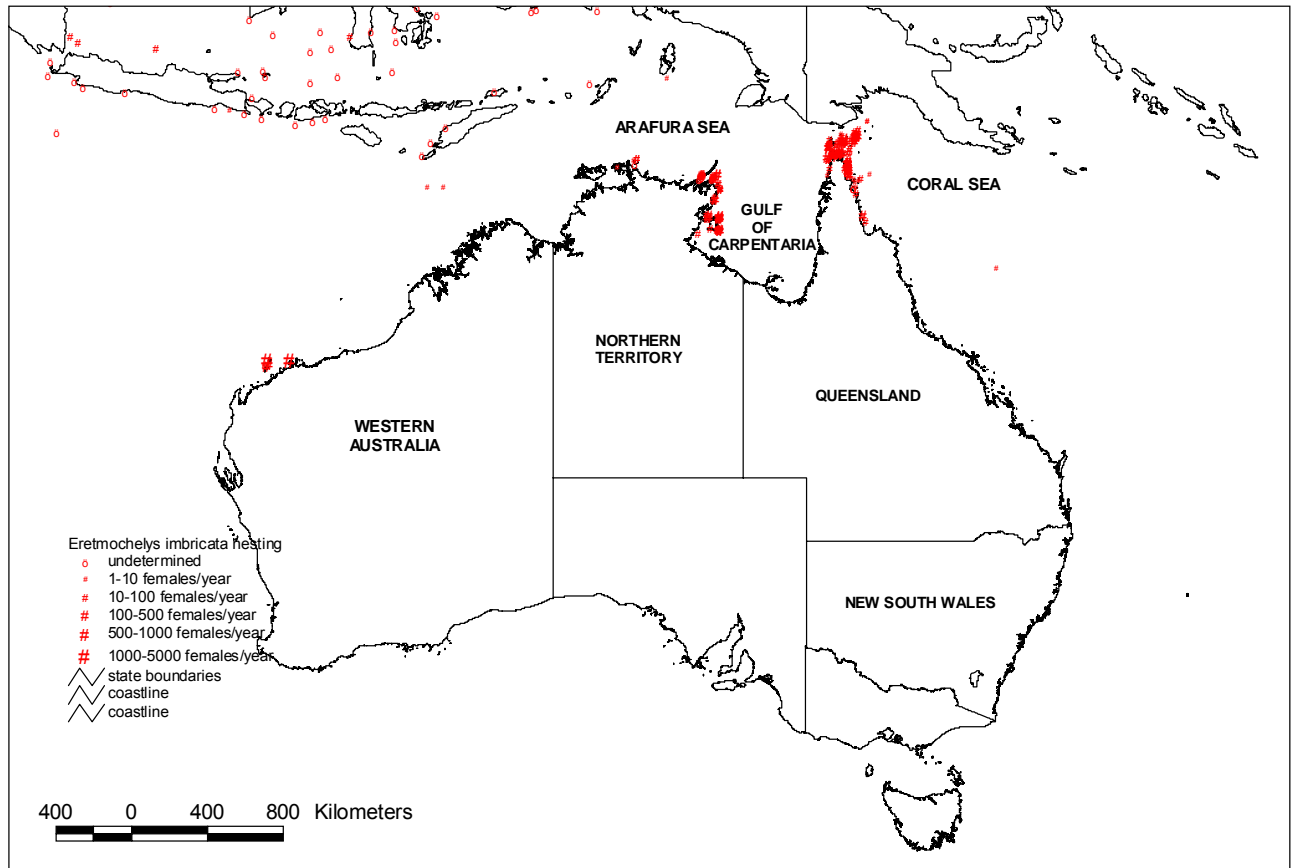


Figure 27: Hawksbill turtle nesting distribution in Australia⁹⁷

Researchers’ estimates of nesting females Hawksbill turtles in Australia are shown in Table 4.

Table 4: Estimates of females Hawksbill turtles nesting in Australia each year⁹⁸

Nesting area	Estimated annual average number of nesting females
Northern Great Barrier Reef and Torres Strait	4,000
Arnhem Land	1,000
Western Australia	1,000 to 2,000

⁹⁷ Limpus and Chatto (2004)

⁹⁸ <http://www.deh.gov.au/coasts/species/turtles/>

Breeding and life cycle

After hatchlings leave the nest they enter the water and swim for several days directly out to sea. They spend from five to ten years on the water surface being carried by ocean currents. Hawksbill turtles grow slowly and take at least 30 - 35 years to become mature adults.

Research has shown that Hawksbill turtles can migrate up to 2,400 km between their foraging and nesting locations. Females nesting in the northern Great Barrier Reef migrate as far as the Solomon Islands, Papua New Guinea and Indonesia (see Figure 28). However most turtles probably only migrate less than 100km between their home foraging and breeding areas.

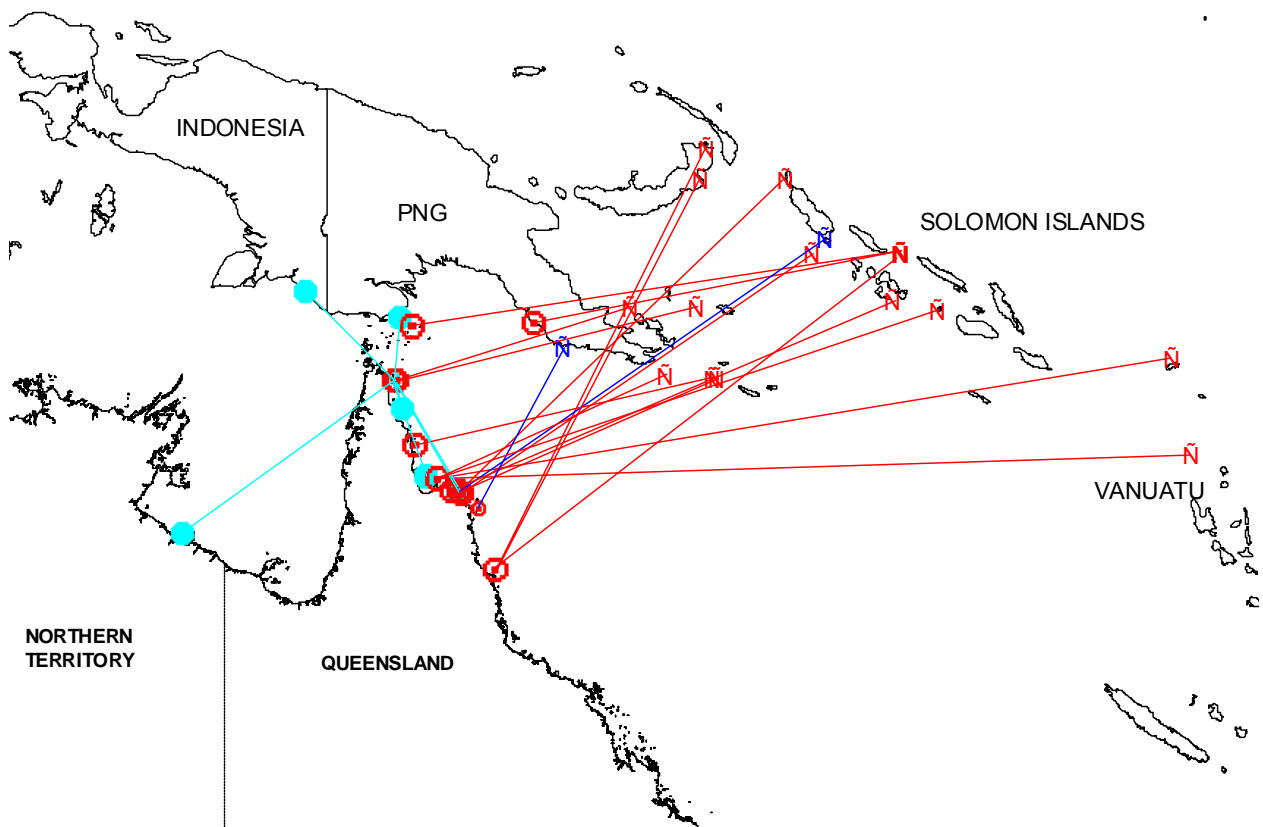


Figure 28: Migration of Hawksbill turtles from nesting beaches in north Qld.⁹⁹

Breeding migration captures of hawksbill turtles from the Coral Sea region. N = breeding site; dot = foraging site for a turtle breeding in Australia; open circle = foraging site for a turtle breeding internationally.

⁹⁹ Limpus and Chatto (2004)

Hawksbill turtle nesting takes place between January and April in the northern Great Barrier Reef and Torres Strait, in the second half of the year in the Northern Territory and all year round (mainly between October and January) in Western Australia.

Female Hawksbill turtles lay between 1 and 6 clutches of eggs each year, with about 120 eggs in each clutch. The clutches are laid about 14 days apart, and each mature female nests every two to five years.

Feeding

Hawksbill hatchlings feed on very small (planktonic) plants and animals floating in the ocean. When they grow to between 30 and 40 cm (curved carapace length) they begin feeding among coral and rocky reef habitats on the sea floor. Juvenile and adults Hawksbill turtles eat a variety of marine plants and animals, particularly algae, seagrass, sponges and shellfish.

Indigenous harvest

There are only small a number of Hawksbill turtles harvested across northern Australia. Hawksbill eggs, however, are harvested by Aboriginal and Torres Strait and communities across the north. As Hawksbills usually nest on islands, it may be particularly important to ensure that the Indigenous harvest in Torres Strait is sustainable.

Concerns

Researchers have identified the threats to survival of Hawksbill turtles include international harvest of immature and adult turtles for tortoiseshell, unsustainable Indigenous harvest of adults and eggs both within Australia and overseas, predation of eggs at nesting beaches by feral animals, ingestion of synthetic materials, boat strike, entanglement in commercial fisheries gear (including ghost nets) and increased incidence of disease.

Numbers of Hawksbill turtles have declined in other countries; Australia probably now has the largest breeding populations in the world. The only Hawksbill turtle nesting population for which there is sufficient information, at Milman Island (northern Great Barrier Reef), indicates a downward trend.

OLIVE RIDLEY TURTLE

Scientific name: *Lepidochelys olivacea*

Description

Olive Ridley turtle hatchlings are blackish brown in colour with a shell about 4 cm long. The shell of adult Olive Ridley turtles is olive-grey and there are five pairs or more of scales between the centre and outer edge of the shell. Adults weigh about 40 kg, with a curved carapace length of about 70 cm and are the smallest marine turtle in Australia.

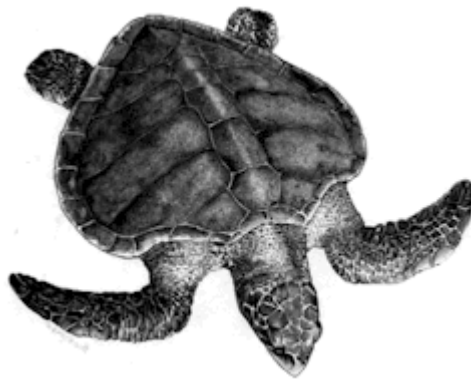


Figure 29: Olive Ridley turtle¹⁰⁰

Distribution and population

Olive Ridley turtles are the most abundant species of marine turtle in the tropical and subtropical oceans waters throughout the world; however they are one of the least common species of marine turtles in Australia. Olive Ridley turtles nest in low numbers on Melville Island and along the coast of Arnhem Land, in the Gulf of Carpentaria and on the north-west coast of Cape York Peninsula (see Figure 30). There are probably only several thousand Olive Ridley turtles living in Australian waters.

Large nesting populations are found in the eastern Pacific and in India, and low density nesting occurs in Papua New Guinea and Indonesia, but the biggest nesting populations are in the eastern Pacific Ocean and south-east Asia. On the coasts of

¹⁰⁰ www.gbrmpa.gov.au/corp_site/info_services/publications/turtle_conservation/images/turtle_olive_ridley.gif

Central America, South America and India, Olive Ridley turtles come together in large nesting aggregations (known as “Arribadas”) of up to 600,000 animals.

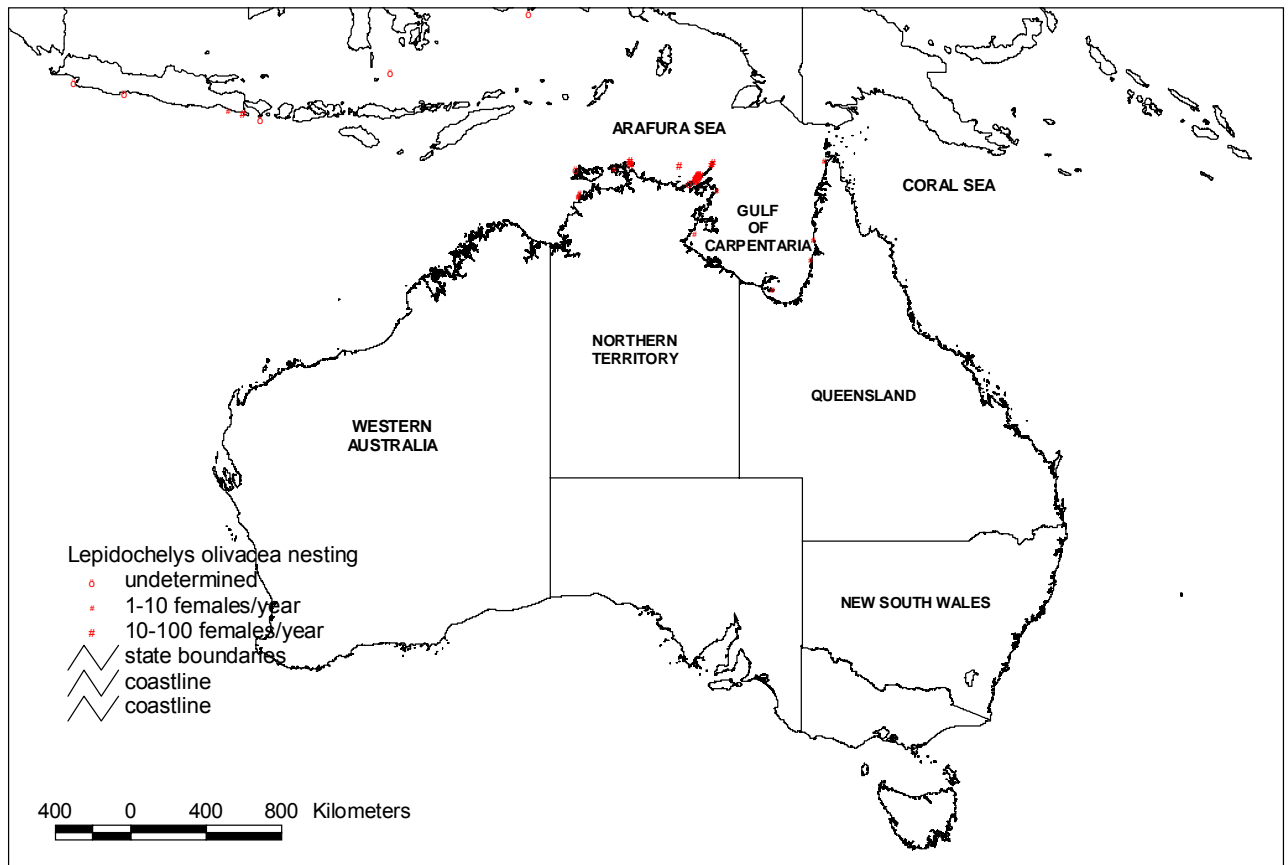


Figure 30: Nesting distribution of Olive Ridley turtles in Australia¹⁰¹

Breeding and life cycle

Olive Ridley turtles mainly breed between May and August in northern Australia. Females usually lay one or two clutches of about 100 eggs per year, but may lay up to 8 clutches in a season. The period between laying each clutch varies between 17 and 45 days.

