

## Part 2a: Dugongs

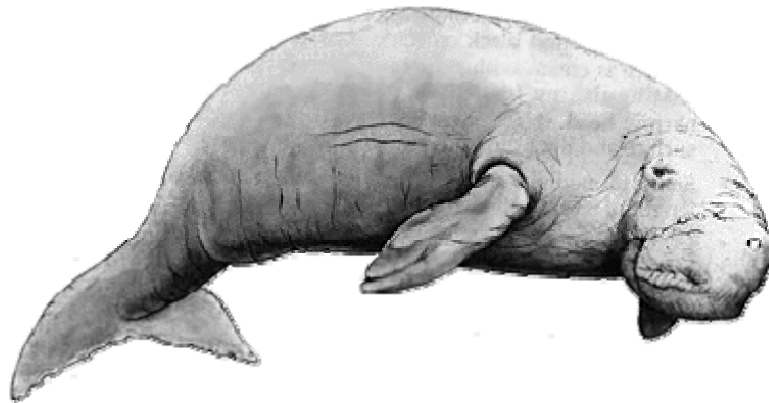
### Knowledge and concerns about dugongs based on scientific research

**English name:** Dugong, Sea Cow

**English classification:** Marine mammal

**Scientific name:** *Dugong dugon*

**Scientific classification:** Class Mammalia; Order Sirenia; Family Dugongidae



**Figure 6:** Dugong<sup>47</sup>

The following information on dugong biology and management is derived from recently published technical literature reviews on dugongs<sup>48</sup> and other sources identified with footnotes throughout the text.

Dugongs are classified as mammals because they:

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

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<sup>47</sup> Photo source: [http://www.gbrmpa.gov.au/corp\\_site/info\\_services/publications/dugong/](http://www.gbrmpa.gov.au/corp_site/info_services/publications/dugong/)

<sup>48</sup> Saafeld and Marsh (2004) and Marsh et al. (2002)

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

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

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

**Box 1: What happened to the Steller's Sea Cow?<sup>49</sup>**



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

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

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

<sup>49</sup> [http://www.gbrmpa.gov.au/corp\\_site/info\\_services/publications/turtle\\_conservation/ip\\_biological\\_notes.html](http://www.gbrmpa.gov.au/corp_site/info_services/publications/turtle_conservation/ip_biological_notes.html)

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



**Figure 7: West Indian Manatee**<sup>50</sup>

The **Amazonian Manatee** (*Trichechus inunguis*) (Figure 8) lives in the freshwater of the Amazon River and its tributaries in South America. This is the smallest member of the family Trichechidae (up to 2.8 metres in length), has smooth skin, no nails on its flippers and feeds on freshwater vegetation. It feeds on aquatic plants floating on the water surface (e.g. water lilies) and aquatic grasses near the water's edge<sup>51</sup>.



**Figure 8: Amazonian Manatee**<sup>52</sup>

**West African Manatee** (*Trichechus senegalensis*) (Figure 9) lives in coastal marine waters, estuaries and rivers of West Africa and grows to between three and four metres long. They eat overhanging vegetations such as mangroves rather than aquatic plants<sup>53</sup>.

