

Dugong and Marine Turtle: Teaching Resource and Information Package



Written and compiled by the Torres Strait Regional Authority's Land and Sea Management Unit.
Published by the North Australian Indigenous Land and Sea Management Alliance (NAILSMA).



CARING
FOR
OUR
COUNTRY

Acknowledgements

We acknowledge Traditional Owners of the six nations of Zenadh Kes (Torres Strait): Gudang, Kaiwalagal, Maluiligal, Guda Maluiligal, Kulkalgal, Kemerker Meriam for their support of the Torres Strait Regional Authority and North Australian Indigenous Land and Sea Management Alliance Dugong and Marine Turtle Project.

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Written and compiled by the Torres Strait Regional Authority's Land and Sea Management Unit (TSRA LSMU).

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Printed November 2009

A PDF version of the printed package can be downloaded from
<http://www.nailsma.org.au/publications/resource.html>

The printed package and CD ROM can be ordered from NAILSMA (subject to availability).
Email nailsma@cdu.edu.au

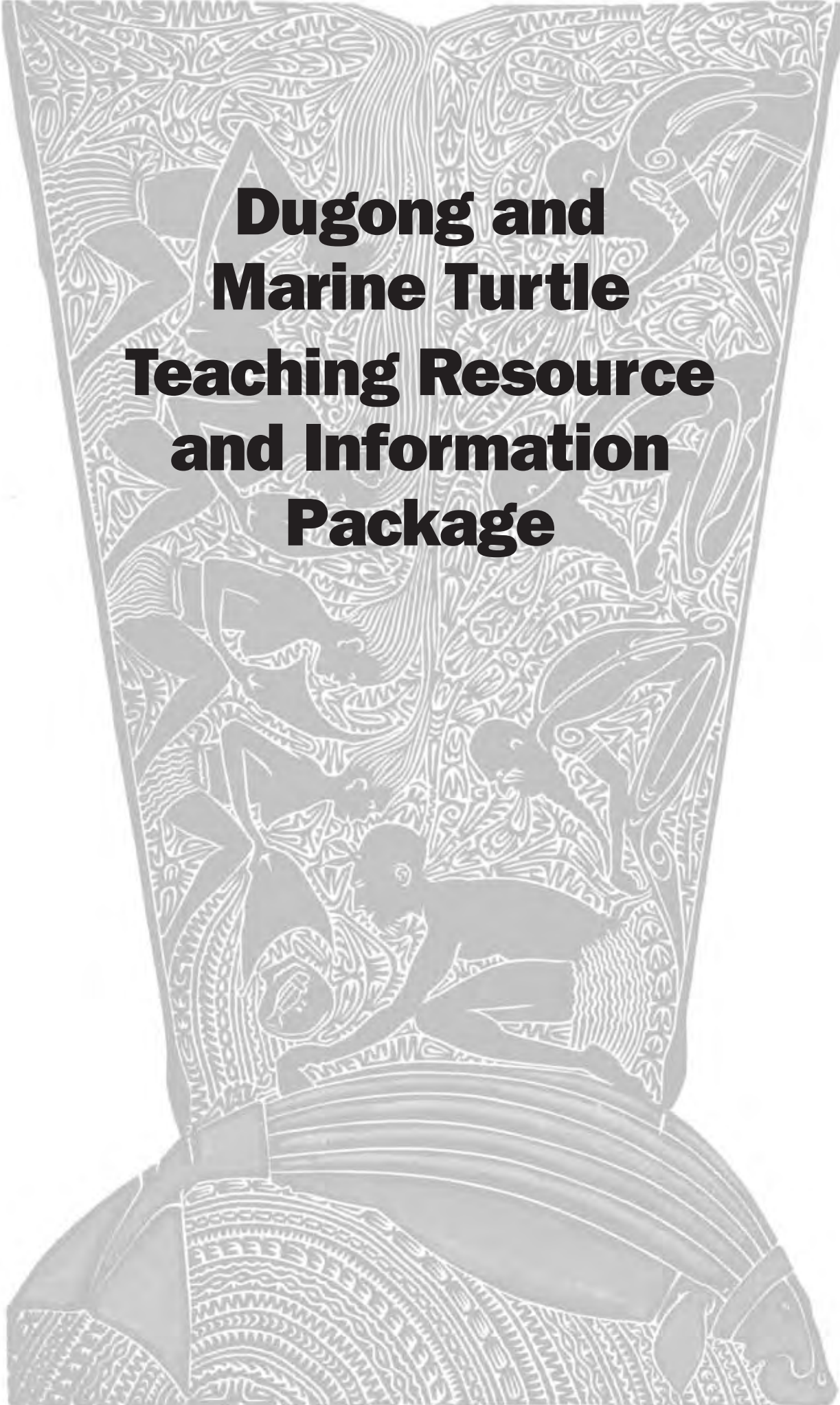
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ISBN: 978-0-9775886-4-0

Artwork by Torres Strait artist Alick Tipoti. Supplied by The Australian Art Print Network.

Front cover: Ai Pugaik

Back cover: Waru Thurul



**Dugong and
Marine Turtle
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and Information
Package**

The CD ROM may contain images or video of Aboriginal or Torres Strait Islander people who have passed away.

Content relating to hunting, cultural use, marine debris and threats to dugong and marine turtle may include pictures of deceased animals. Care must be taken when viewing or showing these pictures as the deceased animal may be a totem of the viewer.

CD ROM

The CD ROM accompanying *Dugong and Marine Turtle: Teaching Resource and Information Package* contains a vast collection of information products, photographs and video clips relating to dugong and marine turtle.

The materials contained on the disk have been sourced from a number of individuals and organisations who have generously contributed to this package in the interest of sharing knowledge about dugong and marine turtle.

The use of materials contained on the CD ROM is strictly limited to non-profit educational purposes only.

CD ROM Contents

Dugong

- Dugong Booklet
- Multimedia
 - Dugong Photos
 - Dugong Video Clips

Marine Turtle

- Booklets and activity sheets
 - Colouring Sheets
 - Sea Turtle Booklet and Poster
 - Sea Turtle Educators' Guide
 - The Monkey and the Turtle – Story from the Philippines
 - Turtle Puzzles
- Multimedia
 - Marine Turtle Photos
 - Marine Turtle Video Clips

Marine Debris

- Marine Debris Booklets and Poster
 - Marine Debris Information and Survey Sheet
 - Marine Pollution Poster
 - Marine Pollution Booklet
 - The Net Kit – A Net Identification Guide to Northern Australia
- Marine Debris Photos

Seagrass

- Seagrass Booklet and Poster

TSRA and NAILSMA Resources

- NAILSMA Dugong and Marine Turtle Knowledge Handbook
- NAILSMA Message Disk 3
- TSRA and NAILSMA Dugong and Turtle Project Newsletters

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Introduction



For Torres Strait Islanders, dugong and marine turtle represent more than just subsistence, a source of meat, or a relic of past times; it is a way of life. Dugong and marine turtle are integral to the customary way of life or *Ailan Kastom* of the Indigenous peoples of Torres Strait.

A complex system of logic, knowledge, magic and language, environmental perception, social expectations and responsibilities, and the roots of Islander totems, myths and legends revolve around dugong and marine turtle.

The dugong and marine turtle are also symbols of Torres Strait Islanders' quest to assert their cultural identity and aspirations for self-determination. Dugong and marine turtle hunting also includes cultural adaptation to the coming of modern times. As such there is a responsibility in *Ailan Kastom*, with respect to culturally important resources such as dugongs and marine turtles.

Looking after dugong and marine turtle is a part of looking after *Ailan Kastom*. A Torres Strait elder voiced his opinions of responsibility to *Ailan Kastom* at a workshop in 1998:

“ *the dugong has fed and healed
Torres Strait Islanders for generations
and now it is time for dugong totem people to look after
dugongs, as we are all related, all Torres Strait Islanders
should have a responsibility to
look after dugongs.* ”

Why a Teaching Resource and Information Package?

Torres Strait Islander knowledge of dugong and marine turtle belongs to Islanders.

This Information package does not try to teach this knowledge or pass it on to younger generations as this is already a part of Torres Strait Islander culture. The information package looks to providing Torres Strait Islanders with access to dugong and marine turtle related information from around the world.

It is hoped that the package will give Islanders more information to use in considering how they want to look after their dugong and marine turtle in Torres Strait in the future.

Activities in this package are linked to Education Queensland's 'The New Basics Project'—specifically the 'Rich Task' component. Torres Strait languages (Eastern Island Language and Western Island Language) feature throughout the package.

What's in the Teaching Resource and Information Package?

The package contains three themes and is designed as a resource to support community education about dugong and marine turtle.

The three themes include:

- dugong;
- marine turtle, and
- marine debris.

Each of the three themes contains the following information sources:

- case-study stories;
- booklets and activities sheets;
- catalogue of imagery and video;
- classroom and school activities; and
- online links and material resources.

Key Messages

- Dugong and marine turtle are important to Torres Strait Islanders and Aboriginal people.
- Torres Strait Islanders and Aboriginal people hold a great deal of knowledge about these animals.
- There is a lot of information available to the world on dugong and marine turtle and this information can be used by Islanders and Aboriginal people to expand their world view of dugong and marine turtle.
- Dugong and marine turtle need to be looked after for the future (sustainability).
- Indigenous management of dugong and marine turtle is happening across northern Australia and around the world.
- Culturally appropriate and ecologically sound community-based management of dugong and marine turtle is the key to dugong and marine turtle sustainability.

Key Outcomes

- Involve everyone (students, rangers and elders) in thinking about looking after dugong and marine turtle together.
- Develop and strengthen Indigenous communities to guide and implement dugong and marine turtle management on their sea estates.
- Encourage Torres Strait Islanders to express their aspirations for, and become involved in the management of dugong and marine turtle and bring together Indigenous groups, resource managers and researchers to assist communities in managing their sea estates and resources.

Teaching Tips

Awaken curiosity. Try to inspire. Spend a moment writing or thinking about what you can achieve through teaching people about the importance of dugong and marine turtle.

- Integrate activities and information into existing curriculum where possible.
- Seize opportunities to highlight the links to every day activities.
- Encourage students to think critically.
- Create a sense of connection to the environment, heritage and culture, and the future of your Torres Strait Island.
- Empower your students to make decisions that will have a positive impact on their future.
- Use positive examples of what students can do to help.
- Involve elders, rangers and hunters in school education delivery.

Recordings and Feedback

The North Australian Indigenous Land and Sea Management Alliance (NAILSMA) is interested in sharing the recordings made by your class with Indigenous students across northern Australia. If you make any recordings and your school is willing to share them please contact NAILSMA.

Please also contact NAILSMA If you have any suggestions on how this information pack can be added to or improved.

NAILSMA's contact details can be found in the section 'Contact Groups' on page six.

Contact Groups

There are a range of government and non-government officers willing to assist schools, communities and Traditional Owners with gaining greater understanding of dugong and marine turtle related issues.

In line with the objectives of this teaching resource and information package, these officers will be able to provide information to Torres Strait Island people about latest dugong and marine turtle research and information from around the region and around the world. This information will assist Islanders to build on their current knowledge and allow them to consider a range of factors when looking after and sustaining dugong and marine turtle.

These groups include:

Torres Strait Regional Authority

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Fax: 08 8946 6388

Queensland Department of Environment and Resource Management (DERM)

Cairns Regional Office
5B Sheridan Street
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Queensland Primary Industries and Fisheries (QDPI&F)

Post: GPO Box 46
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Fax: 07 3404 6900
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Web: www.deedi.qld.gov.au

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Tel: 07 4745 9661

Fax: 07 4745 9660

Email: riki@ghostnets.com.au

Web: www.ghostnets.com.au

Australian Fisheries Management Authority (AFMA)

Box 7051

Canberra Business Centre ACT 2610

Tel: 1300 723 621

Fax: 02 6225 5500

Web: www.afma.gov.au

James Cook University (JCU)

School of Earth and Environmental Sciences

Townsville Qld 4811

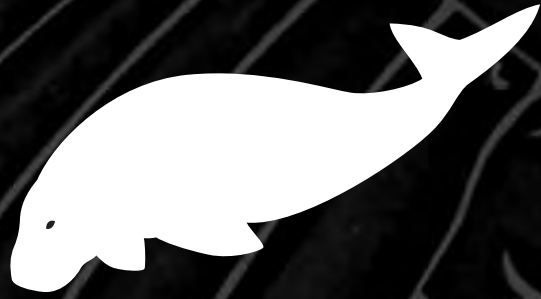
Tel: 07 4781 45 36

Fax: 07 4781 5581

Email: Registrar@jcu.edu.au

Web: www.jcu.edu.au

Dugong



The Sea Cow

Dugongs or *dhangal* as they are known in Western Island Language are the only living species in the Family of *Dugongidae*. Another member of this family, Steller's sea cow, is now extinct. Dugongs are related to elephants.

Characteristics of Dugong

Dugongs are mammals and are found along the coasts of more than 48 countries around the world. Over much of the dugongs range, herds consist of small populations that are separated by large distances.

Life Cycle and Breeding

Dugongs can live for more than 70 years. The age of a dugong can be determined by looking at its tusks. Scientists cut a tusk in half lengthwise and determine the age by counting the growth lines. The dugong lays down one white and one dark layer on their tusks each year — like trees develop growth rings.



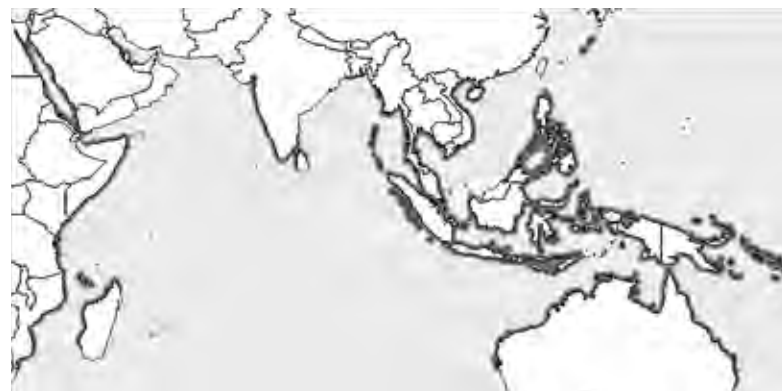
*Dissected dugong tusk showing growth rings.
Photo: Helen Marsh, JCU.*

Things to do:

- Ask an elder if they would like to explain to the students the different stages of life for dugongs, the different names given to dugongs and some information on feeding. Ask about different feeding trails. Ensure that it is appropriate for all in the class to hear the stories and information. Record the language names for body parts and different life stages of dugong.
- Ask students to draw the differences between male and female dugongs.
- Look through the other dugong booklets and activities in the DVD ROM.
- See the dugong section of the accompanying CD ROM to view video of a dugong grazing seagrass beds and photos of seagrass.
- See the seagrass section of the accompanying CD ROM to view a booklet and poster on seagrass.
- Visit the web sites referenced on page 25.