Very little is known about where the hatchlings go after entering the sea. It is likely that the young turtles drift in the surface waters of the open ocean. Large juvenile and adult Olive Ridley turtles feed both on the sea floor and in the water between

¹⁰¹ Limpus and Chatto (2004)

about 10 and 40 metres, and are rarely seen in shallow waters. Olive Ridley turtles are known to migrate up to 2,600 km between nesting and foraging habitats.

Four Olive Ridley turtles were tracked by satellite for several months during 2005, having been released from the Wessel Islands in northeast Arnhem Land with radio transmitters attached to them. The research involved collaboration between Gumurr Marthakal Rangers, the Northern Land Council and Charles Darwin University¹⁰². By the time the transmitters stopped sending information one turtle was well on her way to the Kimberley region of Western Australia, one was near Aru Island (Indonesia), another was near Groote Eylandt while the fourth was mid-way between Wessel Islands and Aru Island (see Figure 31). The deepest dive recorded for all 4 turtles was 140 metres, and the longest dive was 200 minutes. However, most turtles dived regularly to about 90 - 100 metres, seemingly feeding off the bottom. The animal that spent all its time off Groote Island was in shallower water and dived mostly to 50-60 metres.

Feeding

Little is known about what hatchling Olive Ridley turtles eat. Studies on adult Olive Ridley turtles in Australia show that they mainly eat shellfish. Studies in other countries show that Olive Ridley turtles also eat crabs, shrimps, jellyfish and algae.

Indigenous harvest

An unknown number of Olive Ridley turtles and eggs are harvested across northern Australia.

Concerns

Hundreds of Olive Ridley turtles were killed in prawn trawl nets around northern Australia each year until Turtle Excluding Devices (TEDs) were introduced several years ago. Although TEDs now largely prevent turtles dying in prawn nets, the loss of so many turtles in the past will have an impact on the Olive Ridley population for many decades in the future.

¹⁰² Satellite tracking information provided by Corey Bradshaw, Charles Darwin University

It is not known what impact gill nets have on Olive Ridley turtles. However, over 200 Olive Ridley turtles were killed in a set shark net in Fog Bay in the Northern Territory in 1990. Abandoned fishing nets (ghost nets) that are washed up on beaches and then float back out to sea are known to kill Olive Ridley turtles. About 400 marine turtles, a large proportion of which are Olive Ridley turtles, are killed each year in these nets in the Gulf of Carpentaria. Feral pig predation is a threat to the Olive Ridley turtle population that nests along the western Cape York Peninsula coast.

Populations of Olive Ridley turtles are declining around the world and some formerly large Arribadas (breeding aggregations) are now reduced to several hundred nesting females.

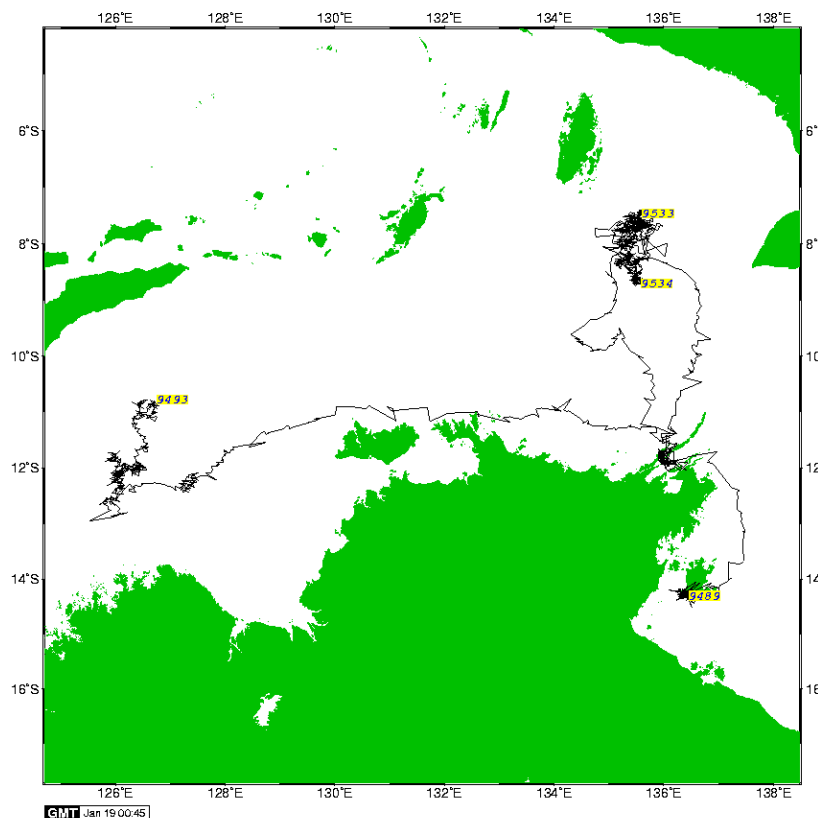


Figure 31: Satellite tracking map of Olive Ridley turtles released in NE Arnhemland¹⁰³

¹⁰³ Map courtesy of Corey Bradshaw, Charles Darwin University

FLATBACK TURTLE

Scientific Name: *Natator depressus*

Description

Flatback turtle hatchlings are olive-green with scales outlined in black; their carapace is about 6 cm long and they weigh about 43 g. The carapace of Flatback turtles is upturned at its edges, fleshy, low-domed and grey, pale grey-green or olive in colour. The curved carapace length of adult females is about 92 cm. The turtles have upturned edges to their carapace.



Figure 32: Flatback turtle¹⁰⁴

Distribution and population

Flatback turtles live only in the tropical seas around northern Australia, Papua New Guinea and West Papua. In Australia, there are two breeding populations of Flatback turtles. One population nests on beaches in the southern Great Barrier Reef; the other breeding population nests in Torres Strait, the Gulf of Carpentaria, along the Northern Territory coast and along the north-west coast of Western Australia (see Fig 33).

The main nesting sites for Flatback turtles are show in Table 5.

¹⁰⁴ Photo courtesy Chloe Schauble

Table 5: Main nesting sites for Flatback turtles in Australia¹⁰⁵

Region	Nesting sites
Southern Great Barrier Reef	Peak Island Wild Duck Island Avoid Island Curtis Island Facing Island
Torres Strait and northern Gulf of Carpentaria	Crab Island *largest in the world Deliverance Island Kerr Island Mainland beaches
Southern Gulf of Carpentaria	Wellesley Islands Sir Edward Pellew Islands
Northern Territory Top End	Cobourg Peninsula Greenhill Island Field Island McCluer Island Bare Sand Cay, Fog Bay
Kimberley Region and North-west Shelf	Cape Drommit Lacrosse Island Barrow Island Cape Thouin

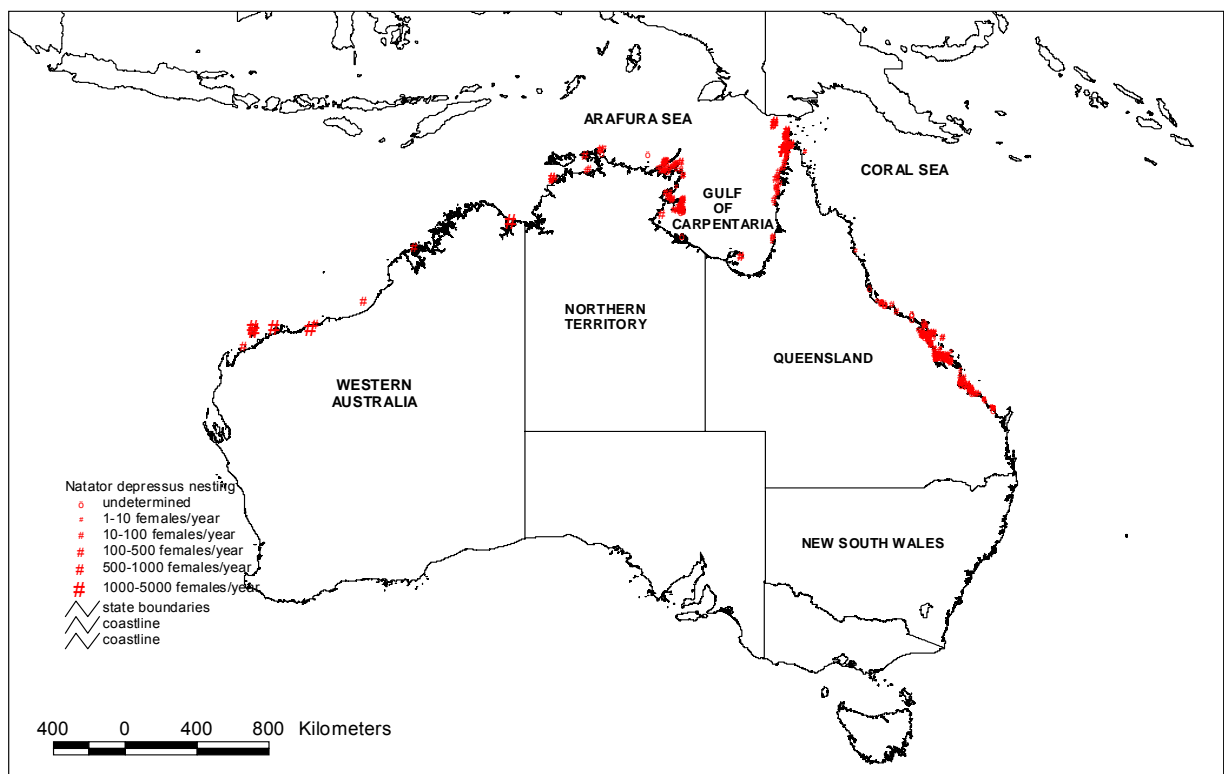


Figure 33: Distribution of Flatback turtle nesting Australia¹⁰⁶

¹⁰⁵ <http://www.deh.gov.au/coasts/species/turtles/>

¹⁰⁶ Limpus and Chatto (2004)

Breeding and life cycle

Unlike other marine turtles, Flatback turtles do not travel long distances out to sea from their nesting beaches. They remain in the surface waters over the continental shelf but do migrate long distances within coastal waters – e.g. from Papua New Guinea to southern Queensland. Adult Flatback turtles forage in coastal waters around northern Australia, Papua New Guinea and West Papua (see Figure 34). Nesting Flatback turtles tagged in southern Queensland have been recaptured between 216 and 1300 km from their nesting beach. They lay eggs the size of billiard balls and hence lay fewer eggs in each clutch (only about 50). They lay 2-3 clutches per season.

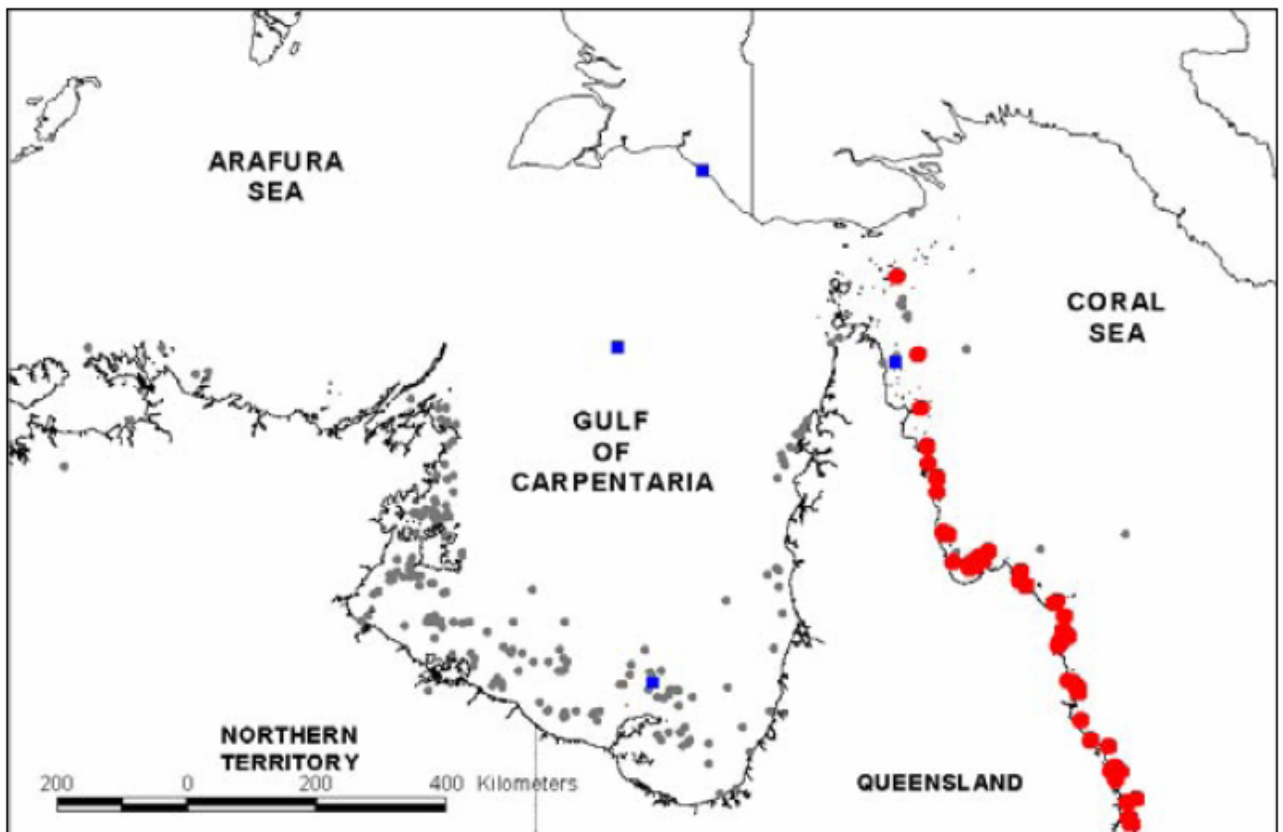


Figure 34: Foraging areas of Flatback turtles in north-eastern Australia¹⁰⁷

- Large dots: Flatback from mid-eastern Queensland breeding stock;
- Squares: Flatbacks from Gulf of Carpentaria nesting populations;
- Small dot: Flatbacks caught in trawl and gill nets, unknown breeding stock.

Surveys in the southern Great Barrier Reef indicate that Flatback turtle numbers have been stable in this region over the last 30 years. There is no data to indicate if Flatbacks in the rest of northern Australia are stable or decreasing.

¹⁰⁷ Modified from Limpus and Chatto (2004)

Flatback turtles begin mating in the southern Great Barrier Reef in October and nest between October and January; in northern Australia Flatback turtles mostly nest between June and August. In the Pilbara region of Western Australia most nesting takes place during the summer, and in the Kimberley nesting occurs in the middle of the year.

Adult Flatback turtles breed once every one to five years. Females lay clutches of about 50 eggs, usually two or three times each year, about 15 days apart.

Feeding

Juvenile Flatback turtles eat shellfish, squid and jellyfish. Adult Flatback turtles are known to forage soft-bottom habitats and eat cuttlefish, hydroids, soft corals, crinoids, shellfish and jellyfish.

Indigenous harvest

Unknown numbers of Flatback turtles and eggs are harvested annually across northern Australia.

Concerns

Hundreds of Flatback turtles were killed in prawn trawl nets around northern Australia each year until the Turtle Excluding Devices (TEDs) were introduced several years ago. Although TEDs now largely prevent turtles dying in prawn nets, the loss of so many turtles in the past will have an impact on the Flatback turtle population for many decades into the future. Flatback turtles are still caught in trawl nets in neighbouring countries, such as Indonesia and Papua New Guinea.

Abandoned fishing nets (ghost nets) that are washed up on beaches and then float back out to sea are known to kill Flatback turtles, though fewer Flatbacks are caught in ghost nets than Greens, Hawksbills or Olive Rидleys.