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

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

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

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



**Figure 9: West African Manatee**<sup>54</sup>

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



**Figure 10: Where Sirenians are found around the world**<sup>55</sup>

### Origins of Dugongs and other Sirenids

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

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

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

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

## **Characteristics of Dugongs**<sup>56</sup>

### ***Size and weight***

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

### ***Distribution and populations***

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

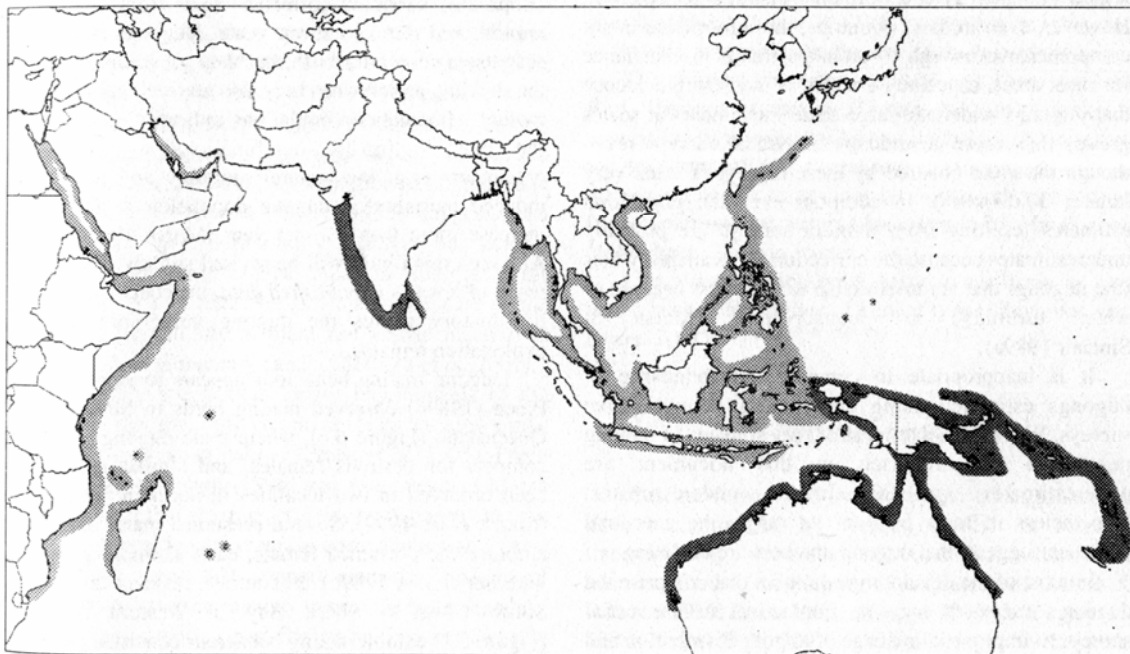
From the information that is available, however, researchers have concluded that over much of the known international range of dugongs only small, isolated populations of dugongs remain, separated by large areas where they are close to extinction or are already extinct. Because dugongs are slow to reproduce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

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

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

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



**Figure 11:** Distribution of Dugongs<sup>57</sup>

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

<sup>57</sup> Saalfeld and Marsh (2004)

**Queensland East Coast**

Along the east coast of Queensland, dugongs are found in shallow waters where seagrass grows. Throughout this range there is on average less than one dugong for every square kilometre, but large herds of dugongs are seen in Moreton Bay, Hervey Bay, Great Sandy Strait, Shoalwater Bay, Upstart Bay, Cleveland Bay, near Hinchinbrook Island, near the mouth of the Starke River, Princess Charlotte Bay and Shelburne Bay. Research on the impacts of a cyclone and flooding in Hervey Bay in 1992 indicates that these severe weather events can cause the destruction of large areas of seagrass. As a result, dugong populations may take years to recover from these extreme weather events<sup>58</sup>.