Feeding

Dugongs feed mainly on seagrass, but can supplement their mostly vegetarian diet with invertebrate animals such as polychaete worms, sea squirts and shellfish. Research has shown that dugongs feed mostly on small, delicate seagrasses, especially species of *Halophila* and *Halodule*.



*Dugong distribution.
Source: www.robortosozzani.it/Dugong/habitatEN.html*



Dugong mother and calf.
Source: www.oceans.gov.au

Dugong Pregnancy

Dugongs have low reproductive rates and long intervals between generations. Research indicates that *Ipika dangal* (females) do not bear their first *Kazi danga* (calf) until they are at least six years old and may not commence breeding until they are 17 years old.

Scientists can tell if a female dugong has bred before by looking inside the dugong's uterus. Each time the female dugong becomes pregnant the placenta leaves a scar inside the uterus.

By counting the number of scars you can tell how many times the female has given birth. Torres Strait Islander and Aboriginal hunters also believe they can tell how many times a dugong has bred by the length and size of the female's teats, getting longer with the number of offspring. Comparisons between researchers' and hunters' estimates of the number of offspring a single dugong has had have shown very similar results.

Things to do:

- Ask an elder or hunter to visit the class and talk to the students about dugong breeding. Ensure it is appropriate for the elder or hunter to talk with the students about dugong breeding.
- Ask the elder to tell the class how they can tell if a female dugong has bred before.

A delay in the onset of breeding observed with some female dugong may be linked to the availability of seagrass; when dugongs do not have enough to eat, it is believed they may delay breeding.

Pregnancy lasts between 13 and 15 months, and usually only one calf results from each pregnancy. There are records of twin fetuses in pregnant dugong, and hunters have observed mother dugong swimming with two calves. Dugong calves are born under the water and swim to the surface for their first breath of air. *Kazilaig* (pregnant dugongs) are known to move into sheltered and protected areas to give birth to their calves to protect them from predators and rough weather conditions. Dugong calves are between one and 1.3 meters in length at birth and weigh between 20 and 35 kilograms.

Nanaig (nursing mothers) suckle their calves for 14 to 18 months, and the time between pregnancies varies between two and a half years and seven years. Young dugongs start eating seagrass soon after birth, while they are still receiving milk from their mothers. Some Indigenous people believe that mother dugongs roll seagrass into balls for their calves, to encourage them to start eating.

During the first two years of life, the dugong calf and *apu kaz* (mother) will stay close together, with the calf staying by the side of its mother or riding close behind in her slipstream. Mother and calf communicate with each other using a number of squeaks and chirping noises.

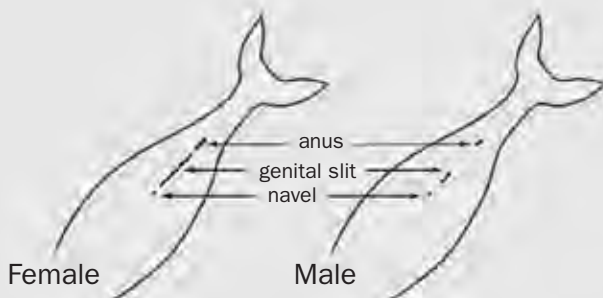
Things to do:

- Ask an elder if they would like to talk with the students about the relationship between dugong mothers and their calves.
- Ask the students to draw mother and calf dugongs and/or write a story about their travels together.
- Ask an elder or hunter to visit the class and talk with the students about the different noises that dugongs make. Ensure that the elder is comfortable discussing these things with the students.

Mature Dugong and Mating

Researchers have observed several types of mating behaviour in dugong. Along the Queensland coast, *garka dangal* (male dugongs) have been observed violently competing for oestrous females (on heat). In contrast, dugongs in Shark Bay in Western Australia have been observed engaging in a mating behaviour known as 'lekking', designed to attract females to the male so that mating can occur. Male dugongs are believed to reach sexual maturity as young as four years of age.

Visual sexing of dugongs



Source: www.jcu.edu.au

Indigenous hunters can differentiate between the sex of mature dugongs by the length of their faces; the face of a male is longer. In addition, the first in line of swimming dugong will be a female and the second a male. A pregnant dugong is distinguished by the tail thrown high when diving. At night the sexes of dugong are distinguished by the sounds they make. The male makes a loud sound and the female a softer whisper-like sound.

When a dugong is captured it is easier to determine its sex by looking at the size of the genital slit. Females have a much longer slit than males.

Research suggests that dugong over 2.5 metres in length are mature and male and female dugong under 2.2 metres are likely to be immature and not at breeding condition. It is known that a feeding mother dugong can become pregnant while still lactating (producing milk) for their last-born young.

Torres Strait Islanders consider that dugong breed throughout the year. In the Townsville area the analysis of captured female dugong suggests their ovaries become active in the latter half of the year (July to December) with dugong calving concentrated around August through to December. The sex ratio of dugong births is considered to be one male to one female, meaning around 50% of the population will be male and 50% will be female.

Things to do:

- Ask the elder if they could discuss places where they see dugong mating and the seasons when dugong mothers calve.

Steller's Sea Cow – Cousin of the Dugong

This species, which could grow up to 10 metres in length and weigh as much as three Landcruisers, used to live in the cold waters 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. 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. Steller described this sea cow as “*strange and absurd*”.

Things to do:

- Why do you think the sealers were killing Steller's sea cows?
- Ask students what it would be like if there were no dugong. Write a story about how important it is to have dugongs in Torres Strait.
- Look at the dugong images and video in the dugong section of the accompanying CD ROM. These may be used in the different activities or to get the students thinking about dugongs.
- Why would Steller have said this sea cow was “*strange and absurd*”?



Florida manatee.
Source: www.quantum-conservation.org

Other Cousins of Dugong

Manatee are cousins of the dugong. Three types of manatee occur in the world but none of them live in Australia. Instead of a forked tail like a dugong, manatees have paddle-shaped tails. Manatees eat similar food to dugongs but unlike the dugong that spends all of its life in saltwater, the manatee may spend time in freshwater rivers as well.

- Why are dugongs sometimes called sea cows? What similarities are there between dugongs and cows?
- Look at the picture of the Manatee. Ask the students what are the differences between dugong and manatees.
- See the section ‘Dugong Information and Resources’ on page 25 for a link to a UNEP web page aimed at children that describes the differences and similarities between manatee and dugong.

Dugong Hunting

In Torres Strait, dugong hunting is a major activity for many men. Although all men consider themselves seamen, not all are hunters. In western Torres Strait a real hunter is called a *buai garka* (male family head). In any dugong hunting party he is the leader, the harpooner and the one who makes all the decisions.

‘A *buai garka* is a respected person. “He knows how to hunt, how to find dugong, how to spear.” It takes a long period of training and experience to become a good hunter using the drift technique for hunting. One has to master a complicated body of knowledge that includes the animal’s behaviour, the precise times and places to hunt, the difference between various types and qualities of animals, and the way to get close enough to a dugong to harpoon it.

To get within harpoon range, the hunter must estimate the drift of his boat, anticipate the feeding interval time, and be able to distinguish the dark form of a submerged dugong from rocks, coral heads, and feeding turtles’.

Teenagers start by going along as crew to help paddle and to pull harpooned animals alongside the dhyngy. During the hunt, the *buai garka* will usually tell them about tides and dugong and marine turtle behaviour. But to teach how to harpoon and to have luck is the role of *audi* (one of a boy’s mother’s brothers). When the novice is strong enough to handle a *wap* (harpoon), he is taken out for lessons. The first dugong that he catches is given to his *audi*. In addition, the boy’s parents must provide a selection of gifts for the *audi* to choose from.

Things to do:

- Ask an elder to join the class to talk about hunting and the training of young boys for dugong hunting.
- Ask the students what sort of things they started out doing when their fathers or *audi* took them hunting the first few times.
- Ask the students to draw a hunt or write a story about what their family does when they plan to go hunting, the things they need to get ready. Include in the story what the family does when they get home with the dugong, if they share it with family and how they prepare the dugong for eating.

During dirty water periods, when much dugong hunting takes place, the hunters must rely on several clues to find the diving dugong: floating sea grass uprooted by dugongs as they feed, milky white sand and silt clouds in the water made by dugongs as they uproot grasses; floating excreta; and wakes, swirls and bubbles on the water surface. Dugong move in and out of some feeding areas with the tide, following a rising tide into good seagrass areas.



Yanyuwa man hunting dugong, Gulf of Carpentaria.
Source: www.ozoutback.com.au

Dugong



Dugong. Source: www.colszoo.org

Things to do:

- Ask the students about where seagrass grows around their home island and if these are the same areas where the dugong are found.
- Ask the students to draw a picture of their home island and draw where the seagrass areas are.
- Contact the Torres Strait Regional Authority Land and Sea Management Unit and ask about becoming part of Seagrass Watch if you have seagrass around your island.
- Visit the Seagrass Watch website. www.seagrasswatch.org

Dugong Behaviour

Dugong live in loose social groupings whose size fluctuates periodically, depending on reproductive behaviour, food supply, environmental conditions, local and long distance movements, and hunting pressure. Dugongs are usually seen in pairs and in small groups of fewer than ten that include young, sexually mature, and old animals. Herds of more than twenty are seen when small groups gather together to shelter from a storm. Some *malu dhangal* (dugong) appear to travel long distances seasonally and may be migratory. Other dugongs seem to reside in large reef and island margin territories.

Dugong are sensitive to tidal fluctuations and changes in water clarity. Moving from place to place, they often swim with the flood and ebb tides. Some seagrass beds are so shallow that they dry at low tide; dugong feeding is thus limited to high tide periods. Torres Strait dugong hunters know where dugong scratching rocks can be found: places where dugongs rub their bodies against for scratching purposes. This behaviour is similar to that of elephants that scratch their bodies against trees and boulders.

Things to do:

- Ask an elder if they feel comfortable to come and talk to the students about dugong behaviour. Ensure that it is appropriate for all the students in the class to share this information.
- Ask if the elders can tell the students about the different names for dugong and the different roles individual dugong play in the herd.
- Ask the students to draw pictures showing the different types of dugong.
- Ask the students to use the different names for dugong to make a story about a dugong herd in Torres Strait around their island.
- Ask the elder to talk to the students about seasonal and weather movements of dugong around their island.

Communication

Dugong are known to make a variety of noises when communicating with each other. The most noticeable is the noise made by the lead dugong in a herd, known as the 'whistler'. Torres Strait Islanders note the whistle noise made by these dugong when moving the herd from seagrass bed to seagrass bed. Researchers have also recorded a number of other noises from dugong, including barks, chirps and squeaks, particularly when mating.

Things to do:

- Ask a hunter or knowledgeable elder to visit the class and talk to the students about how dugong communicate with each other.
- Write an imaginary story about a particular animal in the herd and their travels.

Movements

Dugongs undertake small and large scale movements. Studies have shown that dugong regularly travel over 30 kilometres and sometimes travel distances greater than 100 kilometres to known feeding grounds.

The greatest movement tracked in Australian waters showed a dugong moving up to 500 kilometres over 12 days. All dugongs make large moves, no matter what their size, age or sex.



Dugong surfacing before capture. Photo: Dave Holley, ECU.

Movements within Moreton Bay have shown that dugong in areas of lower latitude and colder waters undertake movements to regulate their body heat. Dugong were observed moving to parts of Moreton Bay that showed flows of warmer currents, residing in these areas for long periods until waters in the remainder of the bay warmed.

Things to do:

- Explain to the students about thermoregulation in mammals. It is much like humans having to move to warmer areas, or to put more clothes on when in a cold place.
- Ask an elder or hunter to visit the class and explain to the students about dugong movements around their island.
- Use a map to see where a dugong could swim to if it undertook a large 500 kilometres movement from your home island to a place outside of Torres Strait.



Bardi Jawi Rangers from the Kimberley follow a dugong before attaching a satellite tracker to its tail. Photo: Richard Meister, KLC.

Dhungal in Torres Strait

The shallow waters of Torres Strait support a large number of dugong in a small area, making it one of the most important dugong habitats in the world. Scientists have attempted to count dugong in Torres Strait six times between 1987 and 2006 using an aerial survey method.

Estimates of the Torres Strait dugong population have varied over the 19 years, ranging from 13,000 to 28,000 animals. The researchers suggest that the large differences in population estimates can be explained by

large movements of dugong in and out of the survey area. Torres Strait Islanders have regularly said that dugong herds move over large distances in response to changes in weather conditions and seagrass.

The survey results also suggest a movement of dugong within the Torres Strait. In 1987, 1991 and 1996 the Orman Reef, north of *Besi* Mabuiag Island (Western Islands) had the most dugongs recorded by the aerial surveys. In 2001, the western region of Torres Strait had the most dugongs in Torres Strait.

Things to do:

- Ask your local Australian Fisheries Management Authority (AFMA) officer to attend the class and discuss how scientists do the aerial dugong surveys. Ask to borrow a copy of the James Cook University aerial survey poster from the Torres Strait Regional Authority Land and Sea Management Unit.
- Explain to the students that the dugong around their island may move to other islands. Explain to the students that this means when they are older, they will be looking after dugong not just for their communities, but also for their neighbouring communities.

Predators of Dugong and Threats to their Survival

As dugongs are large animals, only humans, crocodiles, large sharks and killer whales are a danger to them. Dugong calves are probably vulnerable to attack from large sharks, but mother dugongs are known to protect their calves from predators.

Things to do:

- Ask the students to write a story about the travels of a young dugong including the different predators that the dugong would encounter. Ask the students to draw pictures to accompany the story.



A dead dugong found on Friday Island. The cause of death is unknown. Photo: TSRA Dugong and Turtle Project.

Changes in Population

The dugong is now absent from large areas of its former distribution range in some parts of the world, but aerial surveys in recent decades have estimated the dugong population in Australian waters to be around 80,000. However, population surveys have not been carried out in all coastal regions where dugongs are known to live in Australia.