Other threats to Flatback turtle populations include feral pig predation on eggs, and damage caused by vehicles driving on nesting beaches. Researchers have expressed concern that unsustainable levels of egg harvesting by Indigenous people may result in a decline in Flatback turtle numbers.

LEATHERBACK TURTLE

Scientific name: *Dermochelys coriacea*

Description

Leatherback turtles are the largest of all sea turtles, reaching an average length of 1.6 metres. The carapace is black and leathery with pale spots but without scales; there are prominent ridges running the length of the shell. Leatherback turtles can use changes in blood flow to regulate their temperature, maintaining their temperature in cold water and avoiding overheating in warm water. The pale spots turn pinkish when the turtle is out of the water as blood flows to the surface of the skin to cool the body.



Figure 35: Leatherback turtle¹⁰⁸

Distribution and population

Leatherback turtles live in all tropical, sub-tropical and temperate oceans of the world, but nest mainly on tropical beaches. Leatherback turtles are more widely distributed than any other marine turtle (see Figure 36). Their large size and ability to keep their body temperature higher than the surrounding water enables them to forage in colder and deeper waters than other marine turtles.

¹⁰⁸ <http://seamap.env.duke.edu/seamap/species/images/leatherback-turtle-106.jpg>

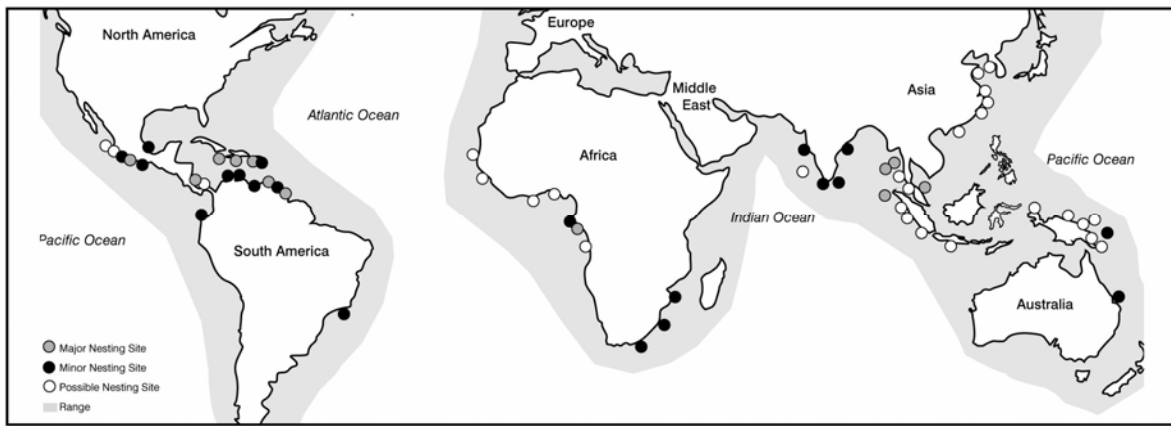


Figure 36: World distribution of Leatherback nesting sites¹⁰⁹

Leatherback turtles feed in coastal waters around the whole of Australia, but nest in only a few locations along the northern coast of the Northern Territory. The number of Leatherback turtles appears to be declining in the Pacific Ocean, suggesting that the population of leatherbacks along the eastern Australian coast may also be declining¹¹⁰. Nesting populations of Leatherback turtles are declining in some parts of the world, such as Malaysia, and rising in other parts, such as South Africa. Nesting and foraging locations for Leatherback turtles in northern Australian are shown in Figure 37

Breeding and life cycle

Leatherback hatchlings swim out to sea after leaving their nesting beach. Little is known about the movement of leatherback turtles. They take about 15 to 20 years to become mature adults, which is ten or twenty years less than for other marine turtles.

Female Leatherback turtles in other parts of the world nest every two or three years during December and January, and lay between 4 to 5 clutches per season, each clutch with between 64 and 100 eggs. The time between laying each clutch is about 9 days. The eggs are white and spherical with a diameter of about 5.3 cm. The eggs hatch after 63 to 93 days.

¹⁰⁹ Modified from www.ccturtle.org/leatherback.htm

¹¹⁰ Spotila et al. (2000)

Some Leatherback turtles feeding in Australian coastal waters probably migrate to neighbouring countries to the north to nest.

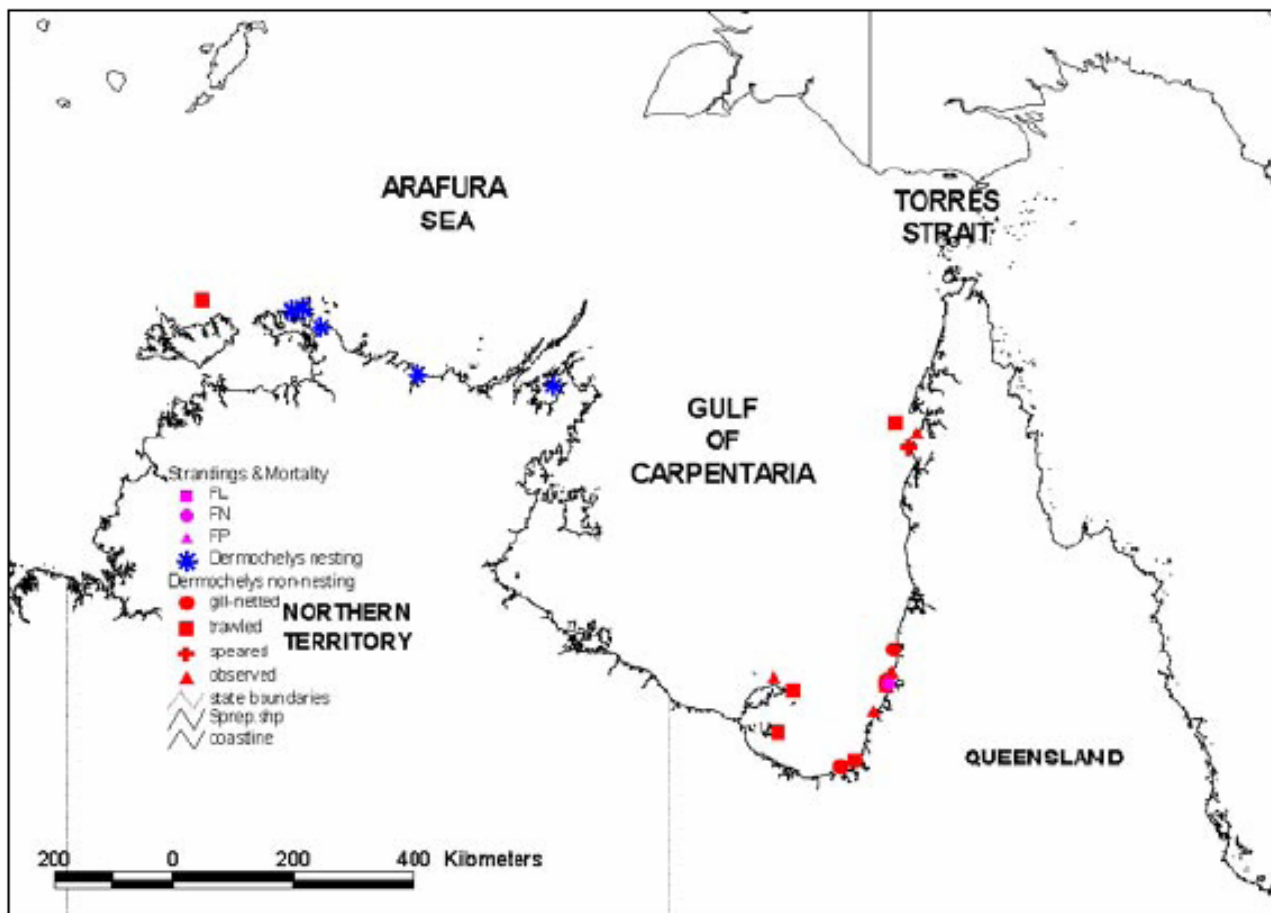


Figure 37: Leatherback turtle nesting and foraging locations in northern Australia¹¹¹

Feeding

The diet of Leatherback hatchlings and juveniles is not known. Adult Leatherbacks feed on jellyfish, salps and squid on the ocean surface and down to depths of 200 metres.

Indigenous harvest

Leatherback turtles are rarely hunted in Australia.

Concerns

Recent reports of a significant decline in the populations of Leatherback turtles in the Pacific Ocean raises concerns for the species in Australian waters. Leatherback

¹¹¹ Limpus and Chatto (2004)

turtles have also been found entangled in marine debris, including fishing lines and nets in many parts of the world including Australia.

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Part 3

PROTECTING AND MANAGING DUGONGS AND MARINE TURTLES

Introduction¹¹²

This Part summarises measures undertaken by Indigenous groups, government agencies and international organisations to protect and manage dugongs and marine turtles in Australia, including:

- Management agreements, programs and partnerships undertaken by Indigenous organisations;
- Legislative protection;
- Declared conservation status;
- Government agency management programs.

Indigenous initiatives in northern Australia

Management of dugongs and marine turtles occurs as part of Indigenous peoples' role in sea country management. Though Indigenous cultures differ from region to region, traditional Indigenous management of sea country and marine resources includes the following features¹¹³:

- Control of access into coastal marine estates;
- Seasonal use of resources, often governed by ecological indicators (such as the flowering of particular plant species);
- Conduct of increase ceremonies to nurture the well-being of particular species;
- Restrictions imposed on individuals based on age, gender, initiation status, moiety and other cultural factors.

Many aspects of Indigenous marine resource management continue today, though there are constraints on how they are implemented due to:

¹¹² Information presented on the protection and management of dugongs in Australia is derived largely from: Marsh et al. (2002) and Havemann et al. (2005); information presented on the protection and management of marine turtles in Australia is derived largely from Limpus and Chatto (2004) and Dobbs (2005); other information sources are indicated by footnotes.

¹¹³ Smyth (1997)

- Lack of recognition of Aboriginal and Torres Strait Islander authority over local marine estates and marine resources;
- Competition from commercial and recreational fishers and other marine resource stakeholders;
- Declining knowledge of traditional management practices and protocols among some younger Indigenous people;
- Changing social and economic conditions, including the relocation of coastal Indigenous groups to large communities, some of which are inland.

Nevertheless, in all coastal regions of Australia Indigenous groups have developed a variety of initiatives to continue or regain their involvement in marine resource and environmental management in ways that give contemporary expression to their inherited rights and obligations to sea country. These initiatives often occur in partnership with government agencies, research institutions and others.

The following examples of Indigenous initiatives in marine resource management are extracted from a recent review of Aboriginal connections to Sea Country across northern Australia¹¹⁴ and other sources as indicated.

Agreement between neighbouring Traditional Owner groups

Traditional Owners of neighbouring sea country estates across much of northern Australia continue to recognise their respective authority, particularly by seeking permission before entering each other's areas. Recognition of customary authority over sea country also typically includes sharing some of the resources harvested with the Traditional Owners of the sea country from which the resources are obtained. The recognition and exercise of customary authority within Aboriginal communities has not been lost as a result of the application of Australian common law principles of open access to the sea, as the following quotes from Traditional Owners of the Wellesley Islands indicate:

*We have rules about permission for travelling on people's country. If people see strange people around their country there may be a tribal fight. You have to get their permission first.*¹¹⁵

In Yangkaal law if you go hunting in someone else's country then you should come back and share with Dulmada people..... The sea is part of our country

¹¹⁴ National Oceans Office (2004)

¹¹⁵ Statement by Vernon Kelly in Wellesley Islands Native Title Sea Claim

*so the same rules apply. Same for Lardil sea. If you want to fish in that area, you have to get permission from Dulmada. It is the same again in the Gangalidda sea.*¹¹⁶

*A person does the wrong thing if they go to Barardkiya without asking. They cannot go fishing or hunting without asking. That's the same whether they are Lardil, Garawa, Gangalidda or a whitefella..... We usually do not have any problem with people going to our country without asking. Most people know they have to ask. When they ask we let them go fishing. We also make people who fish in our country give us some of the catch. It would be wrong in our law if they didn't. We call it wanangalkara. It means "don't share tucker".*¹¹⁷

Strategic planning by Traditional Owners of sea country

Over the last decade, some Traditional Owner groups have taken strategic action on a regional scale to assert their interests in the management of sea country environments and resources. In 1994 Yolngu Traditional Owners of sea country of north east Arnhem Land released an Indigenous Marine Protection Strategy for Manbuynga ga Rulyapa (Arafura Sea)¹¹⁸ based on Yolngu customary law, which would allow Yolngu to progressively resume responsibility for various levels of management control over their sea country, including management of dugongs and marine turtles. The area covered by the strategy includes waters of the Arafura Sea and Gulf of Carpentaria extending from Maningrida in Central Arnhem Land to Numbulwar on the western shore of the Gulf, and extending northwards into international waters. This strategic approach provides a framework for addressing saltwater management issues in the region, but it does not diminish the need to recognise the authority of Traditional Owners to decide and negotiate on issues relating to their saltwater country, rights and interests.

More recently, the establishment of the North Australian Indigenous Land and Sea Management Alliance (NAILSMA) is developing strategic approaches to Indigenous land, sea and natural resource management across all of northern Australia, from

¹¹⁶ Statement by Nelson Gavenor in Wellesley Islands Native Title Sea Claim

¹¹⁷ Statement by Nelson Gavenor in Wellesley Islands Native Title Sea Claim Joseph Watt

¹¹⁸ Ginitjirranj Mala (1994)

the Kimberley to Cape York Peninsula. NAILSMA is currently engaged in implementing a Natural Heritage Trust (NHT) funded \$3.8 million community-based dugong and marine turtle management project¹¹⁹ across northern Australia, in partnership with the Kimberley Land Council, Northern Land Council, Carpentaria Land Council Aboriginal Corporation, Balkanu Cape York Development Aboriginal Corporation and the Torres Strait Regional Authority, each of which has developed their own Dugong and Marine Turtle Regional Activity Plan.

A 'sister' project to the NAILSMA project is the Carpentaria Ghost Nets Programme (CGNP) in which coastal Indigenous communities around the Gulf of Carpentaria are working together to address the major problem of abandoned (mostly foreign) fishing gear especially ghost nets. Activities include surveys, beach cleanups and research to better understand the entry and movement of discarded nets into the sea; as well as working with governments on international solutions to the problem. The CGNP is funded by the NHT (\$2 million) and is coordinated by the Northern Gulf Resource Management Group.

Aboriginal land and sea management agencies

Northern Territory

Formal Aboriginal involvement in land and sea management through the training and employment of Community Rangers, and the associated establishment of dedicated Aboriginal land and sea management agencies, initially developed in several locations in Queensland and the Northern Territory in the mid 1980s. These agencies are Aboriginal organisations, linked administratively to elected Community Councils or as independent, Traditional Owner based organisations, established to protect and manage the environment, resources and cultural values of Aboriginal land and sea over a defined area. Having begun with little government support or recognition, in some locations these agencies have developed into well established organisations with considerable expertise in planning, geographic information systems, research, training and management and have developed constructive partnerships with research, government and commercial organisations. In some coastal communities where formal land and sea management agencies have not been established, Community Rangers are employed directly by the Community Councils to undertake land and sea country management work. There are now

¹¹⁹ http://savanna.ntu.edu.au/publications/savanna_links30/locals_say_in_dugon.html

about 30 Aboriginal land and sea management agencies in the Northern Territory (see Figure 38).