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

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

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

**Torres Strait**

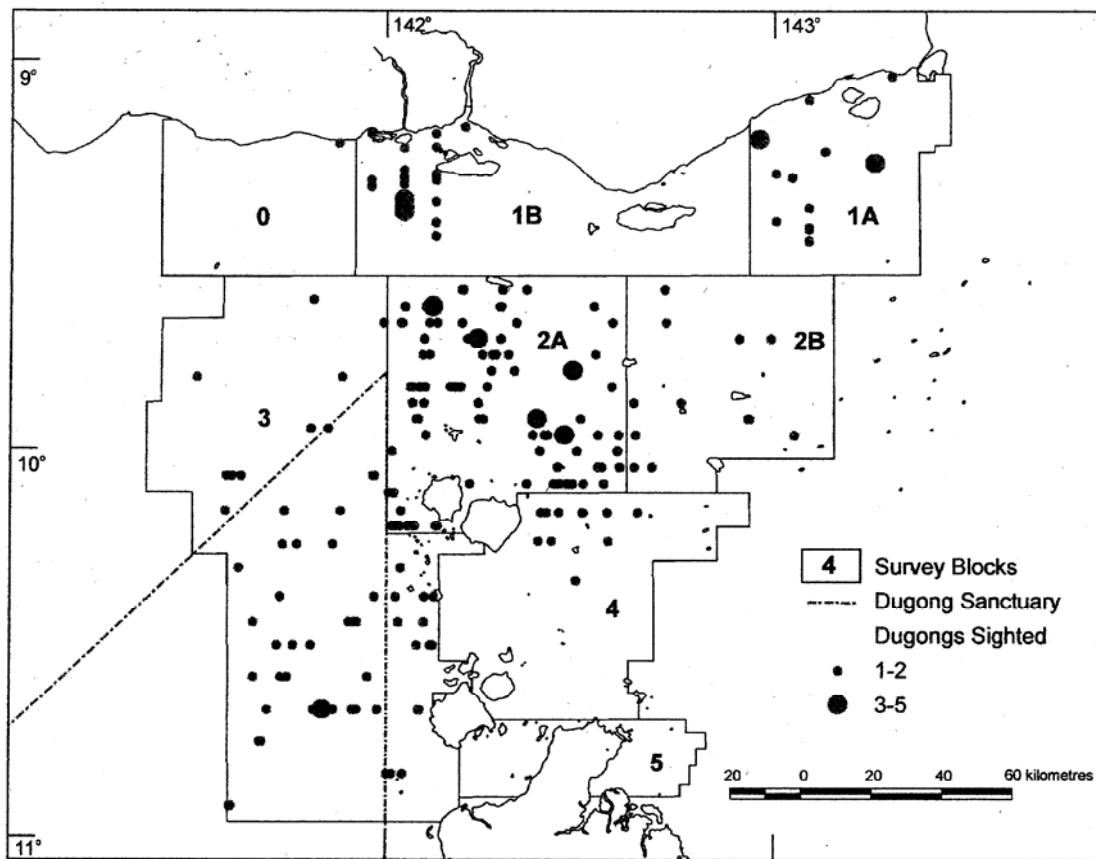
The shallow waters of Torres Strait support a large number of dugongs in a relatively small area, making it one of the most important dugong habitats in the world. Five

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<sup>58</sup> Preen and Marsh (1995)