From their understanding of the dugong life cycle, researchers have estimated that in areas where there are no anthropogenic (human) impacts, dugong populations only increase about 5% per year. Researchers are therefore concerned that a population of dugong will decline if more than about 2% of adult females (considered to represent half of any dugong population) in a population are killed each year.

In some areas of Australia, Traditional Owners have observed decreases in dugong numbers from time to time and have seen changes in the health of dugong. Dugong populations are affected by many threats including:

- harvesting for food, meat, oil, medicaments, magical charms and other products;
- biased harvest concentrating only on females that result in a reduced number of breeding stock;
- the destruction of seagrass habitats by pollution or from direct physical damage by trawling and build-up of silt caused by mining, poor catchment management or coastal development;
- large scale floods that result in seagrass dieback, causing loss of seagrass feed supplies;
- injuries from stone fish and large marine predators;
- boats and boat noise which are said to scare dugong from feeding and breeding areas, and boat strike that can directly result in the death of dugong; and
- entanglement in fishing lines and nets.



Dugong spotting (breathing) over a shallow sand bank. Photo: Toshi Nakata.

These combined impacts can affect local population sizes, such as in the Hopevale area. In response to drops in the number of dugong around Hopevale, the Traditional Owners decided to make a dugong and marine turtle management plan to reduce the level of hunting. Although hunting was only one factor contributing to population changes, the Hopevale community felt they could reduce the pressure on dugong and allow numbers to recover.

Things to do:

- Ask an elder to visit the class and talk to the students about any changes in the number of dugong around their island by comparing numbers when the elder was young to the numbers seen today.
- Ask the students to write a short story about the many different impacts on dugong.
- If the number of dugong has changed over time, ask the elder why they think numbers have changed. Ask the students to come up with ideas (management) that could be used to return populations to the sizes seen when the elder was younger.

Management

Dugong populations around the world have been subject to population declines. Evidence from current long-term monitoring studies is showing that with good management, such as by protecting habitat, reducing deaths in fisheries and ensuring that harvests of dugong is sustainable, dugong populations can be maintained or recover. Research and monitoring is essential for effective management of dugong populations. One of the main tools used by researchers to monitor dugong abundance and distribution is through the aerial survey method.

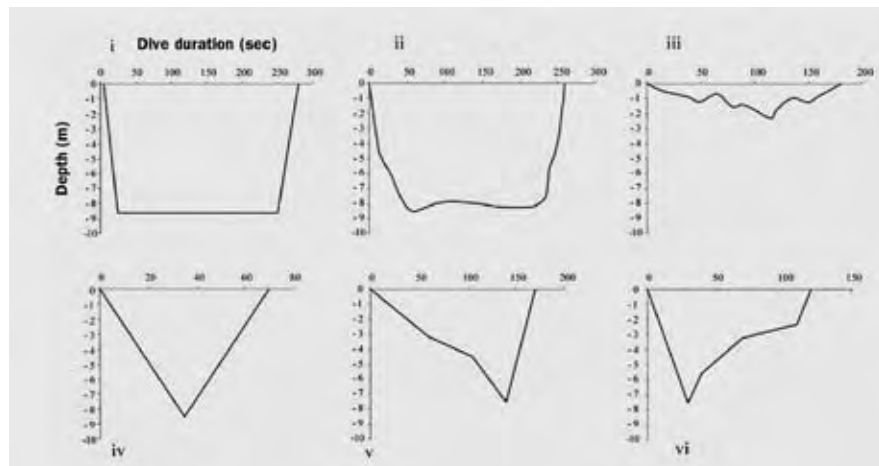
Dugong aerial surveys are undertaken from a fixed wing plane, that flies at a set height along transects over the region of interest. Four observers travel in each plane, two looking out the left side, and two looking out the right side of the aircraft.

Dugongs that are seen are recorded and a total number sighted for a particular area is calculated from both sides of the plane. Scientists then use their knowledge of dugong dive durations to estimate how many dugong within a population will be at the surface, how many will be feeding on the bottom and how many would be either coming up to breathe or descending to feed. This information will tell the researcher what proportion of dugong in a population will be visible to the aerial surveys at any one time, and also the proportion of dugong that would not be visible.

Research and Monitoring

Scientists have attempted to track dugong to determine grazing areas, duration and depths of dives, movements between grazing areas and between regions. Some of these surveys have shown a variety of large and small scale movements. This information is vital for properly informing management decisions. For example, tracking can show researchers the main feeding areas for dugong which allows the researchers to consider the management of net fishing and boat traffic in these areas.

There are many ways that communities are now managing dugong to make sure that populations either stay healthy or recover to the numbers they once were.



Graphs showing dugong dive depth and duration. This information is used to assess the proportions of dugong on the surface and those feeding on the bottom at any one time during an aerial survey. Source: Helene Marsh, JCU.



Bardi Jawi Rangers Trevor Sampi, Kevin George, Dwayne George and Terry McCarthy with ECU researcher Dave Holley attaching a satellite tracker to a dugong. Photo: Daniel Oades, KLC.



Bardi Jawi Ranger Dwayne George prepares to attach a satellite tracker to a dugong's tail by first tying rope to it. Photo: Dave Holley, ECU.

Some of these management activities include:

- go slow zones to reduce boat strike in known dugong feeding areas (Moreton Bay);
- creating permit conditions that mean hunters must seek permission from Traditional Owners before hunting (Hopevale Aboriginal Community);
- creation of quotas to limit the number of dugong taken to ecologically acceptable levels (Girrigun TUMRA, Hopevale Aboriginal Community);
- setting aside sanctuaries where dugong cannot be hunted (Torres Strait);
- restricting commercial net fishing in rivers where dugong are known to occur (Queensland and Northern Territory); and
- only hunting dugong in a set season to allow the populations to be rested for part of the year (Bardi Jawi at One Arm Point, WA).

Things to do:

- Ask an elder if they would like to come and talk to the students. Ask the students to create a dugong life-cycle similar to the marine turtle life-cycle. Use the information from this package, relevant websites and the knowledge of community elders to finish the life-cycle. Add language names for the different cycles.
- Ask the elder to talk about how the community would manage dugong populations when they were young.
- Ask the students to come up with ideas on how their community can make sure that dugong numbers are maintained around their island and in the Torres Strait region.
- Look up the TSRA and NAILSMA Resources section of the accompanying CD ROM to view newsletters produced by the Dugong and Turtle Project that outline work being done by Torres Strait Island communities to manage dugong and marine turtle.

Dugong Activities

DUGONG ACTIVITY SHEET 1: Dugong Role Play

Aims: Encourage students to play an active role in learning in a fun and interactive way. Explore different viewpoints through role playing, and focus on exploring issues, and finding solutions.

Levels: Primary and Secondary

Subjects: Music, English, Creole, Meriam Mir or Kala Lagau Ya, Drama

Materials: Nil

Instructions:

Divide the class into groups. Each group is given a story, or is asked to design their own role-play. Read the story carefully. Students can add further information about the characters as long as it fits the story. The objective of the role play is to resolve the problem through a compromise that makes both sides happy.

Role Play 1: A community celebrates the catch of a dugong by sharing it between the families.

Hunters return from an afternoon hunt with a fat dugong. The women, children, and village men who did not participate in the hunt come down to the beach to watch and comment loudly on the quality and the size of the animal. Three or four men butcher the dugong. Young boys help by washing pieces of meat in the sea.

It is tough work cutting the dugong in the traditional way, counting the number of bowls bought down to the beach by the families. The butchers cut the dugong into many small piles of specific pieces prior to distribution to each of the families.

Everyone on the beach joke and share the story of the hunt. The families take their share of the dugong and go home to share the food.

Role Play 2: Traditional Owners try to convince their community to conserve dugong.

The elders have noticed that there is more and more dugong being caught by hunters in their community. Some hunters are sport hunting, not following traditions for sharing and throwing away meat from their freezers to make room for the fresh dugong. The elders are concerned that the sport hunting is affecting the status of traditional hunters, a part of Torres Strait Island culture. The elders are also concerned that the high numbers of dugong being taken may mean that dugong numbers will decline for future generations. The community — with the guidance of the elders — is working towards developing a community plan to make sure that cultural hunting protocols are followed and that dugongs will be around to be enjoyed by the community for generations to come.

DUGONG ACTIVITY SHEET 2: Write your own Rhyming song or rap

Aims: Teach messages about threats to dugong in a fun and engaging way

Levels: Primary

Subjects: Music, English, Creole, Meriam Mir or Kala Lagau Ya

Materials: Nil

Instructions:

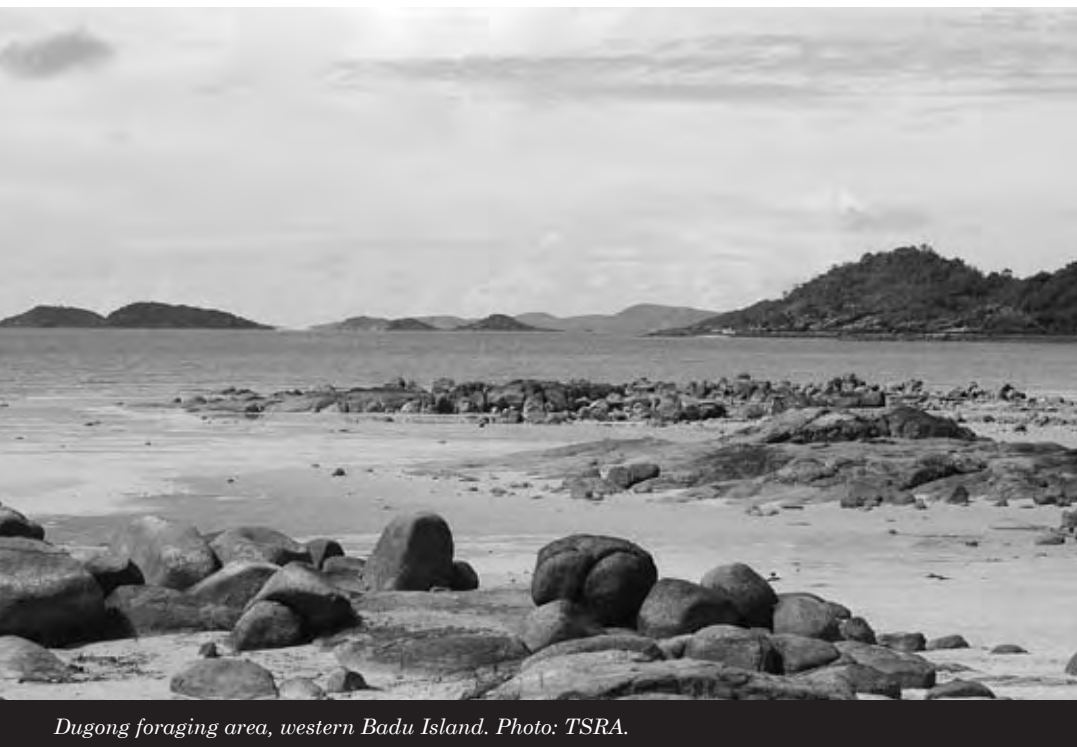
Ask the students to write their own rhyming song / rap to perform to their classmates.

The theme could be the role of dugong in the Torres Strait Islander life and why they are important for culture. The overall aim is for the students to learn about sustainability and looking after dugong so they are around for future generations as part of Islander culture.

The song / rap could be about where dugong is found in the Torres Strait, what they eat, where they live, their life cycles, and what we can do in our community to look after dugong.

Ask the students to pretend they are a local band / singing group who are teaching their local communities to spread the message about looking after dugong.

Their songs need to be between 30 seconds and 1 minute long. You can invite the local radio station to record these songs to play them on the radio. Invite other classrooms and parents and friends to attend a singing day to listen to the songs. Maybe you can organise a community day and invite family and friends to attend this special concert.



Dugong foraging area, western Badu Island. Photo: TSRA.

DUGONG ACTIVITY SHEET 3: Write a radio play

Aims: Encourage students to promote sustainable use of dugong to their communities through the production of small radio ‘plays’

Levels: Primary and Secondary

Subjects: Music, English, Creole, Meriam Mir or Kala Lagau Ya

Materials: Nil

Instructions:

If possible, hook up with a local radio station and discuss whether they would be interested in supporting this initiative.

This could be a series of 15-minute segments, or just a one off. Radio is a fun and entertaining way to teach the community about important issues such as looking after dugong. Radio is also one of the best ways to reach communities in the Torres Strait.

You can write on any subject. Your radio play can be set in the past, present or future. Try to keep it simple.

Work with your students to develop radio plays based on the following guidelines:

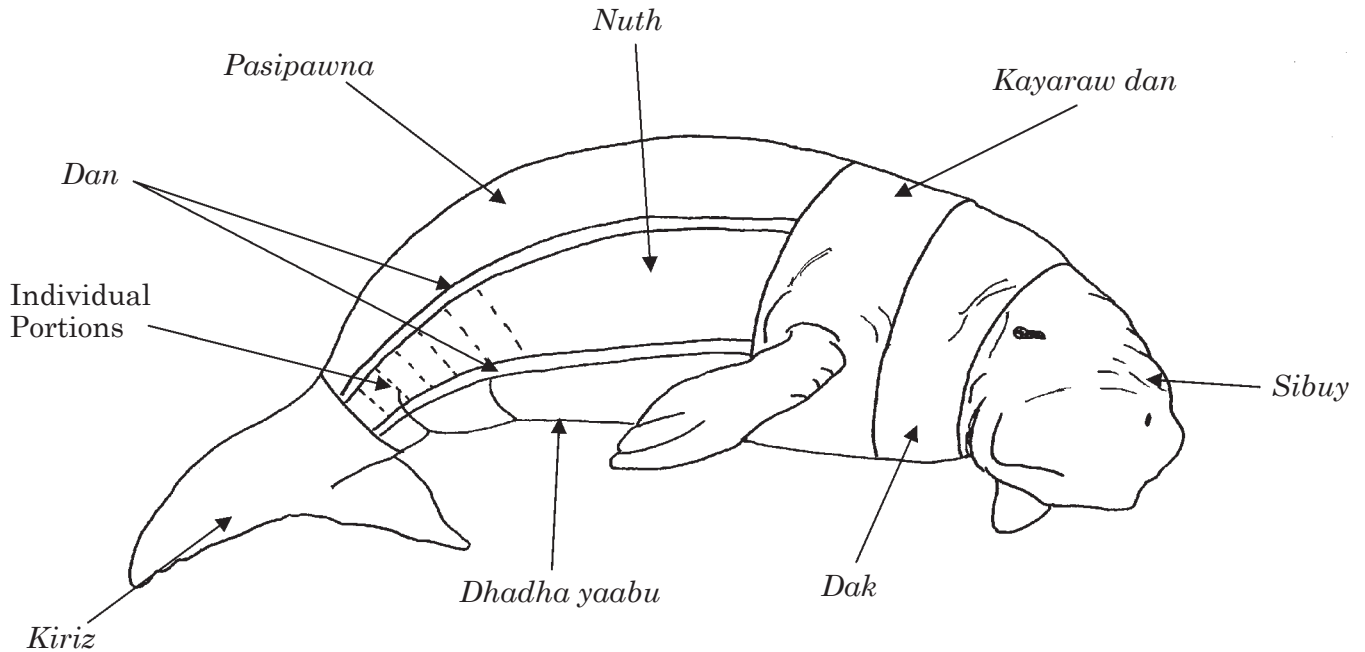
- Think about the key topics you want to share with the audience. Draw the listener in immediately. Write the play around a number of scenes. Vary the pace and length of scenes, as well as their background acoustics and ‘location’.
- Do not have more than six characters in a half-hour play. There is a risk of confusion if you do. The listener only knows a character exists if that character speaks, or if another character refers to him or her by name. Get to know your characters. Each will have their own individual speech mannerisms. Don’t have them all speaking in the same tone of voice.
- Use a number of sounds to support your play and to hold the listeners interest (e.g. waves, wind and birds singing).
- Above all, have fun!