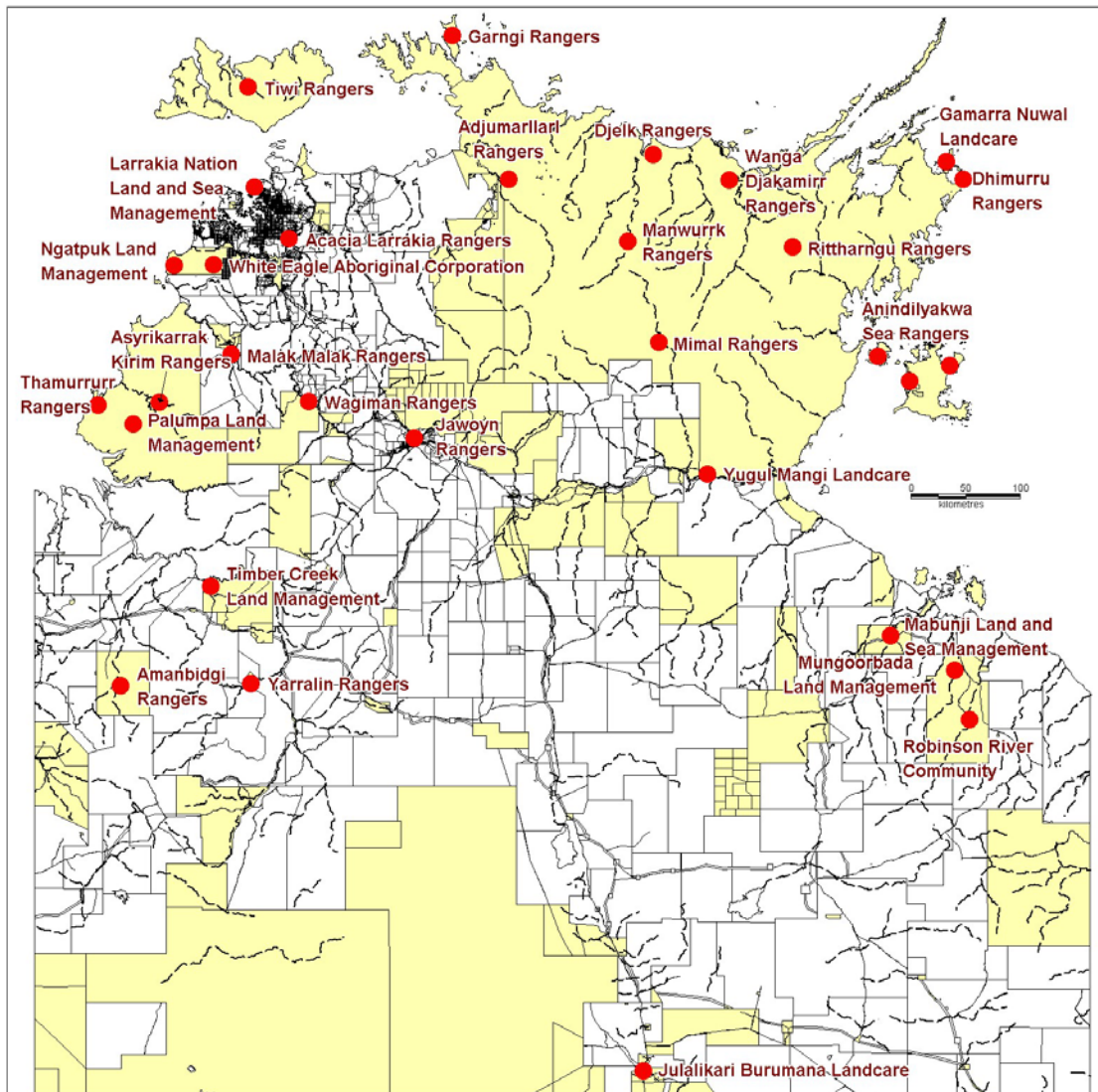


Figure 38: Location of Aboriginal land and sea management agencies in the NT¹²⁰

Dhimurru Land Management Aboriginal Corporation

Dhimurru Land Management Aboriginal Corporation is one example of the Aboriginal land and sea management agencies referred to above. It was established by Yolngu Traditional owners in 1992 in response to the growing impact on Aboriginal land and sea country of the town Nhulunbuy and associated mining and shipping activities. Initially focusing on managing recreational access of Nhulunbuy residents and visitors to Aboriginal land surrounding the town, Dhimurru gradually developed its capacity to engage in strategic planning on land and sea, while also developing

¹²⁰ Storrs et al. (2003)

credibility and partnerships with government and other organisations. This development has been driven by a dual determination to maintain Traditional Owners' rights to manage country, while seeking every opportunity to develop productive partnerships with outside agencies. Key operational issues for Dhimurru include monitoring and addressing the impact of visitor activities on cultural and natural resources in the recreation areas, fostering collaborative research and management partnerships and promoting the role of traditional ecological knowledge in contemporary conservation resource management. The Dhimurru logo is shown in Figure 39



Figure 39: The Dhimurru logo symbolises the two moieties (the black cockatoo represents the Dhuwa moiety and the white cockatoo the Yirritja moiety), encircled by a stem of a coastal ground creeping plant known as *rowu* (*Ipomoea pes-caprae*). This plant represents the unity of the clan groups working together¹²¹.

One of the significant outcomes of this approach was the declaration of an Indigenous Protected Area (IPA) over approximately 101,000 ha of land and sea country on the northeast tip of Arnhem Land, funded initially under the Commonwealth Government's Indigenous Protected Area Program. The Dhimurru IPA is recognised by the Commonwealth Government as part of the National Reserve System of protected areas. The voluntary establishment of the IPA can be seen as an expression of Traditional Owners' desire to achieve good management outcomes, while still maintaining their struggle for more comprehensive recognition of their rights to sea country.

¹²¹ <http://members.octa4.net.au/~dhimurru/default.html>

In 2002 Dhimurru successfully negotiated an agreement under the Section 73 of the *Territory Parks and Conservation Act 2000* to work with the Northern Territory Parks and Wildlife Commission in the administration and management of the IPA. This represents a new type of partnership between Traditional Owners and government conservation agencies in the management of protected areas in Australia.

Dhimurru Land Management Aboriginal Corporation has been involved in a range of marine research projects, including the tagging and tracking of turtles to determine their migratory patterns, and is currently developing a comprehensive Sea Country Plan to provide direction to future marine and coastal management initiatives.

Dhimurru is also involved in the NAILSMA Dugong and Marine Turtle Management Project and the Carpentaria Ghost Nets Programme. In February 2006 Dhimurru released a draft Sea Country Plan of Management, funded by the National Oceans Office (Department of the Environment and Heritage) as part of the development of a Northern Bioregional Marine Plan.

Lianthawirriyarra Sea Ranger Unit

The Lianthawirriyarra Sea Ranger Unit is another example of an Indigenous Caring for Country agency in the Northern Territory. The Lianthawirriyarra Sea Ranger Unit was formed in September 2002 by the Traditional owners of the Sir Edward Pellew Islands in the southwestern Gulf of Carpentaria to undertake regular surveillance of sea country, monitor populations of dugongs, marine turtles and others threatened species, as well as undertake public education and implement measures to control marine debris.

To achieve these objectives the Lianthawirriyarra Sea Ranger Unit has developed partnerships with researchers, conservation organisations and government agencies. Projects undertaken to date include:

- Completion of a Sea Country Plan, with assistance from consultant Dr John Bradley, funded by the National Oceans Office (Department of the Environment and Heritage);
- Monitoring the health and population dynamics of the dugong and sea turtle population with Dr Scott Whiting (WWF);
- Necropsy and tissue sampling of traditionally harvested dugong in cooperation with traditional hunters, to investigate the health of the dugong population in the southwestern Gulf;

- Fauna surveys for threatened species on the Sir Edward Pellew Islands in partnership with Threatened Species Network (WWF) and Parks and Wildlife Service of the Northern Territory (PWSNT);
- Surveillance patrols of the Sir Edward Pellew Islands region, including public education and provision of information on fisheries, Aboriginal island access and local knowledge; monitoring for species mortality; Monitoring illegal fishing activity and public visitation on Aboriginal islands (particularly sacred sites), liaison with traditional owners and commercial fishermen including crabbers; search and rescue operations;
- Joint surveillance patrols with Australian Customs Service, Northern Territory Marine and Fisheries Enforcement Unit and Northern Territory Department of Primary Industries and Fisheries (NTDPIF) and year round intelligence gathering for these agencies;
- Establishment of Marine Wildlife Stranding and Mortality reporting network for the southwestern Gulf with McArthur River Mining (MRM) Bing Bong port facility, King Ash Bay Fishing Club, PWSNT and NT Police;
- Eradication of feral dogs that historically predated on nesting sea turtles on West Island, in cooperation with the Traditional Owner and PWSNT;
- Eradication of feral goats on West Island in cooperation with Traditional Owners in response to their concerns of landscape degradation;
- Partnership (Borrooloola Network Group) with PWSNT, Charles Darwin University, WWF, National Oceans Office, Northern Land Council developed as a result of this Ranger Unit's reports of significant ecological events and concerns raised by Traditional Owners, e.g. fish kills, widespread floating turtle syndrome, 'bad meat' in traditionally harvested dugong and turtle, and decline in other marine species;
- Marine debris survey undertaken in partnership with WWF;
- Liaison with NT Crab Fishermen's Association and crabbers to address ongoing rubbish disposal issues at crab fishermen's camps.

The Lianthawirriyarra Sea Ranger Unit currently comprises three Rangers and one Coordinator and is administered as part of the Mabunji Aboriginal Resource Association based in Borrooloola

Northern Land Council's Caring for Country unit

Regional environmental planning and management by Aboriginal people across the Top End of the Northern Territory is supported by the Northern Land Council through its Caring for Country unit (CFCU), and by specialist staff dealing with fisheries management and more general sea country management issues. The CFCU has developed partnerships with funding, research, conservation and training organisations. CFCU's roles include:

- Consulting and negotiating with Traditional Owners over environmental and resource management issues;
- Promoting the application of Indigenous Knowledge and Western Science to contemporary environmental management problems;
- Facilitating the establishment of community based Natural Resource Management Teams;
- Facilitating clan estate scale environmental assessment;
- Facilitating getting people back to country, including sea country monitoring patrols;
- Facilitating the delivery of natural resource management education and training to communities and individuals;
- Promoting economic enterprise development based on the sustainable use of wildlife.

Indigenous initiatives in Torres Strait

In 1998 the Island Coordinating Council and the Torres Strait Regional Authority (TSRA) jointly released a *Marine Strategy for Torres Strait*¹²². The Marine Strategy has broad goals to achieve cultural, ecological and economic sustainability in the use of the marine resources of Torres Strait, including dugongs and marine turtles.

Torres Strait Islanders have participated in dugong and turtle harvesting monitoring programs since the early 1990s and held several key workshops to develop strategic approaches to dugong and marine turtle management. The Vision Statement from a workshop titled “Towards Community Based Management of Dugong and Turtles in Torres Strait held in June 1998” reads:

Effective community based management of dugongs and turtles conducted in a way which maintains Ailan Kastom and ensures the long term survival of these species as an essential component of Torres Strait culture, identity and sea life.

Torres Strait Islanders are participating in both the NAILSMA Dugong and Marine Turtle Management Project and the Carpentaria Ghost Nets Programme. A Ranger Program has recently been established on Badu Island, jointly funded under NHT, NLP and Department of Education and Workplace Relations Indigenous Employment Program.

¹²² TSRA and ICC (1998)

A Land & Sea Management Strategy has been developed for the Torres Strait region, and the TSRA intends to establish a unit to support land and sea management initiatives utilising seed funding under the Natural Heritage Trust initiative. The Land & Sea Management Unit will play an important role in coordinating regional land and sea management initiatives, including through building local capacity for the co-management of dugong and marine turtles in collaboration with government agencies, researchers and Aboriginal and Torres Strait Islander communities in the region.

Indigenous initiatives in the Great Barrier Reef Region

Many Aboriginal groups in the Great Barrier Reef region, as well as further south along the Queensland coast, have initiated marine resource management projects over the last ten years. Examples of these initiatives include:

- The preparation of a *Sea Plan* by members of the Lockhart River Aboriginal Community in 1995¹²³, which includes strategies and actions for greater Aboriginal involvement in marine management, including commitment to monitor and sustainably use dugongs and marine turtles.
- The preparation of a Dugong and Marine Turtle Management Plan by the Hopevale Aboriginal Community in 1999, which won the Prime Minister's Environment Award in 2000¹²⁴. This Plan has not been implemented consistently for several reasons, including: death of key elders and individuals, personnel changes at Hopevale and GBRMPA, lack of resources, and a federal ministerial decision in 2000 that prevented the managing agencies from issuing community hunting permits, even though such permits were a central part of the Plan¹²⁵. Hopevale Community has collaborated over many years with researchers at James Cook University and staff of the Great Barrier Reef Marine Park Authority (GBRMPA) in relation to research and management of dugongs and turtles.
- Voluntary agreements by several coastal Aboriginal groups to suspend dugong hunting in the southern Great Barrier Reef region due to declining dugong populations. The latest agreement, signed in July 2005, involves a Memorandum of Understanding between Juru, Gia and Ngaro Traditional Owners from Ayr, Bowen and Proserpine and the Queensland Environmental Protection Authority to suspend dugong hunting and introduce a self-managed permit system to control and monitor turtle hunting¹²⁶.
- Giringun Aboriginal corporation in Cardwell has developed a Sea Rangers program and negotiated a Traditional Use of Marine Resources Agreement (TUMRA) as steps towards cooperative management of the part of the Great Barrier Reef Marine Park;

¹²³ Wynter et al. (1995)

¹²⁴ Hopevale Aboriginal Community (1999)

¹²⁵ Haveman et al. (2005)

¹²⁶ http://www.epa.qld.gov.au/about_the_epa/public_reporting/epa_bulletin/issue_19_14_july_2005/#protect

- Sea Forum, a collective of Aboriginal Traditional Owner groups from the Southern Great Barrier Reef (from Cooktown south to Fraser Island), presented a discussion paper to Government in 1999 outlining ways forward for co-management of sea country, including co-management of dugongs and marine turtles¹²⁷; Sea Forum, which is no longer functioning, was established in response to a Ministerial Council decision in 1997 to ban dugong hunting in the southern Great Barrier Reef.

Indigenous initiatives in Western Cape York Peninsula

Turtle Conservation Camps are run by the Mapoon Aboriginal Community on the north-west coast of Cape York Peninsula, during which paying guests (eco-tourists) work with the Mapoon Rangers, Traditional Owners and researchers to measure and tag nesting Flatback and Olive Ridley turtles, fit feral pig exclusion devices to the nesting sites and remove discarded fishing nets from the beach with the aid of purpose-equipped 4WD vehicles¹²⁸.

Indigenous initiatives in Western Australia

The Kimberley Land Council (KLC) has established a Land and Sea Management Unit¹²⁹ to undertake projects for looking after land and sea country, including marine resource management. The unit works with Traditional Owners to look after, manage and take control of traditional country, and has partnerships with community organisations, industry, government agencies and local government. The KLC Land and Sea Management Unit currently manages 26 projects with 6 staff members across the region, including on-ground land-care and conservation projects, cultural heritage site management, recording traditional knowledge and planning for country.

The KLC Land and Sea Management Unit works collaboratively with organisations such as the Kimberley Language Resource Centre, Northern Land Council Caring for Country Unit, and Balkanu Cape York Development Corporation, and with research agencies such as CRC Tropical Savannas Management, CSIRO, Murdoch University. Projects are funded by NHT, CSIRO, Land & Water Australia, CRC Tropical Savannas, Office of National Tourism, and other agencies.

¹²⁷ Sea Forum (1999)

¹²⁸ <http://turtlescapeyork.com/>

¹²⁹ <http://www.klc.org.au/landsea.htm>

The Gnulli Working Group, representing the Traditional Owners of the Northwest Cape area near Exmouth were involved in the development of the Jurabi Turtle Centre which opened in March 2004, in collaboration with conservation, government and industry partners¹³⁰. The interpretive centre is located in the Jurabi Coastal Park, which is a breeding ground for Green, Loggerhead and Hawksbill turtles.