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

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



**Figure 12:** Distribution of dugongs observed during 2001 survey in Torres Strait<sup>59</sup>

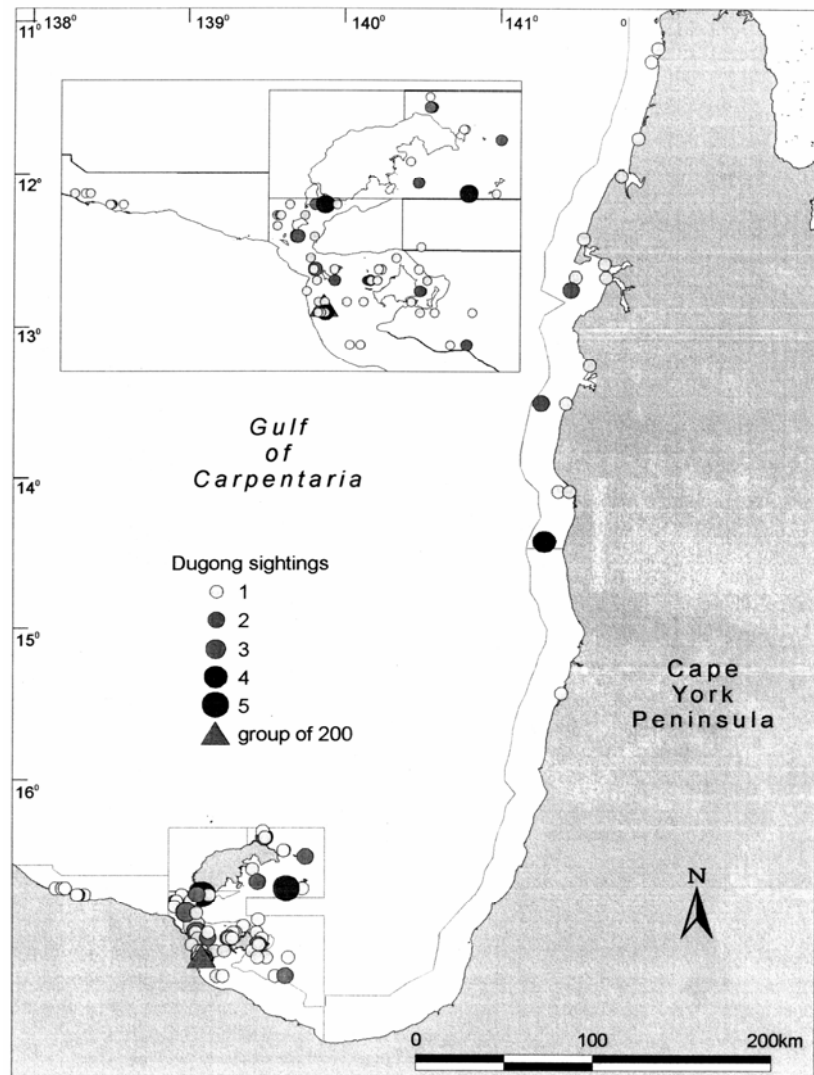
### Gulf of Carpentaria

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

<sup>59</sup> Saalfeld and Marsh (2004)