Bardi Jawi Ranger Kevin George and Torres Strait Ranger Terrence Whap recording a story about dugong management. Photo: TSRA.

**DUGONG ACTIVITY SHEET 4: Kala Lagau Ya Language Names
(Western Island Language)**

**Dugong: *Dangal*
Language: *Kala Lagau Ya***



Butchering Marks

Information provided by Patrick Whap

Dangal: Dugong
Kala Lagau Ya: Language
Mabuyag: Location

Age, Sex, Social Groups

Garka dangal: Male dugong
Ipika dangal: Female dugong
Kazi dangal: Young dugong
Ngawaka dangal: Adolescent female
Kaukuik dangal: Adolescent male
Barakutau garka: Adolescent male that stays with mother
Sabi gudad: Single male
Puru dangalal: Mating dugongs
Kazilaig: Pregnant dugong
Nanaig: Nursing mother
Tuarlaig: Herd leader

Size

Gilab: Really big dugong
Koi dangal: Big dugong
Nurai dangal: Medium-sized dugong
Migi dangal: Small dugong

Dugong Information and Resources

Useful Internet Sites

NAILSMA Website

www.nailsma.org.au

Information from the North Australian Indigenous Land and Sea Management Alliance. Visit the Dugong and Marine Turtle Project section to view video, listen to audio interviews, and read project newsletters. Download the excellent resource 'Dugong and Turtle Knowledge Handbook'. You can also subscribe to receive the project newsletter and future editions of Message Disk - a DVD containing stories from Indigenous land and sea managers who are looking after their dugong and marine turtle resources across north Australia for future generations.

Department of Education and Training (Qld) Curriculum link: Suite 2-3 and wider community and assumes a moderate to high level of English language proficiency.

Hans Rothauscher Website

<http://www.hans-rothauscher.de/dugong/dugong.htm>

German website with detailed information on dugongs from around the world. There is a great deal of anecdotal information and stories of close encounters with dugong, recordings of dugong voice, history of the species and related animals. The website contains old myths and stories related to dugong hunting and mermaids. This is a good website for a broad range of information, quite random but also very interesting.

Department of Education and Training (Qld) Curriculum link: *Suite 1-3 and wider community but probably for school students best to have teacher assist in navigation, assumes a moderate level of English language proficiency.*

Great Barrier Reef Marine Park Authority (GBRMPA) website

www.gbrmpa.gov.au

Website containing general biological information for dugong. The website provides a brief description of dugong history, ecology, connections to Indigenous Australian communities, changes in populations of dugong and summarises management options.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and wider community and assumes a moderate level of English language proficiency.*

Animal Diversity Web

http://animaldiversity.ummz.umich.edu/site/accounts/information/Dugong_dugon.html

Website provides a summary of dugong life history, reproduction, diet, distribution. There are a number of photos of dugong skulls and information on structures of the inner ear. The link goes to a webpage of related dugong information. A good start for quick points on dugong biology and ecology for teachers and students for projects.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and assumes a moderate level of English language proficiency.*

Call of the Siren

<http://www.sirenian.org/caryn.html#KIDS>

Contains some links to other relevant information and activities mostly regarding Manatees but of relevance to dugong. Some good activities such as origami and kids corner which has links to younger school age activities relating to natural resources. Some pictures comparing the sizes of manatees and dugong and Steller's sea cow. Good teacher resource for links to useful activities.

Department of Education and Training (Qld) Curriculum link: *Suite 1-3 and assumes a moderate to high level of English language proficiency.*

Link to dugong video

http://www.heartsong3.com/dugong_video.htm

Video footage of feeding and surfacing dugong from Vanuatu.

Department of Education and Training (Qld) Curriculum link: *Suite 1-3 and wider community, does not assume English language proficiency.*

The Caribbean Environment Programme

<http://www.cep.unep.org/kids/cb01.html>

Useful manatee and dugong information and great colouring in pages. There is not a great deal of information but good resource links.

Department of Education and Training (Qld) Curriculum link: *Suite 1 and assumes a low level of English language proficiency.*

Link to dugong brochure on CRC Reef website

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

Attractive brochure discussing dugong biology and behaviour with some good pictures and relevant information.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and wider community and assumes a moderate to high level of English language proficiency.*

Dugong related Associations:

Sirenia Specialist Group

<http://www.marinemammalogy.org/snews.htm>

Sirenews is a publication released with stories from around the world relating to dugong and manatee research and news stories.

Department of Education and Training (Qld) Curriculum link: *Suite 3 and wider community and assumes a moderate to high level of English language proficiency and suitable for mature ages.*

Dugong related Email Discussion Groups:

MARMAM email discussion list

<http://whitelab.biology.dal.ca/marmam.htm>

Sign up and receive emails regarding latest marine mammal work, ask questions and have them answered by experts and enthusiasts in the field of marine mammals. Useful resource for schools and communities to ask questions to a large number of people involved in dugong conservation and management.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and assumes a moderate level of English language proficiency.*



Dugong. Photo: Toshi Nakata.

Marine Turtle



The Ancient Mariner

Marine turtles have lived in the oceans for over 100 million years.

Evolution

Marine turtles evolved and lived on the Earth before the dinosaurs. Marine turtles remain an integral part of the traditional culture of many coastal peoples throughout the world. Once there were 200 species of marine turtles on Earth. These have been found in fossils like the dinosaurs.

Things to do:

- Show students the picture of the fossilised giant marine turtle.
- Look at the marine turtle images and video on the accompanying CD ROM. These may be used with the different activities or to get the students thinking about marine turtles.
- Ask the students how this fossil is different and how it is similar to the marine turtles they know today.
- Ask an elder to visit the class and if appropriate, ask the elder if their people have stories that describe where marine turtles came from or how they were created.



Green turtle. Photo: Toshi Nakata.



Above: Seventy million year old marine turtle fossil. Source www.euroturtle.org.

Below: Green turtle shell bone - similar in shape to that of the fossil. Photo: Frank Loban.

Species (different types of marine turtle)

Today there are seven marine turtle species surviving in the world — six of these occur in Australia. One species, the flatback turtle, occurs only in Australasian waters. Loss of habitat, over harvesting of marine turtles and their eggs, commercial fishing practices and pollution place all species of marine turtle under threat. Whilst all marine turtles are at risk, the green turtle is hunted more regularly than other species. Indigenous communities prefer to eat the green turtle as it lives as an adult on a diet of seagrass and seaweed, unlike other species of marine turtle. The most commonly found species of turtle in Torres Strait are the flatback turtle (*Natator depressus*), green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*).

The different species of marine turtle have varying shapes and sizes, with the leatherback capable of growing to 3.6 metres in length and weighing up to 550 kilograms. Green turtles are easily identified by their high domed carapace and the four large costal scutes (bony external plate or scale) on either side of the shell. The adult carapace is about one meter long and the colour of the shell is light to dark green with mottling. They can be easily distinguished from the hawksbill turtle that has thick overlapping carapace scales and grows to only 80 centimetres in length. The flatback turtle has upturned edges to the carapace.



From left to right; Hawksbill turtle (*Oonuwa*), green turtle (*Waru*) and flatback turtle. Photos: Col Limpus.

Things to do:

- Show students pictures of the six species of marine turtle found in Australia and ask them to show which ones they have seen in Torres Strait. (see the accompanying CD ROM for turtle booklets)
- Compare the pictures of the marine turtles species and pick out the differences between them. Use the species identification key to identify the different marine turtle species by comparing their shapes and scales.
- Ask an elder or hunter if they would like to come and talk to the students. Look at the turtle life-cycle diagram and ask the elder or hunter if they would like to tell the students about the different language names given to the different species, the different sizes of marine turtles and their body part names. This talk can be linked to Activity Sheet 4 (page 49) and Activity Sheet 5 (page 50).
- Ask students how they tell the turtles apart.
- Ask an elder if they would like to come and talk to the students about the species of turtle near their island, which ones nest there and why they eat green turtles and not hawksbill turtles. Record the traditional names to the different species.

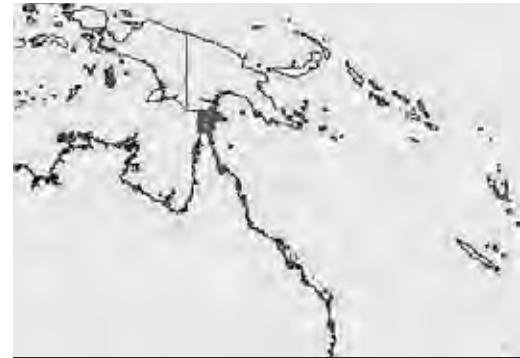
- Visit <http://www.euroturtle.org/bones/skel.htm> and check out the educational activities.
- View the booklets, activities, photos and video on the accompanying CD ROM.
- Make a chart to identify green turtles, hawksbill turtles and flatback turtles and the different patterns on their shell.

Nesting

Marine turtles nest at a large number of areas around Australia but only some sites are considered major nesting areas. For example, near Torres Strait the majority of green turtles nest at Raine Island in the northern Great Barrier Reef, and the central and eastern islands (such as Marray Island). From these sites turtles migrate between Australia, Papua New Guinea and Indonesia, spending long periods at sea and travelling up to 3,000 kilometres during nesting migrations. Very little is known about the journey marine turtle hatchlings make. It is believed they circulate on ocean currents until large enough to take residence closer to shore. This time period is known as the 'lost years'.

However, more is known about adult marine turtles migrating between nesting beaches and feeding grounds thanks to valuable tagging and satellite tracking programs, like those conducted by Indigenous rangers in the Torres Strait.

Through genetic sampling, scientists are able to identify breeding groups and their origins. The ability of nesting females to return to a beach close to where they hatched from is linked to the bearings being imprinted on the 'internal compass' of the hatchlings as they turn clockwise before entering the water. Tragically, many females return to their place of birth for their first mating and nesting season—some 30 to 40 years after their hatching—and encounter concrete paths, cities, dumps and hotels. Females breed for several decades and often mate with more than one male.



This map shows the sites where tags recovered from marine turtles that were tagged while nesting on Raine Island were found. Source: Col Limpus.



Tags used to identify and track marine turtles are made from titanium and carry a unique code. Photo: TSRA.

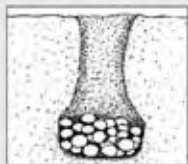
Things to do:

- Visit the unep-wcmc Marine Turtle Nesting Database website (<http://www.unep-wcmc.org/marine/mturtle/home.htm>), select to view the current dataset as an interactive on-line map then search for the major nesting sites in the Torres Strait.
- Visit a turtle nesting beach, or if possible visit a nesting beach during nesting season to see the effort it takes for a marine turtle to move on land and lay eggs.

Marine Turtle

- Ask the students to write or draw a story of the journey of a marine turtle to a beach on their island.
- Ask an elder to talk to the class about marine turtle nesting on their island, ask if it has changed over time. Identify the nesting sites on a map of the island and the species that nest there.

Although females carry hundreds of eggs at a time and may return several times in a season to lay eggs, only one in every 1,000 hatchlings is quoted as surviving. Marine turtle hatchlings are vulnerable to a wide range of predators. The incubation time and sex of the hatchlings is depends on the temperature of the sand. Warm dark sand produces mostly female marine turtles while cool white sand results in mostly males. The eggs are round, white and resemble a ping pong (table tennis) ball. The hatchlings take several days to dig their way to the surface before commencing the difficult journey to the sea.



Eggs incubating in the nest



Hatchlings begin breaking out of shells



Hatchlings work their way to top of nest



Top: Marine turtle hatchling sequence showing emergence from nest. Source: Caribbean Conservation Corporation.

Bottom: Ranger Moses Wailu conducting a nesting success survey. The green turtle hatchlings pictured were recovered after failing to emerge from the nest. Photo: Frank Loban.

Birds, crabs, fish, goanna, wild dogs and pigs can devour many of the newly hatched marine turtles but it is humans that have proven to be the greatest threat to the species. The sale of marine turtle satay on the streets of Bali and the belief that turtle eggs are a tonic for male virility have decimated the number of marine turtles in Indonesian waters. In one case during the late 1990s, 70,000 eggs were harvested in a two week period on three small Indonesian islands. The number of turtles in Indonesia are slowly declining.

Things to do:

- Ask the students what colour the sand is on their island. What sex do the students think the hatchlings will turn out to be?
 - Ask the students if they can tell you the difference between the eggs of different marine turtle species, or ask an elder if they would like to explain the differences.
- Talk about what kinds of animals might eat marine turtle hatchlings as they make their way to the sea.
 - Ask the students what would happen if all the marine turtle eggs at one island were taken every year for 20 years.
 - Create a game board based on snakes and ladders that illustrates the many predators and hazards faced by a marine turtle in its lifetime.