Government initiatives in dugong and turtle management

Legislation

Dugongs and marine turtles are protected and managed under international, Commonwealth, State and Territory legislation, as summarised in Table 6 below.

Table 6: International, Australian, State/Territory agreements relevant to the protection of dugongs and turtles

Jurisdiction	Legislation
International	<i>Convention on Migratory Species</i> <i>Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of Indian Ocean South East Asia (IOSEA)</i> Development of regional arrangements for dugong and Pacific turtles <i>Convention on the International Trade in Endangered Species Wild Fauna and Flora (CITES)</i> <i>Convention on Biological Diversity</i>
Commonwealth	<i>Environment Protection and Biodiversity Conservation Act 1999.</i> <i>Great Barrier Reef Marine Park Act 1975</i>
Western Australian	<i>Wildlife Conservation Act 1950.</i> <i>Wildlife Conservation (Close Season for Marine Mammals) Notice 1998</i> (which manages interactions between humans and marine mammals in state waters)
Queensland: Torres Strait	<i>Nature Conservation Act 1992.</i> <i>Marine Parks Act 1982</i> <i>Torres Strait Treaty</i> <i>Torres Strait Fisheries Act 1984 (Commonwealth)</i> <i>Torres Strait Fisheries Act 1984 (Queensland)</i>
Northern Territory	<i>Northern Territory Parks and Wildlife Conservation Act 2000</i>

¹³⁰ <http://www.ningalooturtles.org.au/partners.htm>

The legislation referred to above provides various mechanisms for the recognition of Indigenous people's right to hunt dugong and marine turtles for subsistence and other non-commercial cultural purposes. Section 211 of the *Native Title Act 1993 & 1998* also protects native title holders' non-commercial hunting rights. Governments, however, retain the authority to regulate Indigenous hunting to ensure the conservation of species¹³¹.

Conservation Status of Dugongs

The conservation status of dugongs internationally and in northern Australia is summarised in Table 7 below.

Table 7: Conservation status of dugongs

Jurisdiction	Conservation Status
International	Vulnerable to extinction (IUCN Red Data Book of Threatened Species) ¹³² Listed in Appendix I of <i>Convention on International Trade in Endangered Species</i> (CITES) and in Appendix 2 of the <i>Convention for the Conservation of Migratory Species of Wild Animals</i> (CMS) (IUCN is currently reviewing the conservation status of dugongs, which is likely to remain listed as "vulnerable")
Commonwealth	Listed Migratory Species (EPBC Act) Listed Marine Species (EPBC Act) Protected Species (GBRMP Act)
Western Australia	Listed as <i>Specially Protected Fauna</i>
Queensland:	Vulnerable (<i>Nature Conservation Act</i>) Protected Species (<i>Marine Park Act 1982</i>)
Northern Territory	Low Risk

Conservation Status of Marine Turtles

The conservation status of marine turtles varies from country to country and depends largely on whether they are given the opportunity to recover after any decline. Marine turtles are considered to be declining globally, despite the implementation of conservation efforts in many countries, including Australia (such as the compulsory use of Turtle Exclusion Devices on trawl nets). The IUCN in

¹³¹ Havemann et al. (2005)

¹³² www.redlist.org/

applying its Red List Categories¹³³ determined the conservation status of marine turtles globally. The vulnerability of marine turtles is also recognised by their listing under international agreements such, as the *Convention for the Conservation of Migratory Species of Wild Animals* (CMS, also known as the Bonn Convention)¹³⁴ and the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES)¹³⁵. The conservation status of marine turtles in Australia and internationally is summarised in Table 8.

Table 8: Conservation status of marine turtles in Australia and internationally

	Australia				International
	EPBC Act	QLD	WA	NT	
Green	Vulnerable	Vulnerable	Rare, or likely to become extinct	Least Concern	IUCN - Endangered, CMS - Appendix I and II CITES - Appendix I
Loggerhead	Endangered	Endangered	Rare, or likely to become extinct	Endangered	IUCN - Endangered CMS - Appendix I and II CITES - Appendix I
Hawksbill	Vulnerable	Vulnerable	Rare, or likely to become extinct	Data Deficient	IUCN - Critically endangered CMS - Appendix I and II CITES - Appendix I
Flatback	Vulnerable	Vulnerable	Rare, or likely to become extinct	Data Deficient	IUCN - Data deficient, CMS - Appendix II CITES - Appendix I
Olive Ridley	Endangered	Endangered	Rare, or likely to become extinct	Data Deficient	IUCN - Endangered, CMS - Appendix I and II CITES - Appendix I
Leatherback	Vulnerable	Endangered	Rare, or likely to become extinct	Vulnerable	IUCN - Critically endangered CMS - Appendix I and II CITES - Appendix I

The reason the species are listed differently under the various conventions & laws reflects the scale at which the assessments are made. For example, the IUCN listing is a world wide assessment. The EPBC Act provides an Australian perspective of the conservation status of marine turtles. For example, globally Hawksbill turtle populations have been decimated across nearly their entire range; however in Australia the populations have not been exploited as much and hence

¹³³ www.redlist.org/

¹³⁴ www.cms.int/

¹³⁵ www.cites.org/

are in a better state than in other places of the world (e.g. Caribbean). This assessment doesn't mean that Australia shouldn't be concerned about protecting the species; rather it means that Australia is better placed to ensure the long term survival of the species in its waters.

Australian Government initiatives

The NAILSMA Dugong and Marine Turtle Management Project.

The Australian government, through the NHT, has provided \$3.8 million to NAILSMA develop strategic community based approaches across north Australia to dugong and marine turtle management and conservation (see previous section on Indigenous initiatives).

A Recovery Plan for Marine Turtles

The Australian Government's *Recovery Plan for Marine Turtles in Australia* was released in 2003¹³⁶; a revised version is currently out for public comment¹³⁷. The *Recovery Plan* identifies six objectives that aim to aid the recovery of marine turtles.

These are:

- A. Reduce the mortality of marine turtles and, where appropriate, increase natural survivorship, including through developing management strategies with Aboriginal and Torres Strait Islander communities for the sustainable use of marine turtles.
- B. Develop programs and protocols to monitor marine turtle populations in Australia, assess the size and status of those populations, the causes of their mortality and address information gaps.
- C. Manage factors that affect marine turtle nesting.
- D. Identify and protect habitats that are critical for the survival of marine turtles.
- E. Communicate the results of recovery actions and involve and educate stakeholders.
- F. Support and maintain existing agreements and develop new collaborative programs with neighbouring countries for the conservation of shared turtle populations.

The Recovery Plan for Marine Turtles is currently being revised by the Australian Government's Department of the Environment and Heritage.

¹³⁶ <http://www.deh.gov.au/coasts/publications/turtle-recovery/index.html>

¹³⁷ <http://www.deh.gov.au/biodiversity/threatened/publications/recovery/marine-turtles/index.html>

***Sustainable Harvest of Marine Turtles and Dugongs in Australia
- A National Partnership Approach***

In January 2004 the Marine and Coastal Committee (the MACC) of the Natural Resource Management Ministerial Council, established a Taskforce on Dugong and Turtle Populations. The Taskforce was established so that the Australian, State and Territory Governments could develop a national approach to the sustainable management of Indigenous harvest of marine turtles and dugongs. The Taskforce included representatives from Australian, State and Territory Government departments and agencies responsible for environment, natural resource management and Indigenous policy. Taking into account submissions from over 30 Indigenous bodies, land councils, conservation organisations, researchers, academics, animal welfare groups and individuals on a draft document released in mid-2005, the Taskforce released its final report, "*Sustainable Harvest of Marine Turtles and Dugongs in Australia - A National Partnership Approach*"¹³⁸ in November 2005.

The *National Partnership Approach* recognises that many Traditional Owner groups, community based rangers and Native Title Representative Bodies are already involved in community initiatives to achieve sustainable management of turtles and dugongs – including the development of Regional Activity Plans by Indigenous communities across north Australia as part of the NAILSMA Dugong and Marine Turtle Project. The document also recognises that nothing in the *National Partnership Approach* can affect Indigenous peoples' native title right to hunt under Section 211 of the *Native Title Act* 1993.

In developing the *National Partnership Approach*, the MACC Taskforce considered:

- the conservation of turtles and dugongs, including the need to act to protect these species before their conservation status worsens;
- the economic, spiritual and cultural importance of turtles and dugongs to Indigenous peoples;
- the importance of turtles and dugongs as part of Australia's unique marine environment to all Australians;
- ensuring consistency with Indigenous people's legal rights pursuant to s211 of the *Native Title Act* and other relevant legislation;
- the wider context of social issues facing Indigenous communities, such as isolation and poverty, the maintenance of culture, and the role that turtle and

¹³⁸ <http://www.deh.gov.au/coasts/species/turtles/national-approach.html#download>

dugong harvesting often plays in remote communities where nutritious diets are often difficult to otherwise obtain;

- the need for the best possible information on which Traditional Owners and government agencies can base management decisions;
- the need to better support and resource Indigenous communities to sustainably manage turtles and dugongs;
- the recognition of the range of impacts adversely affecting turtles and dugongs such as adverse interactions with fisheries, marine debris, and habitat destruction;
- existing measures to address threats to turtle and dugong such as recovery plans, policies and legislation already in place;
- the legal parameters surrounding Indigenous harvest – such as the EPBC Act, the *Native Title Act 1993*, *Great Barrier Reef Marine Park Act 1975*, *Torres Strait Fisheries Act 1984*, the *Community Services (Aborigines) Act 1984* (QLD), the *Community Services (Torres Strait) Act 1984* (QLD), the *Nature Conservation Act 1992* (QLD), the *Territory Parks and Wildlife Conservation Act 2001* (NT);
- the need for jurisdictions to cooperate in a meaningful manner with one another and with those Indigenous communities with sea country where harvest occurs;
- that a regulatory approach would be difficult and expensive to enforce, and may have limited impact; and
- the success of this *Approach* will be dependent on the provision of the necessary resources to Indigenous communities by all levels of government to increase the sustainable management of turtles and dugongs.

The *National Partnership Approach* provides for the establishment of a *Partnership for Sustainable Indigenous Harvest of Turtles and Dugong*, comprising:

- Indigenous representatives from coastal northern, eastern and western Australia within the range of turtles and dugongs;
- two representatives from the EPBC Act Indigenous Advisory Committee;
- one representative from TSRA;
- one representative from the GBRMPA; and
- one government representative from each relevant government jurisdiction (Australian, Queensland, Northern Territory and Western Australian governments).

The Australian Government Department of the Environment and Heritage will provide administrative support to the Partnership. Specific goals of the *National Partnership Approach* are:

- Improve the information base available to Indigenous communities for managing the sustainable harvest of turtles and dugongs;

- Respect Indigenous and non-Indigenous knowledge and management;
- Improve Education and Awareness;
- Identify the economic, social and cultural factors that may contribute to unsustainable harvest levels and identify and implement measures to address them;
- Protect Sea Country resources.

Indigenous organisations involved in dugong and turtle management across northern Australia had not formally responded to proposals contained in the final *National Partnership Approach* document at the time this *Knowledge Handbook* was completed.

Marine Debris

In August 2003, the Australian Minister for the Environment and Heritage listed "Injury and fatality to vertebrate marine life caused by ingestion or entanglement in harmful marine debris" as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)¹³⁹.

Harmful marine debris is considered under this listing to include things such as plastic garbage washed or blown from land into the sea, fishing gear abandoned by recreational and commercial fishers, and solid non-biodegradable floating materials (such as plastics) disposed of by ships at sea. Marine debris resulting from the legal disposal of garbage at sea is not included under this key threatening process listing. Under the *International Convention for the Prevention of Pollution from Ships*, overboard disposal of food, paper, glass, metal and crockery (but not plastics) is permitted from vessels more than 12 nautical miles from land.

Following from the listing of harmful marine debris as a key threatening process, the Australian Government is developing a *Threat Abatement Plan for Marine Debris* which is intended to provide a framework for the prevention and management of the problem. The plan, developed in consultation with representatives from industry, industry-support groups, government, non-government organisations, volunteer groups, conservation organisations and some Indigenous organisations will:

- Review existing policies, codes of practice, conventions and activities to determine their effectiveness;

¹³⁹ <http://www.deh.gov.au/biodiversity/threatened/publications/marine-debris.html>

- Coordinate abatement strategies identified in separate marine animal Recovery Plans such as the Marine Turtle Recovery Plan and the Grey Nurse Recovery Plan;
- Examine the need to strengthen international measures to address the issues of marine debris and its impact on wildlife.

Meanwhile, the Australian Government has allocated \$2 million from the Natural Heritage Trust to fund the *Carpentaria Ghost Net Programme - Saltwater People Working Together*¹⁴⁰, which involves collaboration between Indigenous community groups in the Gulf of Carpentaria and into Torres Strait to address the problem of ghost nets (discarded fishing nets) (see also page 94 under **Indigenous Initiatives**).

There are other key threatening process listed under EPBC Act which are relevant to marine turtles, including predation by the European Red Fox¹⁴¹ and feral pigs¹⁴².

Reducing the impact of the trawl fishery

The Australian Fisheries Management Authority (AFMA) manages a number of fisheries where there are interactions with marine turtles, notably the Northern Prawn Fishery (NPF). In addition to the compulsory use of TEDs from April 2000, there are area closures in the NPF that provide some measure of protection to turtles. Most areas of inshore seagrass habitat in the Gulf of Carpentaria are permanently closed to trawling. These inshore areas are frequently the feeding grounds of turtle species including the Green turtle. Seasonal closures in the NPF may also offer protection to turtles as they coincide with nesting periods for some species. The NPF is seasonally closed from 1 December to 30 March and again from 16 June to 31 July.

Extensive areas closed to trawl fisheries within the Great Barrier Reef Marine Park also contribute to the protection to marine turtles.

Bioregional Marine Planning

As part of the implementation of Australia's Ocean Policy¹⁴³, the National Oceans Office, formerly an Australian Government executive agency and now part of the Marine Division of the Australian Government Department of Environment and

¹⁴⁰ <http://www.mccn.org.au/article.php/id/678/>

¹⁴¹ <http://www.deh.gov.au/biodiversity/threatened/publications/tap/foxes/index.html>

¹⁴² <http://www.deh.gov.au/biodiversity/threatened/ktp/feralpigs.html>

¹⁴³ Commonwealth of Australia (1998)

Heritage (DEH), is currently developing a Bioregional Marine Plan which includes Australian waters in Torres Strait, the Gulf of Carpentaria and the Arafura Sea as far west as Goulburn Islands. A Regional Profile for the Northern Planning Area will be released for public comment in mid-2006. The planning process has involved several initiatives relevant to Indigenous involvement in dugong and marine turtle management, including:

- Publication of *Living on Saltwater Country - Review of literature about Aboriginal rights, use, management and interests in northern Australian marine environments*¹⁴⁴;
- Publication of *Key Species – A Description of Key Species Groups in the Northern Planning Area*¹⁴⁵;
- Publication of *Snapshot of the Northern Planning Area*¹⁴⁶;
- Funding the development of four pilot Sea Country Plans, currently being developed by Traditional Owners for their sea country in northeast Arnhem Land, southwestern Gulf of Carpentaria, Wellesley Islands in the Gulf of Carpentaria and Aurukun in western Cape York Peninsula.¹⁴⁷

Dugong and Marine Turtle Tourism

Dugongs and marine turtles are increasingly becoming part of the marine tourism experience in northern Australia. During 2004 and 2005 the Department of Environment and Heritage funded a research project to develop a Code of Conduct for dugong and marine turtle tourism, to ensure that dugongs and marine turtles, and the Indigenous cultural values associated with them, are not harmed as a result of marine tourism activities. The Code of Practice, developed by a research team from James Cook University in consultation with selected Traditional Owner groups, management agencies, tourism operators and researchers across northern Australia, was released in October 2005¹⁴⁸.