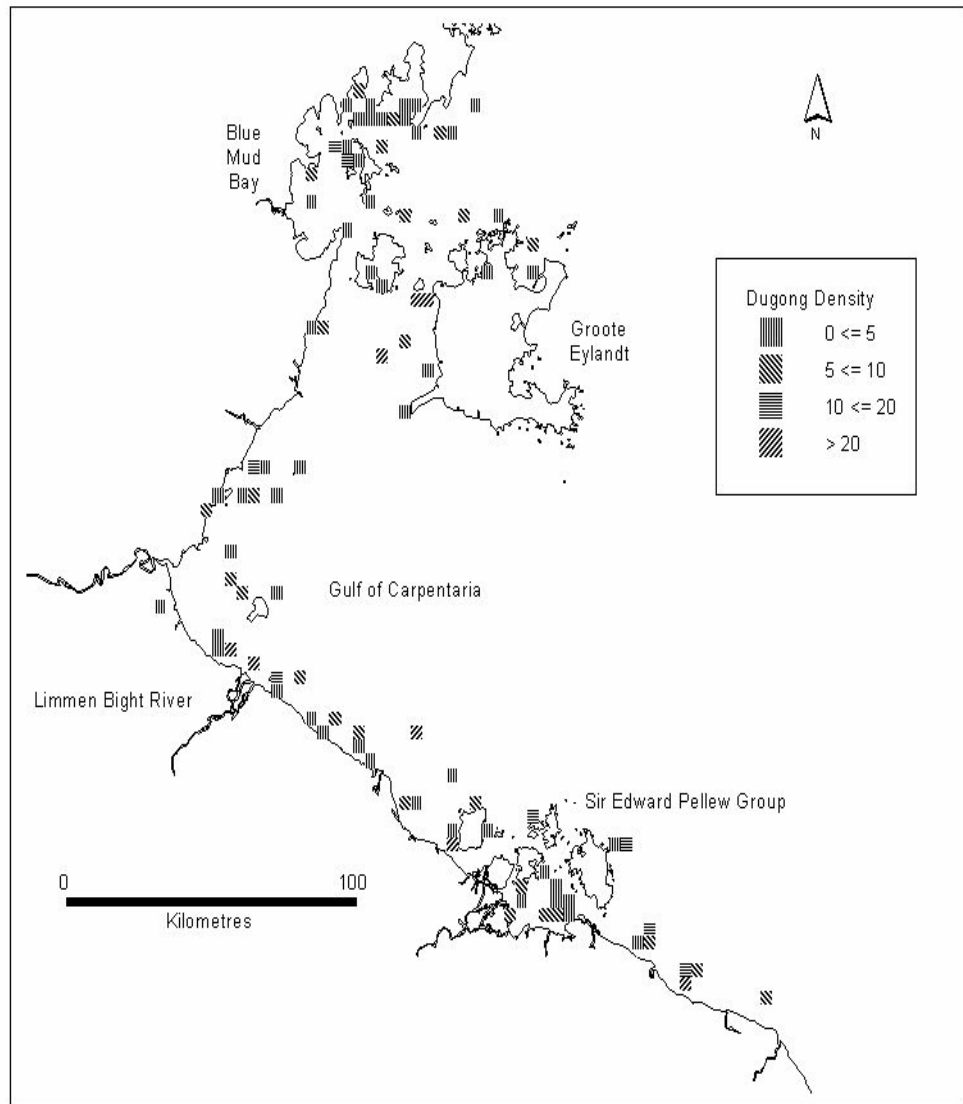


Mud Bay in the Northern Territory. Aerial surveys of the Queensland coast of the Gulf in 1997 and the Northern Territory coast of the Gulf in 1985 and 1994 indicate that the total number of dugongs in the Gulf of Carpentaria is in the range 20,000 to 30,000. The surveys indicate that the northern half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



**Figure 13:** Dugong sightings in the eastern Gulf of Carpentaria during the 1997 survey<sup>60</sup>

<sup>60</sup> Saalfeld and Marsh (2004)