- Visit a nesting beach and find a nest. Ask an elder to accompany you and show how to search for the eggs. Find a nest that has been dug up and see if you can identify what has eaten the eggs.

Turtle Tracks

You can tell the difference between the different species of marine turtle by the tracks they leave on the beach. It is known that *waru* (green turtle), *unuwa* (hawksbill turtle) and *maiwal* (loggerhead turtle) leave tracks that are parallel. These tracks are made by the turtles pulling themselves along the beach with both fore-flippers at the same time. These tracks look like the tracks left by a tractor tyre.

The other marine turtle species found in Australia—*unuwa* (hawksbill turtle), olive ridley and *maiwal* (loggerhead turtle) leave staggered tracks. These tracks are made by the turtle pulling itself along the beach with the left fore-flipper (front flippers) and the right rear-flipper at the same time, then alternating to the right fore-flipper and the left rear-flipper at the same time. These tracks look a bit like a zip (see the marine turtle track identification chart on page 54).

Changes in Population

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 deaths in fisheries and ensuring the harvest of marine turtles and their eggs is sustainable, turtle populations can recover. One of the best examples comes from green turtles in Hawaii, where the numbers of nesting females per year has increased from less than 100 to almost 500 over the last 40 years.



The zipper-like pattern of a hawksbill turtle track, Muyarpui (Wongai Beach). Photo: TSRA.

Community-based Management

There are many ways that communities are now managing their marine turtles to make sure populations either stay healthy or recover to the numbers they once were. Some of these management activities include:

- only taking half the eggs in a nest and marking the nest with a stick to show that someone has already collected eggs (as done in some north Australian Aboriginal communities);
- restricting commercial net fishing around marine turtle nesting beaches during times of mating and nesting (Queensland Commercial Fisheries);
- closing hunting areas for three years and then opening them up for three years to reduce the disturbance of marine turtles made by dinghies and hunters (Fiji);

Marine Turtle



From left to right: Marine turtles caught at Wapa Maza (Warrior Reef) by Torres Strait rangers for tagging before being returned to the sea. A ranger taking skin samples to assess marine turtle population genetics. Photos: TSRA.

- banning egg harvest at important nesting sites (Indonesia);
- moving nests to safe places on nesting beaches to avoid being drowned by high tides (Worldwide);
- putting a limit on the number of marine turtles that can be hunted each year (Hopevale Aboriginal Community); and
- preventing nesting marine turtles from fatally rolling onto their back after falling down small cliffs or holes on major nesting islands. (Erub Islanders working at Bramble Cay (*Maizab Kaur*)).



From left to right: Monitoring nesting marine turtles at Maizab Kaur (Bramble Cay). Management planning meeting on Saibai Island. Rangers undertaking seagrass surveys on Kirirri (Hammond Island). Mer Island school students participate in a marine turtle satellite tagging exercise conducted by rangers on Dowar Island. Photos: TSRA.

The NAILSMA Dugong and Marine Turtle Project is helping communities in Torres Strait to develop their own management plans for marine turtle and dugong. The community-based plan is something developed by communities to address concerns they have for the long-term survival of marine turtle. These plans use the knowledge, expertise and understanding that Islanders have for marine turtle, their island communities and environment to put the best management solutions in place.

Things to do:

- Ask an elder to talk about how communities would look after marine turtles when he or she was young—to make sure future generations would benefit from healthy marine turtle populations.
- Ask the students to come up with ideas on how their community can make sure turtle numbers are maintained around their island and in the Torres Strait region.
- Visit the NAILSMA web site (www.nailsma.org.au) to find out what other Indigenous-led dugong and marine turtle management projects are happening around north Australia.
- View the accompanying CD ROM and show the students video of Torres Strait Island rangers catching and tagging marine turtles.

Marine Turtle Diets

Marine turtles eat a variety of foods. When they are hatchlings, all marine turtles eat small animals that are just big enough to see. As adults, the diet differs from species to species.

Green turtles, like dugong, eat seagrass and algae but they will also eat mangrove fruits. Hawksbill turtles eat algae, seagrass, sponges and shellfish (such as crabs). Flatback turtles eat shellfish, squid and jellyfish. They also eat cuttlefish, hydroids and soft corals. The large leatherback turtle mainly eats jellyfish. This makes the species particularly vulnerable to eating plastic floating in the sea because the leatherback can mistake the debris for jellyfish.



*Marine turtle foraging area—between Dowar and Waier Islands.
Photo: TSRA.*



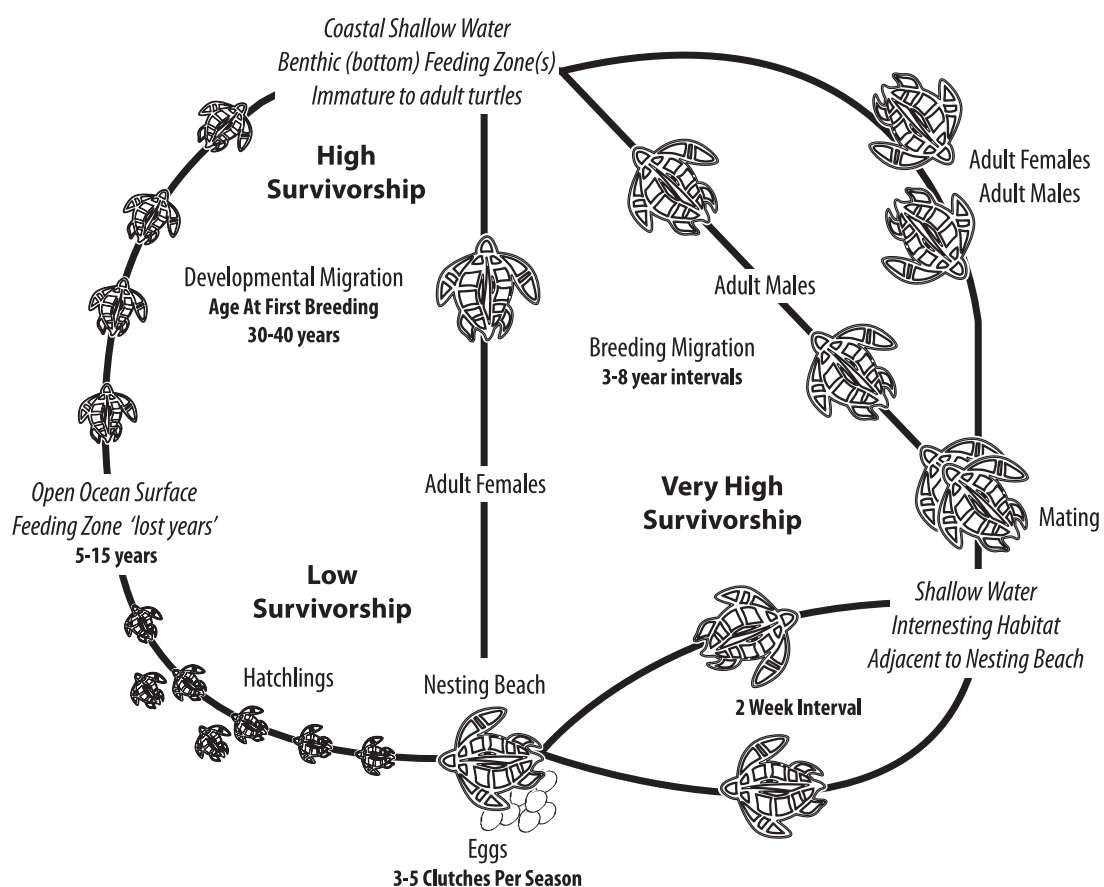
Surveying beaches for turtle nests on Muralug (Prince of Wales Island). Photo: TSRA.

Marine Turtle

Things to do:

- Collect some sea water with some seagrass and look at the small animals under a magnifying glass or microscope.
- Explain to the students that healthy habitats mean healthy marine turtles.
- Do an exercise to look at the different sea environments and animals around your island. Compare this with the different diets of different marine turtles and ask the students which species they think might occur around their island.
- Contact Torres Strait Regional Authority Land and Sea Management Unit and enquire about starting up a Seagrass Watch at the school to monitor seagrass health and condition or visit the Seagrass Watch website: www.seagrasswatch.org.
- How would changes to seagrass, corals or marine plants affect marine turtles? Provide an example of what could happen to green turtles if all the seagrass disappeared.

Marine turtles are long lived, slow growing reptiles. They have a complex life history which takes various species on vast journeys across the planet's oceans. Slowly, over many years of research, scientists have pieced together a life-cycle of the marine turtle.



Nesting

The majority of female marine turtles lay their eggs at night. The conditions at night are more favourable for successful nesting and allow the marine turtles to avoid predators and the heat of the day.

Nesting marine turtles generally crawl above the high tide mark to lay their eggs so that their nest is not flooded by high tides. Some studies suggest that marine turtles show a preference for beaches that are near deep water.

All species of marine turtle lay eggs three to seven times during the one nesting season. About every two weeks, an individual female marine turtle will return to the same beach or area to lay more eggs. The number of eggs laid per clutch depends on the species but it can range from 60 to 120 eggs.

The nesting ritual

All species of marine turtle go through a similar process to prepare their nest before laying eggs, and depending on the species, preparation can take up to two hours. Upon arriving at the beach the nesting ritual begins.

1. Preparing the Body Pit.

Before egg laying begins, the female marine turtle goes through a rigorous process of preparing the nesting site. She uses all of her flippers to clear soft sand and grass out of the way, so that when she begins to dig her egg chamber, the sand will not collapse back into the chamber and she will not be impeded by grass roots. This process is generally known as 'body pitting'.



Green turtle 'body pitting'. Photo: TSRA.

2. Digging the Egg Chamber.

Using her back flippers, the female marine turtle will dig a hole approximately 60 centimetres deep and in the shape of an inverted (upside down) funnel. The egg chamber is about one adult hand span wide at the top and about two adult hand spans at the bottom.



Flatback turtle digging an egg chamber. Photo: TSRA.



Green turtle laying eggs. Photo: TSRA.



Source: Dugong and Turtle Project, green turtle filling in.



Green turtle returning to the ocean. Photo: TSRA.

3. Egg Laying.

The technical term for egg laying by marine turtle, and most other reptiles is called 'oviposition'. The eggs are laid one by one, falling into the egg chamber. The eggs have a leathery covering so they do not break as they fall.

4. Filling In.

The eggs are generally concealed in two stages. Firstly, the female marine turtle will use her back flippers to firmly pack down the sand over the top of the eggs. Secondly, she will use all of her flippers to push all of the soft sand back over the top of the nest site to camouflage the area. As she does this, she will gradually move forward to make sure about 20 to 30 centimetres of sand is covering the eggs.

5. Returning to the Water.

After the nesting ritual is complete, the female marine turtle will return to the water. Marine turtles lay multiple egg clutches during a nesting season. Green turtles for example, usually lay six egg clutches at two week intervals. Marine turtles stay in the water close to their nesting beach until all their egg clutches have been laid for the season.

Nesting marine turtles and their eggs provide an important food source for many coastal Indigenous communities throughout their range. They are also an integral part of these communities' culture.

Threats to nesting marine turtles:

Throughout Australia there are many threats to nesting marine turtles. Some of the main threats include:

- loss of nesting habitat from coastal development and sea level rise;
- increased light on beaches from street lights and housing – light will deter marine turtles from nesting at a particular location and will disorientate turtle hatchlings by changing natural light horizons;
- destruction of nests by introduced animals such as foxes, dingoes and feral pigs; and
- destruction of nests by native animals such as goannas.

Along the western coast of Cape York Peninsula, some Indigenous rangers have found that between 90 and 100 percent of marine turtle nests are being dug up by feral pigs. On some of the islands in the Torres Strait, goannas and dogs also eat large numbers of marine turtle eggs and hatchlings.



From top to bottom: Pig predated turtle nest. Digging shells from a nest predated by goanna. Dead olive ridley turtle removed from a ghost net. Photos: TSRA.

Things to do:

- Show students the pictures of marine turtle tracks and nesting marine turtles in digging poses. You can use these pictures to identify the species of turtle (for example some species crawl up the beach with staggered flipper strokes while others use both flippers to leave a parallel track; different species of marine turtle will position their hind flippers differently when laying eggs).
- Ask the students where they have seen lots of marine turtle tracks and if they have ever watched a marine turtle nesting.
- Ask the students if they ever see nesting marine turtles with tags on their flippers. Encourage students to return turtle tags from harvested marine turtles to learn more about their movements.
- If possible, contact your local island ranger group and enquire if it would be possible to organise a class trip to watch nesting marine turtles. To increase your chances of seeing a marine turtle successfully lay her eggs, read the 'Hints for Marine Turtle Watching in the Torres Strait' guide on page 55.
- Show the students the video of nesting turtles at Bramble Cay on the accompanying CD ROM.

Incubation and Hatching

The sun's warmth incubates the eggs and it generally takes eight to 12 weeks before they hatch. The temperature of the nest determines the sex of the marine turtle (temperatures higher than 29 °C produce females while lower temperatures produce males).

Hatching and emergence is a team effort and it generally takes two to five days for hatchlings to work their way up through the egg chamber before emerging on the beach.



Green Turtle hatchling scrambling to the ocean. Photo: TSRA.

Hatchlings

Marine turtle hatchling emergence normally happens at night or late afternoon once the surface sand temperature has cooled, but can happen during the day if it is overcast or rainy. Emerging at night generally has its advantages — it protects the hatchlings from the heat of the day and from some predators such as birds.

During their dash across the beach, marine turtle hatchlings imprint to the dip and strength of the Earth's magnetic field. This is an important process that will help them navigate throughout the world's oceans later in life.

Upon reaching the ocean, the hatchlings go into a swimming frenzy that takes them into deeper water, where they have a better chance of survival. Scientists believe that only one in 1,000 hatchlings will survive to maturity – the rest don't survive the many predators of the sea.

Once they have reached deeper water, marine turtle hatchlings are carried by oceanic currents, possibly seeking cover under floating seaweed or floating debris, and feeding on small animals that are also taking cover under these floating objects.

Some hatchlings may find their way to other countries around the world, except for the flatback turtle which is known to stay around the Australasian coastline only. In Australia we rarely see turtles less than the size of a dinner plate, apart from marine turtle hatchlings that have just left their nest.