¹⁴⁴ National Oceans Office (2004)

¹⁴⁵ National Oceans Office (2004b)

¹⁴⁶ National Oceans (Office 2003)

¹⁴⁷ http://www.oceans.gov.au/Sea_Country.jsp

¹⁴⁸ <http://www.dugongturtletourism.org/>

Western Australia Government initiatives

Dugongs

Initiatives and programs to protect and manage dugongs in Western Australia include:

- Shark Bay was closed to commercial mesh net fishing in 1986 to protect the dugong population.
- Educational information about dugongs is presented at the Monkey Mia visitor centre.
- The WA Department of Land Management (CALM) has developed a Code of Conduct for licensed charter boats operating from Monkey Mia, which limits vessels to one trip per day to seagrass beds occupied by dugongs, and which prescribes how vessel interaction with dugongs should occur.
- Regular reviews by CALM of the habitat protection provisions for the Ningaloo Marine Park, to assess their capacity to protect dugongs and their habitats.
- The Jurabi Turtle Centre, a tourism interpretation and community education centre has recently been opened in Jurabi Coastal Park north-west of Exmouth, where nesting of Green, Loggerhead and Hawksbill turtles takes place. The Jurabi Turtle Centre is the result of collaboration between government, conservation groups, Traditional Owners and industry partners.

Marine Turtles

Under the Western Australian *Wildlife Conservation Act 1950* Loggerhead and Leatherback turtles are listed as threatened species. All other turtles are protected as native fauna. Provision is made in this Act for hunting by Indigenous people. The Western Australian Department of Conservation and Land Management (CALM) is involved in marine turtle conservation and the Western Australian Marine Turtle Program has been operational since 1985. Most significant rookeries (nesting sites) are on island nature reserves, but there is a need to develop protocols for the management and use of these sites. A management plan is currently being prepared for marine turtles in Western Australian waters. Research and monitoring activities include:

- long-term monitoring of most major rookeries;
- migration studies;
- estimates of inshore numbers at feeding grounds;
- management of oil field lighting and seismic activities to minimise impact on marine turtles;
- diseases in marine turtles (the petroleum industry has provided support);
- development of interaction with indigenous groups in monitoring programs;

- salvage of Leatherback and other turtles entangled in crayfish pot floatlines in summer.

No reliable figures are available on the bycatch of marine turtles from Western Australian trawl fisheries. Fisheries WA has developed a program and timeframe for the implementation of the Western Australian Policy on Fisheries Bycatch. Development of action plans for the Shark Bay Trawl Fisheries and the Pilbara Trawl Fishery. Marine turtle bycatch will be addressed with these action plans. The development of bycatch action plans takes account of potential bycatch issues by separating fisheries into three groups on the basis of the nature and degree of significance of bycatch issues.

Western Australia's system of Marine Conservation Areas, including nine marine parks, contributes to the protection of dugongs, marine turtles and their habitats¹⁴⁹.

Northern Territory Government initiatives

Dugongs

The Northern Territory Parks and Wildlife Service (Department of Infrastructure, Planning and Environment) have prepared a Draft *Management Program for the Dugong in the Northern Territory 2003-2008*¹⁵⁰ to provide for the long-term conservation of dugongs within the Northern Territory.

The Objectives and Actions of the Draft *Management Program for the Dugong in the Northern Territory* are set out below:

Objectives

- Maintain viable wild populations of Dugong and conserve the marine habitat upon which they depend, by:
 - I. Identifying and encouraging protection of important Dugong habitats;
 - II. Identifying anthropogenic sources of Dugong mortality;
 - III. Managing and mitigating identified direct and indirect threats to Dugong and Dugong habitat;
 - IV. Developing a monitoring program on Dugong in Northern Territory waters for monitoring of both populations and habitat at all scales.

¹⁴⁹ http://www.naturebase.net/national_parks/marine/index.html

¹⁵⁰ http://www.nt.gov.au/nreta/pwcnt/pwcnt/docs/dugong_management_program.pdf

Actions

Management

- establish the need for declaration under Section 37 *Territory Parks and Wildlife Conservation Act 2001 (TPWCA)* of areas of essential habitat for Dugong conservation;
- consult with Aboriginal people regarding the need for protected areas for Dugong, within which indigenous requirements in relation to Dugong protection are addressed;
- cooperate with the Commonwealth in the protection of Dugong habitat in Commonwealth waters;
- consult with professional fishers, the Department of Business, Industry and Resource Development (DBIRD), the Northern Territory Seafood Council (NTSC) and Aboriginal people to identify those areas of Dugong habitat where mesh nets are used;
- consult with professional fishers, DBIRD, NTSC and Aboriginal people to determine a range of management options that may be implemented if monitoring indicates a Parks and Wildlife Service Department of Infrastructure, Planning and Environment Dugong Management Program requirement to regulate fishing in an area to reduce incidental catch. Management options to be considered may include:
 - I. use of fishing gear and fishing practices that reduce incidental catch, and
 - II. zonal closures (total and/or seasonal);
- in consultation with professional fishers, DBIRD, NTSC and Aboriginal people, develop an education program for professional fishers on aspects of Dugong conservation biology and management, and on methods to minimise the incidental catch of Dugong.

Monitoring

- consult with Aboriginal communities to establish culturally acceptable mechanisms to monitor traditional harvest;
- consult with professional fishers, local communities, DBIRD and NTSC to establish mechanisms to monitor incidental catch;
- monitor Northern Territory Dugong population distribution and abundance using aerial surveys;
- continue mapping of seagrass distribution as part of the marine habitat mapping program.

Sustainable Utilisation

- consult with Aboriginal communities regarding co-management arrangements which, subject to need, may include:
 - I. issue of permits under Section 73(1B) of the *TPWCA* for the taking of Dugong in accordance with Aboriginal tradition,
 - II. closed areas where hunting is not permitted,
 - III. seasonally closed areas where hunting is not permitted,
 - IV. annual harvest limits for specific hunting areas, and

- V. annual harvest limits for individual hunters and/or communities;
- consult with Aboriginal communities to develop culturally appropriate education programs to ensure that Aboriginal people are aware of:
 - I. the need for Dugong conservation,
 - II. the potential impacts of traditional hunting, and
 - III. the need to take responsibility for conservatively managing their Dugong harvest.

Other measures to protect or manage dugongs in the Northern Territory include:

- An information kit prepared by the Northern Territory Fishing Industry Council in 1997 outlining specific practices and precautions when fishing in dugong areas;
- The Northern Prawn Fishery has made considerable effort to close off all areas of seagrass to prawn trawling;
- The Northern Land Council and the Northern Territory Fishing Industry Council jointly released a strategy in 1996 to minimise accidental capture of dugongs in barramundi nets. The Strategy, which applies to the area from Bing Bong Creek to Pelican Spit along the coast of the Gulf of Carpentaria near the Sir Edward Pellew Islands, includes:
 - the protection of parts of a seagrass dugong feeding area near the mouth of the McArthur River;
 - a ban on the use of nets near the mouth of the McArthur River;
 - a ban on the use of bait nets from Bing Bong Creek to the Queensland border;
 - Bait net fishers to attend their nets at all times.

Marine Turtles

The *Territory Parks and Wildlife Conservation Act 2000* lists marine turtles as protected wildlife. The Northern Territory Government also has a 'Conservation through the sustainable use of wildlife' policy, and on behalf of Aboriginal landholders and others has encouraged research into the production of marine turtles through ranching and captive breeding. The commercial export of products derived from turtles is currently prohibited by the EPBC Act. The Parks and Wildlife Commission of the Northern Territory (PWCNT):

- has carried out aerial and ground surveys to determine where the high use breeding areas are for marine turtles;
- is identifying and mapping marine habitats;
- has examined habitat use by marine turtles around Cobourg Peninsula and monitored and tagged flatback turtles on Greenhill Island between 1995 and 1997;

- is monitoring nesting by turtles at Cobourg Peninsula and Casuarina Beach in Darwin;
- is working with Dhimurru Land Management Aboriginal Corporation particularly on the ghost netting of juvenile turtles on Cape Arnhem;
- is working with the Northern Land Council to increase cooperation between coastal communities and PWCNT;
- has recently reviewed the status of all turtle species in NT waters with loggerhead classified as endangered and leather back turtles classified as vulnerable; and
- in conjunction with relevant stakeholders, is investigating options for ranching and captive breeding of hawksbill turtles.

The Northern Territory Department of Business, Industry and Resource Development (NTDBIRD) has collaboratively been involved in quantifying marine turtle/fisheries interactions and trialing TEDs and BRDs.

Queensland Government initiatives

Dugongs

Gulf of Carpentaria

Measures to protect and/or manage dugongs in Queensland waters within the Gulf of Carpentaria include:

- Closure of 17 of the 27 rivers in the Gulf of Carpentaria to commercial fishing;
- Negotiation of an agreement between the Environment Protection Agency and the Angumothimaree people restricting dugong and turtle hunting in the Pine River area near Weipa to four months per year
- The establishment of the Wellesley Islands Protected Wildlife Area, which prohibits the use of gills nets around the islands and adjacent mainland – though barramundi gill nets are exempt from this prohibition;
- The Northern Prawn Fishery has closed off specific areas within the Gulf of Carpentaria from prawn trawling.

Torres Strait

Measures to protect and/or manage dugongs in Torres Strait are primarily governed by the provisions of the Torres Strait Treaty, ratified in 1985, between Australia and PNG and the *Torres Strait Fisheries Act 1984*. The Treaty establishes an area in the Torres Strait known as the Torres Strait Protected Zone. The principal objective in establishing the Protected Zone is to acknowledge and protect the traditional way of

life and livelihood of the traditional inhabitants of the area. Management regulations and initiatives of relevance to dugongs (*dangal* and *deger*) and turtle (*waru* and *nam* in the traditional languages) currently implemented include:

- Dugong hunting in the Torres Strait Protected Zone and adjacent areas is managed as a fishery under the *Torres Strait Fisheries Act 1984* and take is limited to traditional inhabitants only. Dugong and turtle may only be taken in the course of traditional fishing and used for traditional purposes (e.g. subsistence food or for special occasions such as weddings, funerals and tombstone openings).
- In 1985 a segment of the Torres Strait Protection Zone and an adjacent area were designated as a “Dugong Sanctuary” (see Figure 40) in which no Indigenous hunting was to take place. As there is little surveillance of the Sanctuary, and the area is known to support low numbers of dugong, the effectiveness of the sanctuary is uncertain.
- In 1995 the Torres Strait Protected Zone Joint Authority implemented a ban on hunting methods other than use of the traditional *wap* or spear thrown by hand. This was mainly to address the problem of fishers from Papua New Guinea netting dugongs in Australian waters around Saibai and Dauan Islands. There are currently no other limits on hunting effort, numbers of hunters or catch of dugongs.
- The taking or carrying of dugong or turtle on a commercial fishing boat is prohibited. A person is exempt from this prohibition if a current Traditional Inhabitant Boat licence is held where the nominated boat is less than or equal to 6 metres in length.
- A CSIRO program monitored the marine catch of communities in the Australian Sector of the Protected Zone between June 1991 and May 1993. The program trained Islander observers to monitor the marine catch with the aim of detecting changes in the fishing pattern, catch and levels of seafood use in the “Protected Zone”.
- AFMA staff participate in and contribute to the Australia-Papua New Guinea Torres Strait Environmental Management Committee, which reviews the progress of dugong and turtle management programs in Torres Strait. AFMA staff take an active role in dugong conservation and management
- AFMA officers conducted an education program in the Australian Sector of the “Protected Zone”, the Thursday Island area and northern Cape York Peninsula, from 1990-1999 which included teaching school children about the life cycle of dugongs and turtles, and the need for a conservative approach to their harvesting.
- The children also collected dugong and turtle catch data using calendars and stickers. The main emphasis of this program was to educate future hunters on turtle and dugong biology. Similar education of adult hunters occurred through community meetings, and a weekly fisheries radio program.

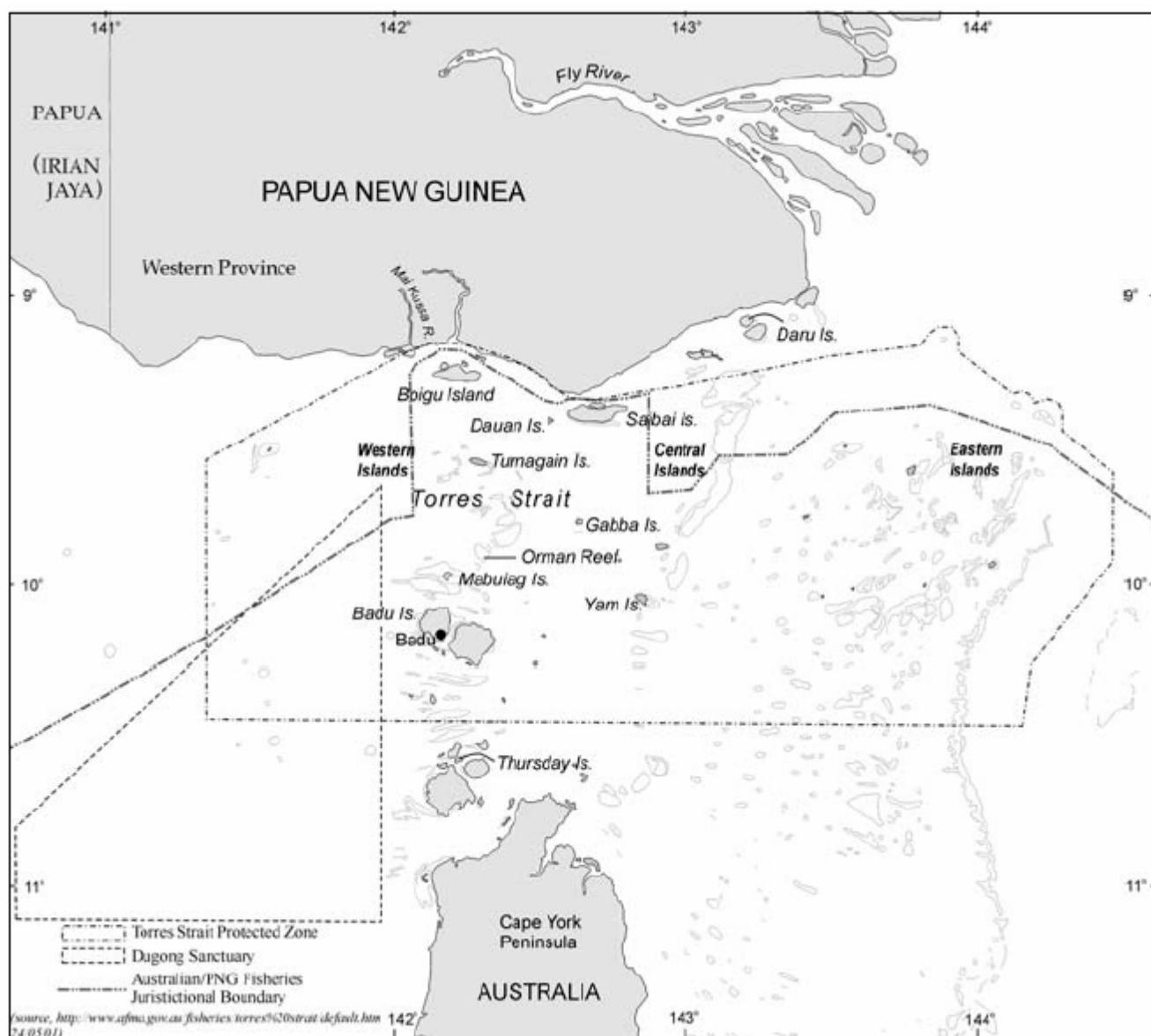


Figure 40: Map of Torres Strait showing the Torres Strait Protected Area and the Dugong Sanctuary¹⁵¹

- AFMA has prepared videos, posters, books and other material on dugong and turtle conservation in Torres Strait.
- In 1996 AFMA, in collaboration with the Marine Strategy Coordinator for the Island Coordinating Council, trained a fisheries officer from Papua New Guinea's Western Province in the technique used to monitor community dugong and turtle catches in Torres Strait.
- In 1997 the Torres Strait Fisheries Management Advisory Committee recommended to the Protected Zone Joint Authority that a community-based management strategy be developed, to ensure that traditional hunting of dugongs and turtles in the Torres Strait is sustainable.

¹⁵¹ Marsh et al. (2002)

- A workshop “Towards Community Based Management of Dugongs and Turtles in Torres Strait” was held on Thursday Island in June 1998 bringing together Torres Strait elders, hunters, community chairpersons, scientists, fisheries managers and representatives from the Queensland and Commonwealth environment departments and the Great Barrier Reef Marine Park Authority. The workshop affirmed the special role of dugongs and turtles as inherent in the cultural practices of Torres Strait Islanders. To ensure dugongs and turtles are in abundance for future generations, the workshop identified the following needs:
 - community rangers or others with equivalent roles;
 - elder guidance in the maintenance of traditional practices, and
 - provision of resources and management links with relevant government agencies and neighbours like Papua New Guinea and Papua Barat (West Papua).
- The need for community-based management of dugongs and turtles was discussed and agreed on by leaders of Australian and Papua New Guinea communities at the Australia-Papua New Guinea annual Traditional Inhabitants’ Meeting in August 1998.
- In 1998 the Australian Fisheries Management Authority also discussed this issue with the Papua New Guinea National Fisheries Authority at the annual Treaty Liaison Meeting. The need for complementary community-based management on both sides of the Torres Strait border was discussed further at the annual Australia-Papua New Guinea Torres Strait Environmental Management Committee, and the high level Torres Strait Joint Advisory Council meetings in October 1998. Concern over the lack of information available to indigenous communities on the levels of heavy metal, especially cadmium, in parts of the meat, fat and organs of dugongs, and the effect this may have on their health prompted a poster campaign. This campaign warned Indigenous communities about the possible health risks of eating internal organs of dugongs and turtles.
- In 2003 the Australian Fisheries Management Authority and the National Oceans Office conducted a technical workshop designed to develop methods to monitor the traditional catch of turtles and dugongs in the Torres Strait (and elsewhere). Issues raised included the need to involve Indigenous people in meaningful paid activities, the importance of extension of results, awareness of cultural sensitivities and the need for the program to be ongoing.
- CRC Torres Strait and James Cook University have funded a project to research the biology of marine turtles in Torres Strait, in collaboration with Torres Strait Islanders, with a focus on the sharing of Indigenous and scientific knowledge¹⁵².
- In 2005 CRC Torres Strait produced an updated version of their video *Dugong for Our Children*, providing information to Torres Strait Islander communities on the biology and sustainable management of dugong.

¹⁵² Research undertaken by Prof Helene Marsh and Dr Mark Hamann (http://www.crctorres.com/research/T4_3.htm)

- Torres Strait Islanders have collaborated with researchers and government environmental managers over many years to research, survey and monitor dugong and turtle populations in Torres Strait. Under the CRC Torres Strait research program, a PhD project¹⁵³ is currently being undertaken in the Kaiwalagal (Inner Islands of Torres Strait) region to develop strategies to assist communities to undertake catch monitoring. Kaiwalagal people from Hammond Island and Thursday Island have been employed and trained in all aspects of the project, including the collection of biological data and catch monitoring.
- Kaiwalagal people are also currently involved in a Green turtle satellite tracking project jointly funded by the Commonwealth Department of the Environment and Heritage, James Cook University and CRC Torres Strait, in partnership with Hammond Island Council and TRAWQ Community Council¹⁵⁴. Figure 41 shows the tracks of a Green turtle (called Waru). Waru was initially caught at Dollar reef (near Thursday Island) in October 2005. She was examined by laparoscope to show she was ready to breed and fitted with her transmitter. During the next 33 days she traveled via the PNG coast to Raine Island and began nesting. She nested several times until leaving Raine Island and migrating back to Dollar Reef. Her last known location was at Dollar Reef on April 21, 2006.

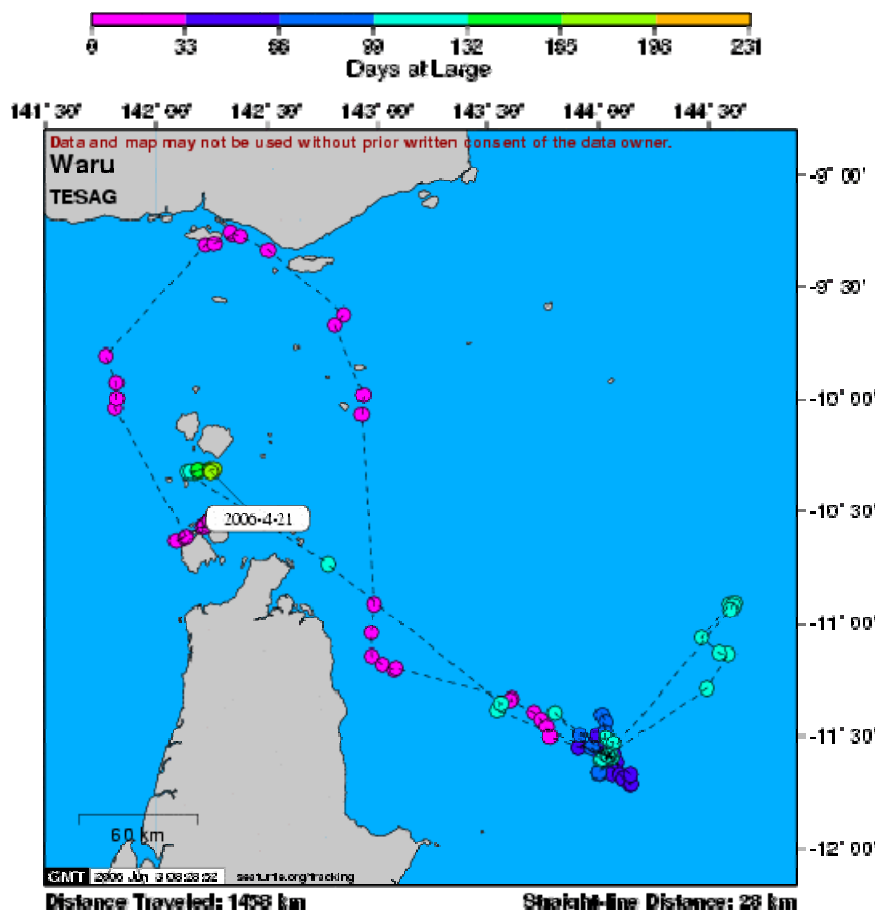


Figure 41: Movements of a green turtle (Waru) tracked by satellite in Torres Strait¹⁵⁵

¹⁵³ Research undertaken by Jillian Grayson (<http://www.crctorres.com/research/T1-11.html>)

¹⁵⁴ TRAWQ represents the residents of Tamway, Rose Hill, Aplin, Waiben & Quarantine on Thursday Island.

¹⁵⁵ http://www.seaturtle.org/tracking/?project_id=100

Great Barrier Reef Region

Traditional Use Marine Resource Agreements (TUMRAs)¹⁵⁶

The Great Barrier Reef Marine Park Authority is currently implementing Traditional Use of Marine Resources Agreements (TUMRAs) as a mechanism to cooperatively manage dugong and turtle hunting by the 70 Traditional Owner groups in their sea country within the Great Barrier Reef Marine Park. A TUMRA is a voluntary agreement created by a Traditional Owner group and accredited by GBRMPA under the 2003 Great Barrier Reef Marine Park Zoning Plan. A TUMRA will set out agreed processes for exercising Traditional Owners' rights to hunt in their sea country, with the intention of achieving sustainable use of traditional marine resources by that group. Once a TUMRA is accredited its provisions can be enforced. However, a TUMRA will not affect a Traditional Owner's native title right to hunt under s.211 of the *Native Title Act 1993*, and hence the TUMRA scheme as currently envisaged may not deliver comprehensive management of Indigenous harvest of dugongs and marine turtles in the Great Barrier Reef Marine Park. Nevertheless, since TUMRAs are focused on a geographical area they have the capacity to form the basis of cooperative management of the sea country of a Traditional Owner group. The first TUMRA, developed by Giringun Aboriginal Corporation on behalf of Djiru, Gulnay, Girramay, Banjin, Warrgamay and Nywaigi Traditional Owners, was completed in November 2005.

Turtle and Dugong Conservation Strategy for the Great Barrier Reef

The Great Barrier Reef Marine Park Authority, in conjunction with the then Queensland Department of Environment and Heritage, released the Turtle and Dugong Conservation Strategy for the Great Barrier Reef in 1994. The Goal of the Strategy is:

To have conservation strategies that contribute to maintaining turtle and dugong populations at current or higher levels throughout their range in the Great Barrier Reef Region, whilst providing for their traditional, cultural use by Aboriginals and Torres Strait Islanders.

¹⁵⁶ http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/turtles/indigenous.html

The Strategy sets out seven Issues and Objectives (see Table 9), for which detailed strategies, timelines and implementation agencies are assigned¹⁵⁷. The strategies are to be implemented with consideration of the biological constraints of the species and through negotiation with scientists, Aboriginals and Torres Strait Islanders, conservation groups, the commercial fishing industry, management agencies and the general public.

Other measures to protect and manage dugongs in the Great Barrier Reef Region and the southern Queensland coast include:

- Protection of dugong habitat through zoning of the Great Barrier Reef Marine Park and Queensland Marine Parks;
- Special measures have been put in place, via the *Shoalwater Bay (Dugong) Plan of Management 1997*, to protect dugongs and dugong habitat in Shoalwater Bay, which is home to the largest dugong population in the southern Great Barrier Reef region (see Figure 42).
- Permanent strip closures of seagrass habitats have been established under the *Queensland Fisheries Regulations 1995*;
- Trawlers are fitted with satellite Vessel Monitoring Systems to track their movements and make sure they comply with zoning regulations;
- In 1997 the Australian and Queensland governments agreed to several measures specifically aimed at stopping the decline of dugongs along the urban coast of Queensland, including:
 - not to issue permits for the Indigenous hunting of dugongs from Cooktown down to the southern border of the Great Barrier Reef Marine Park;
 - to develop arrangements for the cooperative management of dugongs with Indigenous people;
 - to review penalties for illegal taking of dugongs;
 - to replace shark nets with drumlins;
 - to establish a two-tiered system (Zone A and Zone B) of Dugong Protection Areas (DPAs) (see Figure 43).
- Gill and mesh netting are greatly restricted or banned in seven Zone A Dugong Protected Areas totaling 2,407km², and subject to lesser modifications in eight Zone B Dugong Protected Areas totalling 2,243km² (*Fisheries Amendment Regulation [No. 11] 1997 [Queensland]*).

¹⁵⁷ http://www.gbrmpa.gov.au/corp_site/info_services/publications/turtle_conservation/tucs_strategies.pdf

Table 9: Issues and Objectives of *Turtle and Dugong Conservation Strategy for the Great Barrier Reef Marine Park*

ISSUE	OBJECTIVE
1. Habitat Protection	Identify and manage destructive human activities to protect crucial habitats for turtles and dugongs.
2. Commercial Fishing:	Continue to change fishing practices (trawling and gill netting) to minimise the level of accidental capture and death resulting from the incidental capture of turtles and dugongs.
3. Aboriginal and Torres Strait Islander Issues	Establish cooperative management systems to locally manage use, conservation and preservation of turtles and dugongs and their habitats, whilst allowing for continuance of Aboriginal and Torres Strait Islander cultures.
4. Incidental Injury and Kills	Significantly reduce the levels of incidental turtle and dugong injury and kills by boats, accidental capture, pollution, and the loss of habitat as a consequence of catastrophic events.
5. Illegal Take	By legal deterrents and community pressure, minimise illegal killing of turtles and dugongs.
6. Restoration Plans	Develop and implement the means to restore degraded or threatened habitats and turtle and dugong populations.
7. State, National and International Issues	<p>A. Encourage a reduction in the killing of turtles and dugongs in South Pacific and Asian countries through representations to state, national and international committees.</p> <p>B. Encourage a commitment by state, national and international agencies to protect and conserve turtles and dugongs.</p>

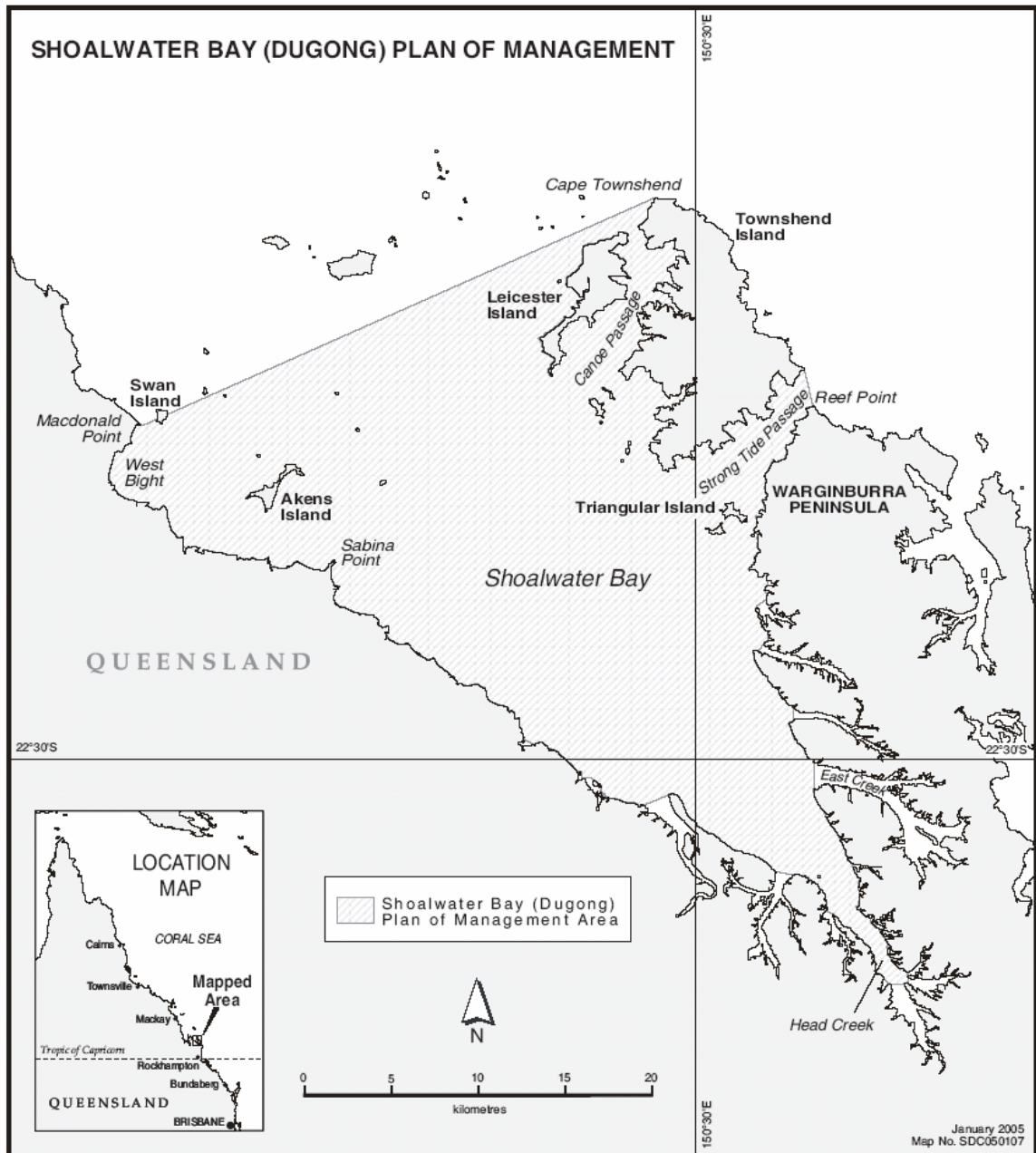


Figure 42: Map of the area of the Great Barrier Reef Marine Park subject to the *Shoalwater Bay (Dugong) Plan of Management 1997*¹⁵⁸

- An additional Zone A Dugong Protected Area of 1703km² in which gill and mesh netting practices were modified was established in Hervey Bay.
- A conservation plan for dugongs in Queensland was implemented by the Environmental Protection Agency in 1999, further reinforcing the functions of the Dugong Protection Areas.
- The Great Barrier Reef Ministerial Council has developed transit lanes with marker buoys to designate a *voluntary* 25 knot speed limit transit lane and a

¹⁵⁸ http://www.gbrmpa.gov.au/corp_site/management/shoalwater_bay/

10 knot speed restriction zone within identified important dugong feeding areas or on observing a marine animal at close range.