*Torres Strait rangers surveying nesting habitat on Maizab Kaur.
Photo: Mariana Fuentes.*

Things to do:

- Show students pictures of different species of marine turtle hatchlings and ask the students to map what species they have seen in different areas throughout the Torres Strait.
- Ask the students if they have ever kept marine turtle hatchlings as pets.
- Ask an elder or hunter to visit the class and talk about the different sizes of marine turtles found on the island's reefs, ask if they ever see marine turtles smaller than the size of a dinner plate.
- Show the students the video of hatchling marine turtles at Bramble Cay on the accompanying CD ROM.



Boigu Dugong and Turtle Officer Ishmael Gibuma about to release a waru kaz (immature green turtle). Photo: TSRA.

Immature Marine Turtles

Depending on the species, immature marine turtles that have hatched on Australian coastlines will return to Australian reefs and coastal bay areas from the open ocean when they are between five and 15 years of age. Immature green turtles the size of dinner plates are the most commonly seen small marine turtle species in Torres Strait waters. They will stay in a set region of the world to feed and live. Marine turtles have a strong bond with their feeding areas and return to these places after migration for breeding.

At this size, immature turtles are less likely to be lost to predation by fish and sharks and as marine turtles get older, they have a much better chance of survival.

Mature Marine Turtles and Mating

At around 30 to 50 years of age, turtles breed for the first time. During the breeding season, male and female marine turtles will find each other and mate. One female can mate with up to six or seven different males during one breeding season. This allows her to store enough sperm to fertilise the three to seven clutches of eggs she is likely to lay. An adult male marine turtle can be recognised by his long tail.

Mature female marine turtles generally return to nest at the same beach or area of coast where they hatched. They find their way to these areas by using the information they stored as a hatchling (based on the Earth's magnetic field), sometimes travelling up to thousands of kilometres back to their natal beach (the beach where they hatched).

Adult female marine turtles do not breed every year because it takes them at least two years to store enough energy to travel such long distances to their nesting areas.

Interesting fact

Between 1973 and 1983 in southeast Queensland, scientists tagged about 250,000 marine turtle hatchlings (flatback, loggerhead and green turtles) by clipping a combination of scales on the edge of their shells. It was anticipated that this study would reveal how old marine turtles were when they first bred and if they would return to their natal beach as an adult. The first of these turtles (loggerheads) were recorded nesting on their natal beach in 2003 – 29 years after they were first tagged as hatchlings.



Green turtle hatchlings. Photo: TSRA.

In Torres Strait, four marine turtles were caught in 2005 by Hammond Island rangers during the *turtle saulal* (the time of year marine turtles can be observed mating on the ocean's surface). The movements of these breeding marine turtles (three female and one male) were tracked using satellite technology. All three female marine turtles travelled to the northern Great Barrier Reef to lay their eggs; swimming 600 to 1,450 kilometres over a period of about four months. The male marine turtle swam between the inner islands of the Torres Strait — presumably in search of female marine turtles. He swam about 60 kilometres during the same period.



*Badu ranger Jimmy JK Panuel removing turtle shell from ghost net.
Photo: Poppy Stockell.*

Looking after Resources from Fishing Traditions

Communities in Torres Strait are starting to get together to plan how they want to look after their traditional sea foods. These sea foods include marine turtle, which is culturally significant and an important food source for Islanders.

The NAILSMA Dugong and Marine Turtle project is helping communities to develop ways to look after these resources that are culturally appropriate. The Project recognises that communities have been managing marine turtle in their traditional ways for many thousands of years, but today modern pressures are affecting turtle populations.

Fishing nets, pollution, plastic bags and sea level rise are impacting on marine turtle populations around the world.

Traditional harvest of turtle for *kai kai* (food), celebrations and trade, combined with these modern pressures may make some species of marine turtle vulnerable to over exploitation.

Coastal communities that rely on marine turtles for food and have embedded the marine turtle as an integral part of their culture, need to consider these modern pressures when they think about looking after turtles.

Developing community-based dugong and marine turtle management plans as part of the NAILSMA Dugong and Marine Turtle Project is one way Torres Strait communities are helping to ensure future generations of Islanders will be able to enjoy these animals.

Things to do:

- If you look after animals they will be there for future generations. Explain this concept to the students and the words 'sustainable' and 'sustainability'. Ask the students to use 'sustainability' in a story about looking after fish and sea animals.
- Ask an elder or your local ranger to visit the class to talk to the students about looking after sea and land resources, how to ensure you keep animals for the future and why it is important.
- Encourage students to put all their rubbish in the bin, especially plastics, to prevent it from reaching the sea through drains and creeks. Plastic bags can be confused for jelly fish and marine turtles (along with other marine life) have been known to eat them. Also encourage the students to cut the plastic rings found on the top of milk bottles and jars – marine turtles have been found stuck in these plastic rings.



Torres Strait research participants collecting measurements from marine turtles caught foraging on Wapa Maza (Warrior Reef). Photo: TSRA.

Marine Turtle Activities

MARINE TURTLE ACTIVITY SHEET 1: Where have all the turtles gone?

Aims: Introduce the topic of marine turtles in a fun and light manner

Levels: Primary

Subjects: Music, English, Creole, Meriam Mir or Kala Lagau Ya

Materials: Nil

Instructions

This chorus was developed by *Wan Smolbag*, a theatre group in Vanuatu using drama to raise awareness about conservation issues. *Wan Smolbag* has been very active in conserving marine turtles through working with local communities.

This chorus looks at the survival of marine turtle hatchlings as they are going from their nest site and into the sea. First the birds are waiting, then the big fish in the sea and then the people.

Where have all the turtles gone?

Chorus

*When the mother turtle
Comes to lay her eggs
She travels a long way*

*If the little turtles
Get to be bigger
All the people are waiting*

*If the mother turtle
Crawls up the beach
All the pigs are waiting*

*They eat all the little turtles
Before they have a chance
Before they have a chance
To lay a single egg*

*If the mother turtle
Lays her eggs in the sand
All the people are waiting*

*They eat all the turtle eggs
Before they have a chance
Before they have a chance
To hatch into little turtles*

*When all the turtles
Come out of their eggs
All the sea birds are waiting*

*If the little turtles
Get to the sea
All the living fish are waiting*

MARINE TURTLE ACTIVITY SHEET 2: Marine Turtle Role Play

Aims: Encourage students to play an active role in learning in a fun way.
Explore different viewpoints through role-playing and finding solutions.

Levels: Primary and Secondary

Subjects: Music, English, Creole, Meriam Mir or Kala Lagau Ya, Drama

Materials: Nil

Instructions

Divide the class into groups. Give each group a story, and ask them to design a role play. Read the story carefully. Students can add further information about the characters as long as it fits the story.

The objective of the role-play is to resolve the problem through a compromise that makes both sides happy.

Role Play 1: Removing a group of marine turtles stuck in a ghost net

A young boy and his father are travelling home after an afternoon fishing in their dinghy. Close to home they spot splashing in the water. The boy and his father pull up near the splashing to find six adult marine turtles stuck in a ghost net that has drifted over the seagrass beds. The marine turtles are tangled up and need to be released before the weight of the net drowns them.

The boy and his father head for the village beach to raise the alarm and to get dinghies and community members together to rescue the marine turtles before they drown. Some community members don't want to help rescue the turtles.

Role Play 2: A young mother tries to convince her community to help stop wild dogs digging marine turtle nests and attacking nesting marine turtles on the beach

The young mother has noticed large numbers of marine turtle nests being dug up on her country. She follows dog tracks from the bush to the nests and finds paw prints around the nests.

As the young mother walks further she finds a dead marine turtle lying on the beach. Dog paw prints surround it. The young mother realises that wild dogs are digging up the nests and attacking the marine turtles. The young mother talks to elders in the community to organise a meeting to work out what can be done about the problem. The community chairman thinks that some community dogs are also involved and is concerned that the community might not want to do anything about these dogs.

MARINE TURTLE ACTIVITY SHEET 3: Write your own Rhyming Song or Rap

Aims: Teach messages about threats to marine turtles in a fun way and engaging way

Levels: Primary

Subjects: Music, English, Creole, Meriam Mir or Kala Lagau Ya

Materials: Nil

Instructions

Ask the students to write their own rhyming song / rap to perform to their classmates. The theme could be the role of marine turtles in the Torres Strait Islander life and why they are important for culture. The overall aim is for the students to learn about sustainability and looking after marine turtle so they are around for future generations as part of Islander culture.

This could be about the types of marine turtle found in the Torres Strait, what they eat, where they live, their life cycles, and what we can do to look after marine turtles in their communities.

Ask the students to pretend they are a local band / singing group who are teaching their local communities to spread the message about looking after marine turtles.

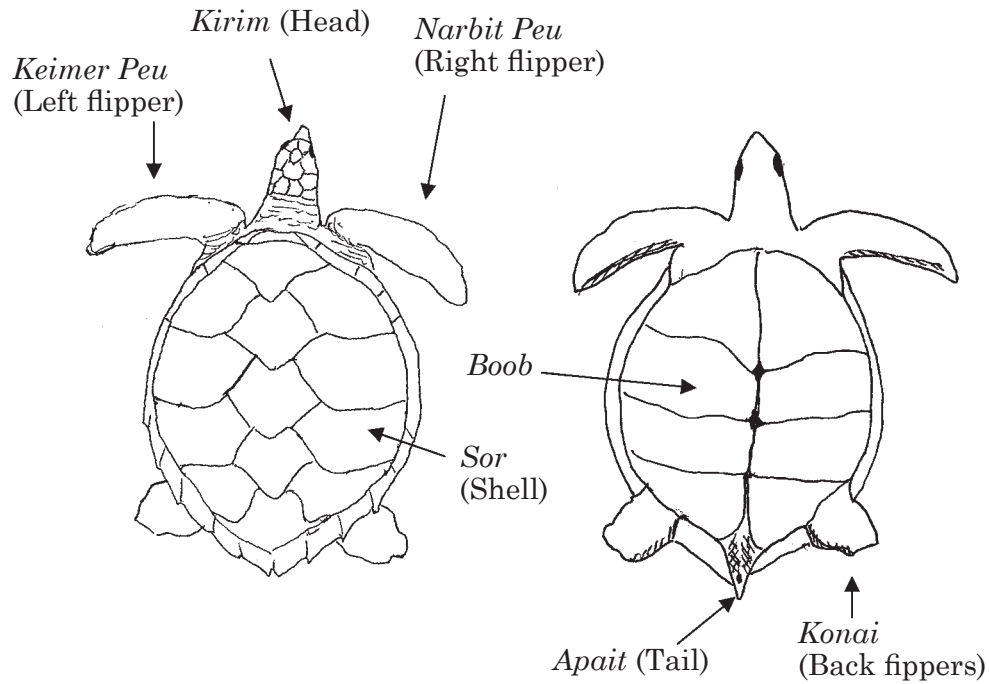
Their songs need to be between 30 seconds and 1 minute. You can invite the local radio station to record these songs to play them on the radio. Invite other classrooms and parents and friends to attend a singing day to listen to the songs. Maybe you can organise a community day and invite family and friends to attend this special concert.

MARINE TURTLE ACTIVITY SHEET 4: Meriam Mir Language Names

(Eastern Island Language)

Turtle: *Nam*

Laanguage: *Meriam Mir*



Types of Marine Turtle

- Kimyar Nam*: Man turtle
- Kosker Nam*: Woman turtle
- Kebi Nam*: Baby turtle
- Korkor*: Middle turtle or young female turtle
- Salwal*: Turtle mating

Species

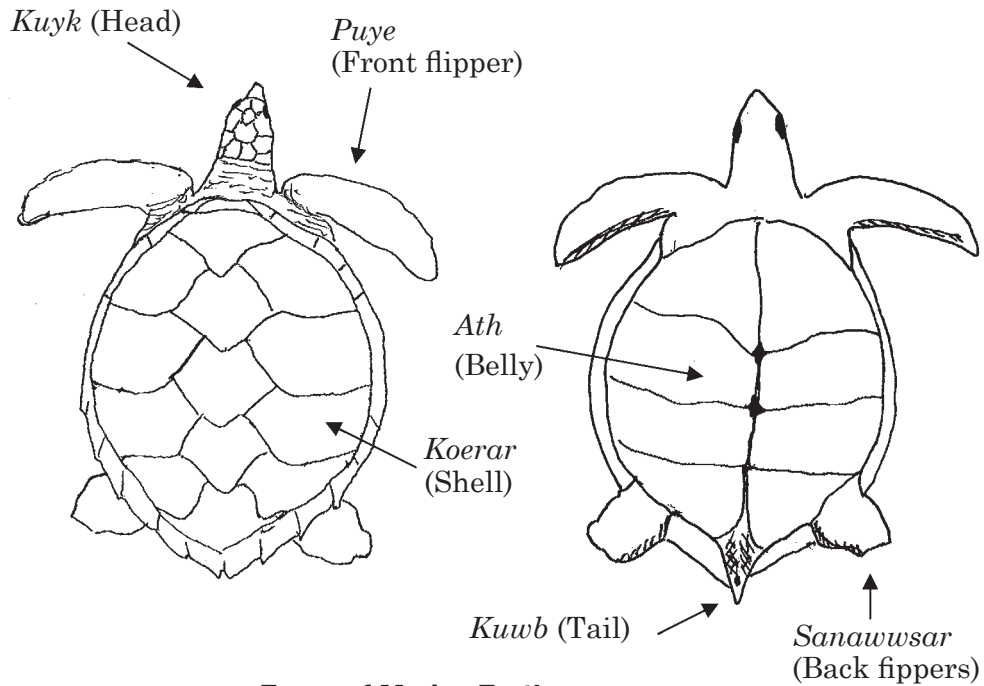
- Nam*: Green turtle
- Zag Nai Pu*: Loggerhead turtle
- Baug*: Hawksbill turtle

Totems

Nam is totem to the *Magaram* clan of *Dawar*

MARINE TURTLE ACTIVITY SHEET 5: Kala Lagau Ya Language Names
(Western Island Language)

Turtle: Waru
Laanguage: Kala Lagua Ya



Types of Marine Turtle

- Garka waru:* Man turtle
- Lpika waru:* Women turtle
- Kazi waru:* Baby turtle
- Sulal waru:* Mating turtle
- Gatau waru:* Old, dry reef turtle

Size

- Waiatan baba-sigmai waru:* Really big turtle
- Koi waru:* Big
- Murai:* Medium
- Migi waru:* Small

Species

- Waru:* Green turtle
- Unuwa:* Hawksbill turtle
- Maiwal:* Loggerhead turtle

Totems

Waru is a subsidiary totem of certain clans of *Mabuiag*

Marine Turtle Information and Resources

Useful Internet Sites

NAILSMA Website

www.nailsma.org.au

Information from the North Australian Indigenous Land and Sea Management Alliance. Visit the Dugong and Marine Turtle Project section to view video, listen to audio interviews, and read project newsletters. Download the excellent resource 'Dugong and Turtle Knowledge Handbook'. You can also subscribe to receive the project newsletter and future editions of Message Disk - a DVD containing stories from Indigenous land and sea managers who are looking after their dugong and marine turtle resources across north Australia for future generations.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and wider community and assumes a moderate to high level of English language proficiency.*

Euro Turtle

http://www.euroturtle.org/ed_welcome.htm

The Euro Turtle website contains a comprehensive education section that is suitable for Suites 1–3. The website has strong links with environmental education. There are a number of curriculum-linked activities which have been designed to increase awareness about conservation issues facing marine turtles. The education activities are interactive, on-line and cross-curricula and have been tested in an educational environment. Although marine turtle orientated, the issues raised apply to most other endangered species.

Department of Education and Training (Qld) Curriculum link: *Suite 1-3 and assumes a moderate level of English language proficiency.*

The Indian Ocean and South East Asia turtle Memorandum of Understanding website <http://www.ioseaturtles.org/index.php>

The MoU looks to protect and conserve and recover marine turtle populations in the region. This website covers a number of conservation, management and sustainable development issues. It is a regularly updated website with stories of marine turtle conservation work from around the Indian Ocean and southeast Asia. This is a good website to browse for new stories.

The http://www.ioseaturtles.org/electronic_lib2.php?cat_id=3 link on the website provides a guide of education materials available on request and can be downloaded.

Department of Education and Training (Qld) Curriculum link: *Suite 1-3 and assumes a moderate to high level of English language proficiency.*

Green Turtle Dreaming

<http://www.mfgsc.vic.edu.au/greenturtledreaming/index.html>

The Green Turtle Foundation 'Green Turtle Dreaming' exhibition website. Green Turtle Dreaming was selected as a pilot project for the Australian-Indonesia Arts and Community. The website contains beautiful art works, painted scrolls and stories from around the region about marine turtle. The website follows the migratory patterns of green turtle and their journey between Australia and Indonesia. The website also gives an insight into how different cultures view turtle, as well as how marine turtles link different cultures through shared stories. The website provides some very interesting teaching materials and ideas. There is also a material education kit that can be obtained by request, see website for details.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and assumes a moderate to high level of English language proficiency.*

Seaturtle.org

<http://www.seaturtle.org/>

Useful website with links to resources and the latest information on marine turtle projects from around the world. Good information on research and monitoring work as well as tracking devices. The website also contains some good images of marine turtles and their habitat. This site provides different ideas on marine turtle conservation and ways that people can become involved in looking after turtles.

Department of Education and Training (Qld) Curriculum link: *Suite 3 and assumes a moderate to high level of English language proficiency.*

Useful Information Packages:

A matter of time: Sea turtles of Queensland (1994).

Produced by the Queensland Turtle Research section of the Queensland Department of Environment and Heritage.

A good black and white guide to some basic marine turtle information, threats and management specific to Australia. Good resource for teachers as it gives accurate and interesting facts about marine turtles that occur in Australia, threats to them, habitats and how people can join in helping marine turtle conservation.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and assumes a moderate level of English language proficiency.*

Sea Turtles: An ecological guide (2003)

Written by Gulko and Eckert and published by Mutual Publishing.

A fantastic colour book containing information on marine turtle conservation and management. Excellent photos and comparisons between species with colour photos. A comprehensive book, full of useful images and stories, facts and figures on marine turtles. Worth obtaining a copy for the school or community library.

Department of Education and Training (Qld) Curriculum link: *Suite 1-3 and wider community and assumes a low to high level of English language proficiency.*

Turtle related Associations:

The Turtle Foundation

http://www.turtle-foundation.org/epages/engl_home.html

This website provides information on how associations raise awareness about marine turtle conservation. The website contains stories about what conservation is and why conservation is needed. The website provides some basic information that provides a different perspective to marine turtle management from other areas of the world. Good links to species descriptions, images and projects.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and wider community and assumes a moderate level of English language proficiency.*

Turtle related email discussion groups:

CTURTLE

<http://accstr.ufl.edu/cturtle.html>

Website link gives instructions on how to subscribe to a marine turtle email discussion group. Students and teachers can post questions and let people know about marine turtle related activities they are happening in Torres Strait. A good way to meet people in other countries but may need to be used after giving thought to a question. Links to a number of interested people, willing to provide advice but can create a lot of messages in inbox.

Department of Education and Training (Qld) Curriculum link: *Suite 3 and wider community and assumes a low to moderate level of English language proficiency.*

Turtle Track Identification



Green turtle track – parallel flipper marks



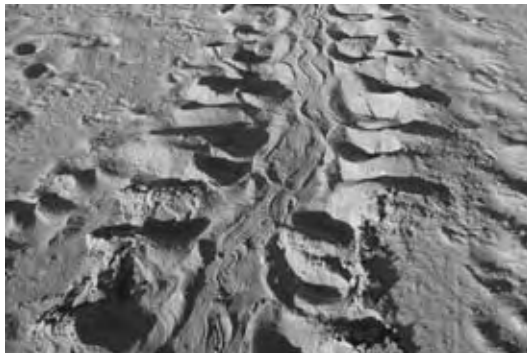
Loggerhead turtle track – alternate flipper marks



Leatherback turtle track – parallel flipper marks



Olive ridley turtle track – parallel flipper marks



Flatback turtle track – parallel and alternate flipper marks



Hawksbill turtle track – alternate flipper marks

Source: TSRA

Hints for Marine Turtle Watching in the Torres Strait

Marine turtles nest on many mainland and island beaches throughout Queensland. Some of the world's largest nesting populations of green turtles, hawksbill turtles and flatback turtles are found right here in the Torres Strait.

On some of the Torres Strait islands, the opportunity exists to see these magnificent creatures in the wild.

Marine Turtles

There are six species of marine turtles found in Australian waters and, three of those frequently live around or visit the Torres Strait region:

- green turtle (*Chelonia mydas*);
- flatback turtle (*Natator depressa*); and
- hawksbill turtle (*Eretmochelys imbricata*).

Marine turtles are reptiles and live their life almost entirely in the sea. It is only during times of breeding when females venture out of the sea and onto land. They are protected animals — whether they are in a nature reserve or not — but can be used by Torres Strait Islanders for traditional purposes.

Some interesting facts about marine turtle nesting behaviour

Depending on the species, marine turtles come ashore to lay eggs at certain times of the year. In the Torres Strait, marine turtles can be found nesting most nights. They emerge from the water during the night and make their way up the beach to an area that is safe from erosion and flooding from the tide. It is here where the nesting ritual begins.

For most marine turtles, the nesting process takes about one to two hours after leaving the water. Green turtles take much longer. Remember, marine turtles are wild animals so there is no set time to view them nesting.

Tears?

When the marine turtle is on the beach nesting, you will notice a liquid flowing from her eyes. The turtle is not crying. This liquid is actually a concentrated salt solution that serves two purposes. Firstly, it is the marine turtles way of excreting excess salt that has built up in her body from drinking salt water all day. Secondly, it helps lubricate her eyes when in the dry nesting environment and washes her eyes free of sand. These 'tears' are in no way related to pain and in fact, these salt glands continuously excrete this salty solution, even when the turtle is in the water.

Eggs

Depending on the species of marine turtle, the number of eggs per clutch is different. The green turtle lays about 90 to 100 ping pong (table tennis) ball sized eggs per clutch. The hawksbill turtle lays 120 eggs per clutch while the flatback turtle lays only 50 to 60 eggs the size of billiard balls.

All marine turtles lay several clutches of eggs in a season at about two-weekly intervals. The green turtle can lay up to eight or nine clutches in a season. The hawksbill turtle generally lays between one to six clutches in a season. And, the flatback turtle lays only two to three clutches of eggs in a season.

The same marine turtle does not usually nest each year. On average, hawksbill and flatback turtles return to nest every two to five years. Green turtles return every three to seven years.

After the eggs are laid, they are incubated naturally by the warmth of the sand. Eggs laid at the beginning of the season or during extended periods of wet weather may take up to 12 weeks to incubate.

During the incubation period, the temperature of the sand determines the sex of the hatchling. Warmer sands tend to produce more females. Cooler areas produce more males.

Hatching and Emergence

The hatching process usually occurs about two to five days before the hatchlings are seen emerging from the nest. In a team effort, the hatchlings work their way to the top of the nest. When they are ready to emerge, they wait for the sand temperature to cool before crossing the beach. This means that most hatchlings emerge at night. There are no special tide times for good viewing of hatchlings. The best time is from sunset until midnight, but like nesting marine turtles, there is no set time for emergence and they may be seen at any time during the night.

Size

Marine turtles vary in size between both males and females and also between species. The average size of nesting green turtles is generally 105 to 110 centimetres in length. Nesting flatback turtles are about 95 centimetres in length, and nesting hawksbill turtles are normally about 82 centimetres in length.

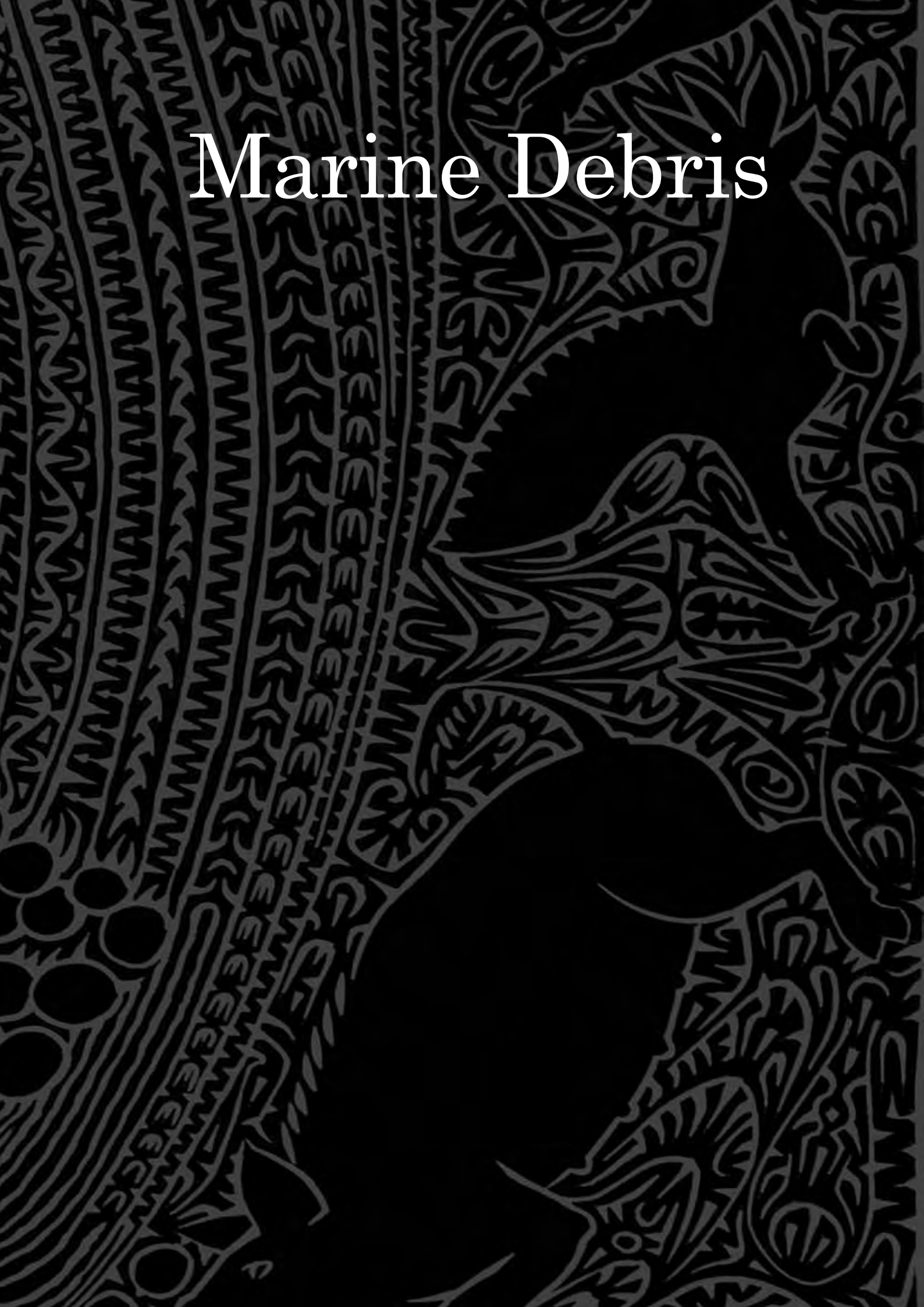
Age

It is unknown exactly how long marine turtles live, but from all the research that has been undertaken, it is estimated that they may have a life spanning around 60 to 70 years. Growth rate studies on wild marine turtles in the Great Barrier Reef feeding grounds suggest that female marine turtles do not start breeding until they are about 30 to 50 years old. After this they endure a long breeding life.