- Signs have been placed at boat ramps in the Dugongs Protected Areas informing boaters about the areas and regulations.
- An education campaign is underway to seek a voluntary reduction in boat speeds in shallow waters. 'Sunfish', which represents recreational fishing interests, has published a 'Code of Conduct' with suggested measures to minimise boat strikes on dugongs.
- In its 1999 review of measures for dugong conservation, the joint Commonwealth and Queensland Ministerial Council upgraded procedures for responding to reports of stranded dugong, including refining processes to establish 'cause of death' and fast release of information to the public.
- The Department of Defence has agreed to a moratorium on the use of explosives in all Dugong Protected Areas along the Queensland coast, except the Shoalwater Bay Military Training Area.
- The Department of Defence has ceased underwater detonation activities in important seagrass meadows near Triangular Island in Shoalwater Bay, and has altered other practices to minimise their risk to dugongs.
- In July 1999 the Great Barrier Reef Ministerial Council endorsed negotiations to secure a phasing out of the use of high explosives within the GBR World Heritage Area.
- Plans of management for the major tourist regions of Cairns and the Whitsunday Islands were finalised in 1998 and a plan of management for the Hinchinbrook region was finalised in 2004. These plans include protective measures for dugongs. (Note: dugongs and marine turtles are now afforded protection by being listed as Protected Species rather than under the Great Barrier Reef Marine Park Zoning Plan);
- The Moreton Bay Marine Park covers most of the Bay's tidal lands and tidal waters seawards to the limit of Queensland waters. There are five areas designated as "turtle and dugong" areas. Within these areas there are speed regulations which state that boat operators are not permitted to motor their boats on the plane. A publicity campaign was launched to assist in informing boaters of the new regulations. A Moreton Bay Dugong Watch monitoring program was launched in March 1998.
- An education and information program has been developed by the Great Barrier Reef Marine Park Authority to enhance public awareness of the value and plight of dugongs, and to advise people on how they can assist in minimising impacts. The program includes information kits, media releases, community service announcements, reef user workshops and liaison with advisory committees and interest groups.

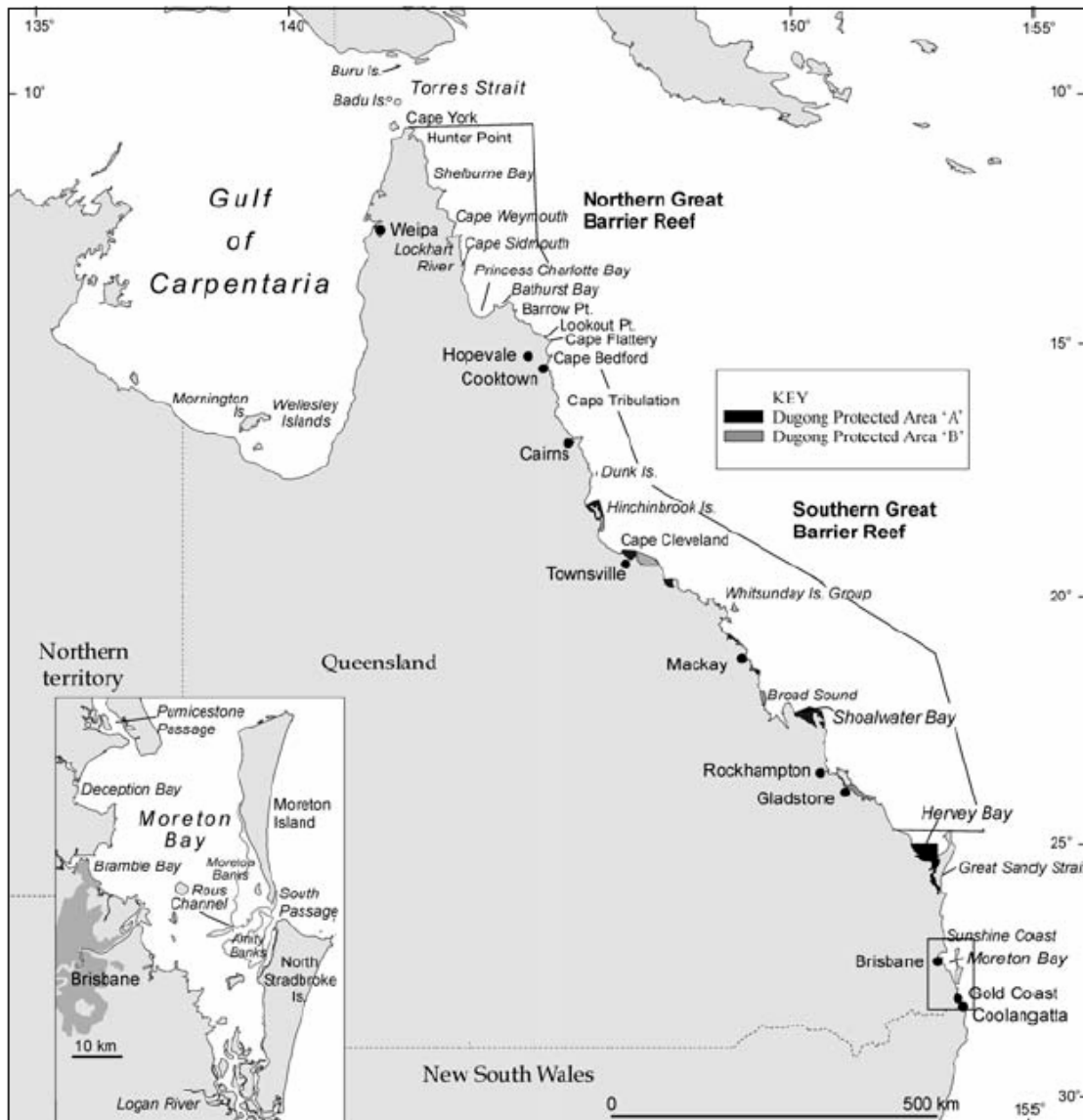


Figure 43: Map of Queensland showing the Great Barrier Reef Marine Park and Dugong Protected Areas¹⁵⁹

Marine Turtles

Queensland legislation prohibits the taking of marine turtles for commercial purposes. The *Queensland Nature Conservation Act 1992* provides protection for marine turtles, listing them as endangered and vulnerable species. Most significant rookeries for all species in eastern Queensland have been declared protected habitat under this Act. State marine parks such as Woongarra Marine Park and the Moreton Bay Marine Park contribute significantly to turtle conservation. The proportion of marine turtle nesting habitat protected in Queensland is summarised below:

¹⁵⁹ http://www.gbrmpa.gov.au/corp_site/management/shoalwater_bay/

- Loggerhead turtle: more than 90% marine turtle nesting habitat protected;
- Green turtle: more than 90% nesting habitat protected;
- Hawksbill turtle: more than 30% nesting habitat protected;
- Olive Ridley turtle: no nesting habitat protected;
- Leatherback turtle: nesting habitat protected (but access is controlled);
- Flatback turtle: about 75% nesting habitat protected.

Queensland Environment Protection Agency (QEPA) has a well-developed monitoring program for marine turtles with some data sets dating from the late 1960s. The major elements of the QEPA marine turtle research, monitoring and management program are:

- monitoring
 - Tagging census and
 - Stranding database
- research
 - demographic studies at nesting beaches and feeding areas,
 - population genetics studies,
 - migration studies,
 - incubation/embryological research,
 - El Niño Southern Oscillation (ENSO) regulation of green turtle breeding rate,
 - nutritional studies,
 - health studies, and
 - population modelling;
- management
 - fox baiting to improve loggerhead breeding success, and
 - environmental education programs.

The Queensland EPA operates a long-standing turtle interpretive, educational and research facility at Mon Repos near Bundaberg, where visitors can observe Loggerhead turtles nesting between November and March each year¹⁶⁰.

A management plan for the Queensland East Coast Trawl Fishery (ECTF) requires TEDs throughout the fishery. Legislative closures (both permanent and seasonal)

¹⁶⁰ <http://www.epa.qld.gov.au/projects/park/index.cgi?noback=1&parkid=83>

provide limited protection for nesting and/or feeding ground turtle populations, including shallow inshore seagrass areas. In the trawl fisheries of northern Australia, there are selected area closures that coincidentally provide a measure of turtle conservation. Many of the area closures are associated with inshore, shallow-water seagrass beds that are frequently the feeding grounds of some turtle species. In the Torres Strait, trawling is permanently prohibited in the area west of Warrior Reef.

Seasonal closures are applied to northern Australian trawl fisheries for a variety of reasons, however, many of the closures coincide with nesting times of some turtle species. This provides some level of conservation to nesting turtles. On the Queensland east coast, trawling is prohibited north of 22°S between 15 December and 1 March and south of 22°S between 20 September and 1 November. There are also a number of closures specifically implemented to reduce trawl activity in known turtle nesting areas, such as a closure at the northern tip of Fraser Island to protect nesting loggerhead turtles.

The ECTF developed a code of fishing ethics in regard to the capture of marine turtles and to minimise the impact of trawling on marine turtle populations. The major elements of the code are to:

- refrain from trawling within two to three nautical miles of 'major' turtle nesting beaches during the nesting season;
- limit tows to less than 90 minutes in areas of high turtle numbers;
- apply resuscitation procedures where appropriate, and return live turtles to the water as soon as possible;
- forward information on tagged or marked turtles to the Southern Fisheries Centre;
- participate in research programs monitoring the incidental capture of turtles in trawl nets; and
- participate in research programs trialing bycatch reduction devices.

Options for community management of marine turtles

Government recommendations

The Australian Government's Department of the Environment and Heritage has prepared the following recommendations¹⁶¹ to assist communities to contribute to the management of marine turtles in Australian waters:

Turtle care hints

- see and learn about marine turtles and join in the turtle watching and monitoring activities at Mon Repos Conservation Park in Queensland or other organised venues;
- do not discard old fishing lines, nets, plastic or other pollutants on beaches or into the sea;
- when boating, be on the lookout for turtles to avoid injuries to them, especially in shallow waters;
- help to control foxes and pigs near nesting beaches and ensure domestic dogs are kept under control at all times;
- control street and building lighting by appropriate design and landscaping in the vicinity of nesting beaches. Keep outside lights off during the turtle nesting season;
- avoid the use of campfires, torches and vehicle or boat lights near turtle nesting beaches;
- contact local community groups or government departments active in turtle conservation to see how you can help, especially with regular monitoring and recording of turtle activities. Record any sightings of dead turtles and identify the possible causes of death. Send these details with any tags to your state or territory conservation department.

Fishing activities

Help reduce turtle mortality:

- check longlines, gillnets and lobster/crab pots frequently to disentangle any turtles caught accidentally;
- use Turtle Excluder Devices (TEDs) for trawling and other fish netting activities. These devices allow large animals such as turtles to escape from trawl nets without being drowned;
- avoid trawling near turtle rookeries;
- avoid collisions with turtles;
- keep turtles which are in a coma on board, with their belly down and head sloping downwards until they revive.

Turtle watching

- keep the use of lights to a minimum;
- do not approach closely or shine lights or take photos using flash lights when the turtle is leaving the sea;
- wait until the turtle is laying eggs before shining lights or taking photos;
- minimise noise and sudden movements;

¹⁶¹ : <http://www.deh.gov.au/coasts/species/turtles/conservation.html>

- keep dogs away from turtles and turtle nests.

Traditional harvesting by indigenous communities

- take immature turtles in preference to adult-sized turtles;
- preferably, take eggs only from nests that are likely to get washed by the tide;
- during the mating and nesting season take male turtles in preference to female turtles;
- record hunting details such as numbers taken, location, date, species, sex, and size. Record tag numbers and send these to the address provided on the tag.

Turtle monitoring

- Record date, numbers, locations and species of marine turtles seen at sea or nesting;
- Report all sightings of sick or injured turtles;
- Report any tag numbers sighted on turtles. Include date, location and information about the turtle (do not remove tags from live marine turtles);
- Count turtles using particular nesting beaches or estimate the number by counting turtle tracks (for each set of tracks leading onto the beach and back to the sea, count one turtle) and if possible, identify the species.

Other options

In some parts of the world turtle managers take a more direct approach to supporting marine turtle populations, including:

- Relocating eggs that have been laid in nests that are likely to be flooded by high tides, raided by animals or stolen (in locations where egg collection is illegal);
- Artificially incubating eggs and raising hatchlings before releasing them into the sea (a process known as “head-starting”);
- Maintaining breeding populations of marine turtles in captivity, artificially incubating the eggs and raising turtles for the commercial market and for release into the wild.

Relocating eggs from doomed nests and/or protecting nests from predation/theft has the potential to significantly increase the production of hatchlings, and hence increase the numbers of turtles reaching breeding age. For example, a program of nest protection and egg relocation over 20 years on one island in the Caribbean is credited with increasing the number of nesting female Leatherback turtles from 18-30 during the 1980s to 186 in 2001, with a corresponding increase in hatchling production of from about 2,000 to over 49,000 per year¹⁶². In Costa Rica local villagers have made a deal with conservation authorities that they will only take eggs from nests laid below the tide line.

¹⁶² Dutton et al. (2004)

The conservation or commercial benefits of marine turtle captive breeding programs (“farming”) and head-start programs using eggs or hatchlings harvested from the wild (“ranching”) are much less certain.¹⁶³ An attempt to establish a commercial Green turtle farm in Torres Strait began in 1970, funded by the Australian Government. However, persistent difficulties in obtaining food supplies for the young turtles, disease and parasites led to the closure of the farm ten years later after an expenditure of \$6 million.

A marine turtle ranching operation on Reunion Island in the Indian Ocean began in 1972, using hatchlings collected annually from two islands 600 and 2,000km from Reunion. Despite slow growth and disease in the captive turtle population, meat and shell products were produced for the local domestic and tourist market for over 20 years. Permission from CITES to trade internationally in turtle products was not granted and the operation transferred their production to fish aquaculture, research and education during the 1990s.

A Green turtle farm has been operating on Grand Cayman Island in the Caribbean since 1969, using eggs harvested from Costa Rica, as well as mature adults harvested from several Caribbean countries. Without permission to trade internationally the farm became bankrupt and was taken over by the Cayman Island Government. The farm continues largely as a tourist facility and produces meat for the local market; the farm also releases immature turtles into the sea.

In summary, turtle farming or ranching is very expensive and requires substantial expertise and long term commitment. Similarly, scientists and managers generally agree that head-starting is not an effective way of increasing turtle numbers. Released turtles may introduce diseases into the wild population or may change the natural genetic make up of a wild breeding population. Turtles raised in captivity may also not have developed the normal behavioral patterns that enable them to join a breeding population or to find an appropriate nesting beach. Instead, protecting habitats and reducing mortality of turtles and eggs are more effective and a better use of time of resources.

¹⁶³ Ross (1999); Donnelly (1994)

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