Dugong and Marine Turtle: Teaching Resource and Information Package

How to find nesting marine turtles	Marine turtle watching tips
At night, walk along the beach at the high tide mark and look for marine turtle tracks. Also keep an eye out for marine turtles making their way up the beach or at the waters edge.	Avoid using torch light at this stage – lights can disturb marine turtles when they are crossing the beach. Let your eyes adjust to the darkness.
If you see marine turtles emerging from the water or crossing the beach, stand still until it has passed.	Your movement can easily disturb the marine turtle from continuing up the beach.
If you find a set of marine turtle tracks, follow the tracks carefully onto the dune to locate the marine turtle. Always try to approach the marine turtle from behind until you know what stage of nesting she is up to.	Marine turtles are easily disturbed by movement and light in the early stages of nesting. Avoid using lights or moving in front of the marine turtle at this stage.
Wait behind the marine turtle until she is laying her eggs. You can usually tell if the marine turtle is laying if she has stopped moving all her flippers. Once the marine turtle has laid about 20 eggs, she is not normally disturbed by lights or noise.	You can turn your lights on at this stage without disturbing the marine turtle. Flash photographs can also be taken.
Remember: Always keep a distance, keep domestic animals away from marine turtles.	Marine turtles are wild animals.
<p>Turtle Tags</p> <p>Marine turtles are tagged to learn more about their movements, growth and nesting history. If you find a marine turtle with tags in its flippers, please record the tag number, the date and the location. Do not remove the tag from nesting marine turtles.</p>	<p>Tag Returns</p> <p>Please return tags to the address on the back of the tag or to the AFMA office on Thursday Island:</p> <p>AFMA 38 Victoria Pde (PO Box 376) Thursday Island Qld 4875</p>
How to find marine turtle hatchling	Marine turtle watching tips
At night, walk just below the grass line on the beach. Look for hatchlings or hatchling tracks in the dunes and down the beach. Be very careful if you are walking in the dunes – the sand becomes very soft when a nest is ready to emerge.	Use a torch while looking for hatchlings to avoid treading on them.
If you find hatchlings running down the beach, stay on the ocean side of them with your light. Hatchlings are attracted to light and you can disorientate them with your torch light.	Guide the hatchlings to the water using your torch by staying on the ocean side of them. Do not pick them up and put them in the water.
If you find hatchlings emerging from their nest do not block their way to the water.	Do not help the hatchlings out of the nest by digging around – let them emerge naturally.
<p>Flash Photography</p> <p>You can take flash photographs, but remember that hatchlings are attracted to light and you can disorientate them with your camera flashes or your torch lights.</p>	

Marine Debris



Marine Debris

Ghosts in the Gulf of Carpentaria

The Gulf of Carpentaria is an internationally important foraging and breeding ground for dugong and marine turtles in northern Australia. For many thousands of years a slow, predominantly clockwise circulation of water around the margins of the gulf has occurred, with water driven into the Gulf from the east by the Southern Equatorial Current and an outflow to the west. However, the currents in the Gulf of Carpentaria are also variable and generally reverse in response to monsoonal wind changes.

Today, these same currents and circulation of water carry tonnes of rubbish and discarded fishing nets (ghost nets) that have originated from southeast Asia (Kiessling 2003).

During the monsoon and the coming of the southeast wind season, rangers at Groote Eylandt on the Northern Territory side of the Gulf collected 61,800 kilograms of debris over 137 kilometres of coastline over 31 days. Around 90% of the debris was ghost nets. Some of these nets weigh as much as two *Toyota Troop Carriers* and would measure around four kilometres in length and with a drop of 12 meters. It is thought that ghost nets in the Gulf of Carpentaria go on fishing for a number of years, getting washed ashore and washed back into the sea during storm or king tide events. On the eastern side of the Gulf (western Cape York) the nets arrive during the monsoonal season; on the western side of the Gulf the nets get swept in during the southeast trade winds.

Since 1996, 205 stranded marine turtles have been recorded on Cape Arnhem alone. The most numerous items found on the beaches of the Gulf include rubber thongs, Indonesian water bottles and light bulbs.



*Marine debris washed onto a Torres Strait Island.
Photo: TSRA.*



Badu ranger Horace Nona preparing to remove a ghost net from the reef at Badu Island using a hookah. Photo: TSRA.

Things to do:

- Start a marine debris survey with the help of rangers and Torres Strait Regional Authority Land and Sea Management Unit (contact the LSMU for details on 07 4069 2947).
- Get involved in the Carpentaria Ghost Net Programme counting and cleaning up discarded fishing nets off beaches. You can use the Net Kit on the accompanying CD ROM to identify different ghost nets. Visit the Carpentaria Ghost Nets Programme website to learn more about the programme. www.ghostnets.com.au
- Create your own marine debris story to talk about where rubbish is coming from.
- Show students pictures of marine debris. The accompanying CD ROM contains images that can be used for this. Ask the students to highlight the problems, causes and possible answers.

Why marine debris is bad for the environment

It takes about 450 years for plastic to breakdown. Plastics and other debris can float in the ocean. Some marine animals like marine turtles may swallow the plastic because they mistake this rubbish for food such as a jellyfish. Animals can choke on the plastics and be suffocated or the debris may drown the animal or stop it from being able to eat. In the Gulf of Carpentaria, marine turtles and dugongs can become trapped in old fishing nets and drown.

Things to do:

- Show students pictures of marine debris and marine animals caught in them. The accompanying CD ROM contains images that can be used for this.
- Collect plastic bottles and use ropes and bamboo or sticks to make a floating raft.
- Make a hammock out of the discarded fishing net if it is new and strong. Use rope and washed up timbers.
- Ask students to draw what some marine animals eat and think about what marine debris those animals might mistake for food.
- Look at the marine debris and pollution booklets in the accompanying CD ROM.

Examples of changing times

The materials once used to wrap food were organic. As economies have grown the use of packaging has increased. In Indonesia fifteen years ago it was normal to buy food wrapped in banana leaf. When the leaves were thrown away on the ground they decomposed very quickly. The rubbish found in the Gulf of Carpentaria is the result of people buying small quantities of packaged items frequently, and inadequate disposal systems for rubbish. It would be unfair to pass judgment on those creating the rubbish without thinking of Australia's current use of 20 billion plastic bags a year.

Things to do:

- Visit the local store and look at the packaging. Notice how most things come in plastic. Talk about how long this takes to break down and that it should end up in the tip and not in the sea. Ask students how rubbish issues can be addressed (highlight problems, cause and solutions).
- Recycle glass bottles and jars and see how they are used by some people in the community or at school. See what items from the beach can be recycled.
- Talk about using banana leaf in *kup maurri* (an underground oven) and cook something for lunch using natural wrapping or ask someone from the community to demonstrate cooking with leaves or natural methods instead of synthetic materials.
- Talk about using *bilum* (string bag or material) instead of plastic and ask if students think either is better and why.
- Ask an elder if they would like to talk about how they used to cook and what they used for packaging and carrying. Ask the students to make up a story of how things have changed on their island.
- Ask students to work together to develop management plans for rubbish disposal on their islands.

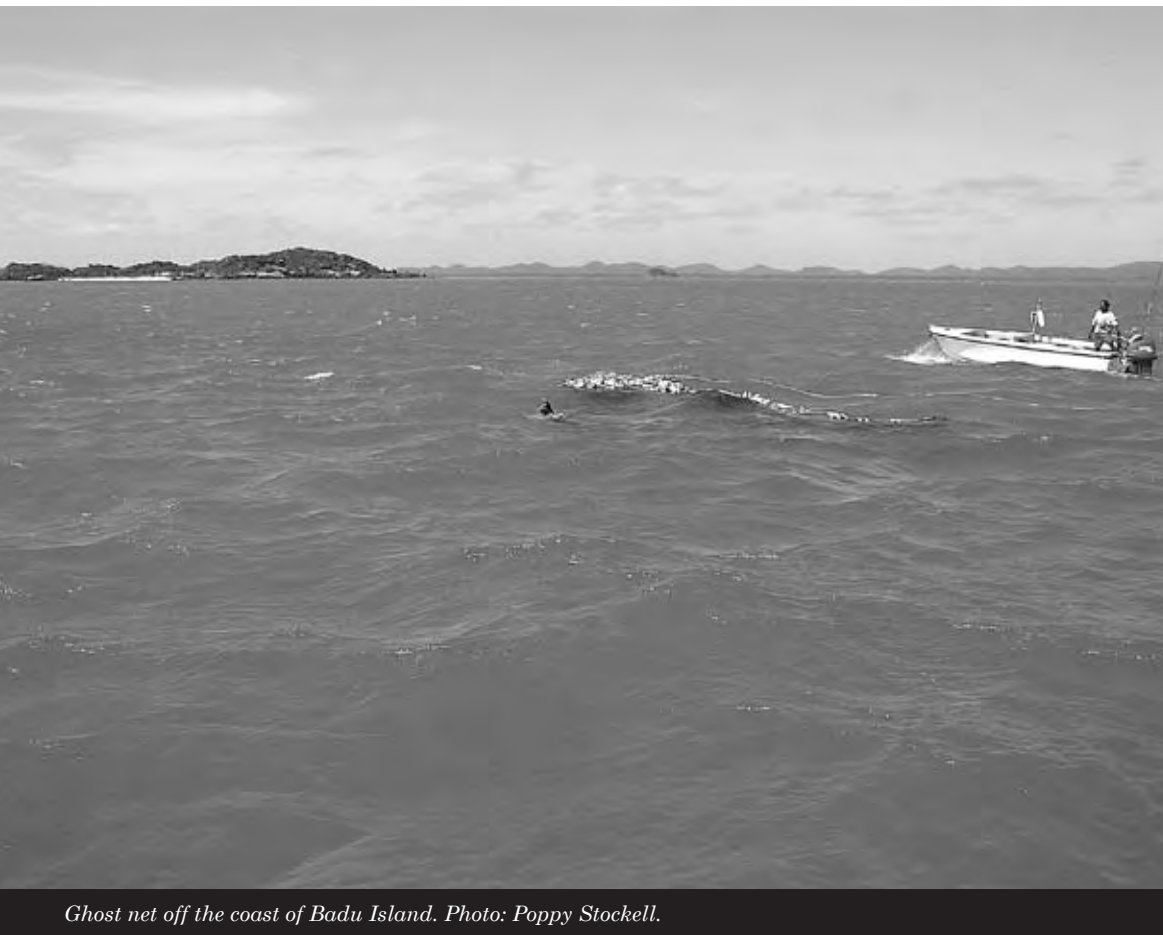
Carrying marine debris

The movement of tides and currents are central to the life of the sea. The rubbish travels on the same currents as fisherman and traders do and have done throughout history. This knowledge of the sea and the winds is still held in communities. Indigenous people's respect for the sea dictates that some may never raise their voice to the ocean, must ask permission from the old people to cross a sand bar and that to be shipwrecked is deserved. In the old times in Torres Strait, if people were *sarup* (lost or shipwrecked) then returned to their communities alive they would be seen as a stranger. Each coastal community places names and seasonal significance on the shifting winds and tides. As the seasons change, island communities everywhere follow a fixed sequence of activities linked to the weather and the ocean phases. For hundreds of years, the northwest monsoon brought the Macassan traders to north Australia where they collected trepang (sea slugs). Months later they left on the wind from the east. Today, the northwest monsoon brings discarded fishing nets, thongs, bottles and light globes to Australia's northern shores.

Marine Debris

Things to do:

- Ask an elder if they would speak to the students about the sea, currents, tides and their use to trade and for fishing.
- Talk about the seasons. With the students, make a seasonal cycle, showing the different seasons and the different winds. Ask a community member to come and talk to the students about the different winds, and include the language names for the seasons.
- Ask the students where they would expect to find marine debris in particular seasons (eg. *kuki* northwesterly winds — debris may wash up on the northwest beaches). You could use a map of your island.
- Ask the elder if they would like to tell the students about trade in the area and if there was marine debris when they were young.
- Ask the students what are some of the different things they see at different times of the year arriving on currents, winds and tides.



Ghost net off the coast of Badu Island. Photo: Poppy Stockell.

Reusing Marine Debris

Coastal communities have been using marine debris, both natural and man-made, for thousands of years. More recently, man-made marine debris, including old fishing nets have been used for a wide variety of applications, including crayfish holding bags, door mats, fences for gardens, shopping bags, house decorations and sand dune stabilising. There are opportunities for remote coastal communities to utilise marine debris for making products that could then be sold to markets in other parts of the country or overseas.

Recently, the Carpentaria Ghost Net Programme coordinated a competition for people to engineer different products using ghost nets that could then be mass produced and sold for a profit to the community.

Things to do:

- Ask the students about all the different ways that marine debris are reused in their community. Make a list of these.
- Create a small business project that the students can use to recycle marine debris that could then be sold on to markets around the country. The students would have to think of a product, utilise the internet to do some market research, design the product and make some prototypes.

Marine Debris Information and Resources

Marine Debris and Pollution

Harmful marine debris consists of 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 animals may identify the debris as food (*kai kai*) or as refuge and either swallow or become entangled.

Entanglement in marine debris can cause restricted mobility, starvation, infection, amputation, drowning and smothering. Ingestion of debris usually causes a physical blockage in the digestive system, leading to painful internal injuries.

Keeping Tabs on Marine Debris (booklet and survey)

Survey template developed by WWF to assess marine debris by community groups. Template and details can be found on the accompanying CD ROM. The surveys look at all types of materials that wash up on beaches, survey particular areas and analyse the types, origins and quantities of debris floating into an area. The survey form is quite complex. School classes can utilise the survey ideas and develop their own survey form suitable for school children

Department of Education and Training (Qld) Curriculum link: *Suite 3 and wider community and assumes a moderate level of English language proficiency and numeracy skills. Survey forms and projects can also be developed that are suitable for Suites 1 and 2.*

Useful Internet Sites

Carpentaria Ghost Nets Programme

<http://www.ghostnets.com.au/index2.html>

This program is assisting coastal communities in northern Australia reduce the problems caused by discarded fishing nets (ghost nets). Ghost nets capture marine turtles, sharks and dugongs and make a mess of northern coastlines. The Carpentaria Ghost Nets Programme is a valuable community group activity that provides insight into global ocean currents. The majority of nets come to north Australia from southeast Asia.

Department of Education and Training (Qld) Curriculum link: *Suite 3 and wider community and caters to a range of English language proficiencies.*

Department of the Environment, Water, Heritage and the Arts marine debris information pages

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

The Department of Environment and Water Resources has identified marine debris as a threat to the survival of marine animals and the environment. The web page provides information on marine debris, their impacts and species most likely to be effected.

Department of Education and Training (Qld) Curriculum link: *Suite 2-3 and wider community and assumes a moderate level of English language proficiency and numeracy skills.*

OceanColor Web website link to marine debris information page

http://seawifs.gsfc.nasa.gov/OCEAN_PLANET/HTML/peril_marine_debris.html

This website link provides some basic, useful information about marine debris, their impacts on marine environments and animals and ways that some groups are addressing these issues. The ideas here on ways to recycle marine debris could be useful for small remote communities that get a lot of debris washing up on their beaches, by transforming the debris into something the community could then sell.

Department of Education and Training (Qld) Curriculum link: *Suite 1-3 and wider community and assumes a low level of English language proficiency and numeracy skills.*