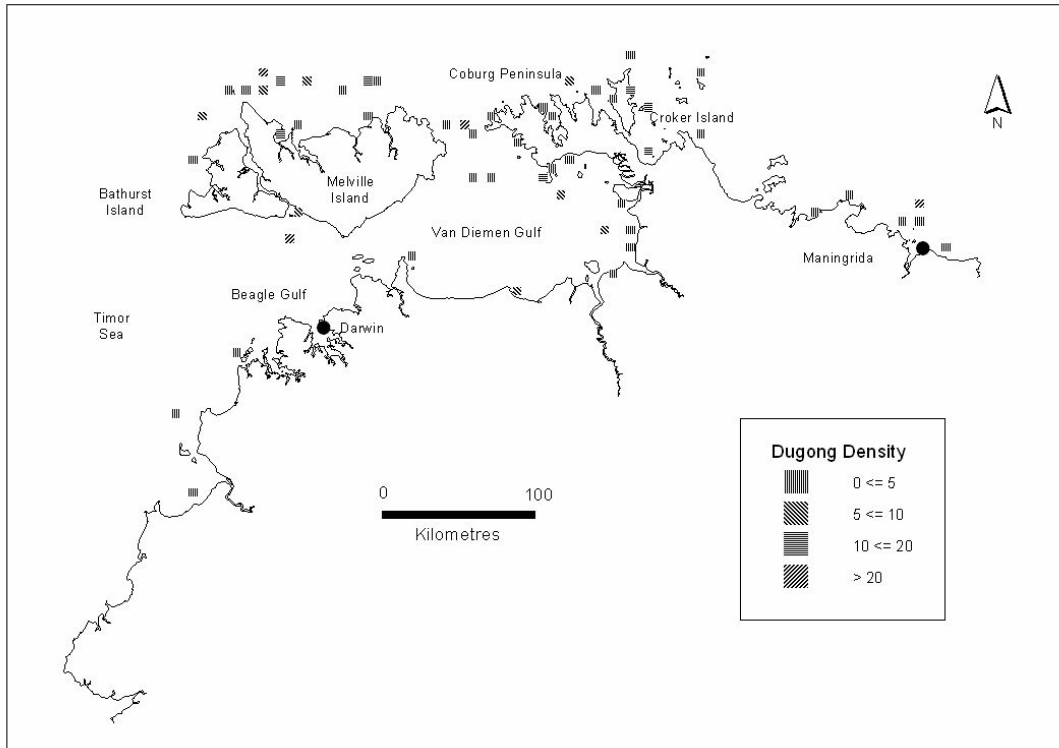


**Figure 14:** Dugong sightings in the western Gulf of Carpentaria during the 1994 survey<sup>61</sup>

**Top End Coast**

Along the northern coast of the Northern Territory, most dugongs are found around the Tiwi Islands, Cobourg Peninsula (Garig Gunak Barlu National Park), and Croker Island, with smaller numbers near Maningrida. Two aerial surveys along this stretch of coast undertaken 12 years apart, in 1983<sup>62</sup> and 1995<sup>63</sup>, indicate that there is a population of between about 10,500 and 16,500 dugongs. Figure 15 shows the distribution of dugong sightings during the 1995 survey.

<sup>61</sup> Saalfeld and Marsh (2004)  
<sup>62</sup> Bayliss and Freeland (1989)  
<sup>63</sup> Saalfeld (2000)



**Figure 15:** Dugong sightings on north-west coast of Northern Territory in 1995<sup>64</sup>

**Western Australia**

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

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

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

<sup>64</sup> Saalfeld and Marsh (2004)

One aerial survey of the Pilbara Coast (Exmouth Gulf to De Grey River) in April 2000<sup>65</sup> estimated a dugong population of about 2,000 in this region.

### **Life cycle and Breeding**

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

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

### **Feeding**

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

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<sup>65</sup> Prince et al. (2001)



**Figure 16a:** Seagrass - *Halophila ovalis*<sup>66</sup>



**Figure 16b:** Seagrass – *Halodule uninervis*<sup>66</sup>



**Figure 17:** Dugong feeding trails in a seagrass meadow<sup>67</sup>

<sup>66</sup> Copyright Queensland DPI&F (Len J. McKenzie)

<sup>67</sup> Photo courtesy Anthony Roeloffs Queensland DPI&F

**Box 2: Seagrass<sup>68</sup>**

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

**Why seagrass isn't seaweed!**

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

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

**How seagrass grows**

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

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

**Ecological value**

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

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

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

For further information on seagrass, go to the Seagrass Watch website:  
[www.seagrasswatch.org](http://www.seagrasswatch.org)

<sup>68</sup> Adapted from: [http://www.epa.qld.gov.au/nature\\_conservation/habitats/marine\\_habitats/seagrass/](http://www.epa.qld.gov.au/nature_conservation/habitats/marine_habitats/seagrass/)

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

**Box 3: Case study: Hervey Bay seagrass and dugong<sup>69</sup>**

In mid-1992, fishers in the Hervey Bay area began to report large numbers of dead dugongs in the area. Researchers set out to check on the seagrass beds but found that where in 1988 there had been 1000km<sup>2</sup> of this dugong food, now there was none.

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

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

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

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

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

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

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

### ***Indigenous harvest***

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

<sup>69</sup> [http://www.epa.qld.gov.au/nature\\_conservation/habitats/marine\\_habitats/seagrass/](http://www.epa.qld.gov.au/nature_conservation/habitats/marine_habitats/seagrass/)

The following estimates are based on recently published summaries of the available information<sup>70</sup>.

### Western Australia

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

### Northern Territory

The only information on dugong harvest is from the Numbulwar and Borroloola regions of the Gulf of Carpentaria. Dugong harvest at Numbulwar was estimated to be an average of 62 per year during the 1960s, which reduced to approximately 10 per year during the 1980s<sup>71</sup>. In Yanyuwa country, around the Sir Edward Pellew Islands, the dugong harvest is estimated to have reduced from about 450 per year in the 1920s, to 135 per year in the 1950s, to 48 per year in the 1970s and to about 14 per year in the 1990s<sup>72</sup>. Anecdotal evidence suggests that dugongs have disappeared altogether from waters around Groote Eylandt, and that people now regularly hunt dugongs in waters off the nearby mainland to bring meat back to the island<sup>73</sup>.

### Queensland, Gulf of Carpentaria

Several surveys during the 1970s suggested that the dugong harvest around the Wellesley Islands was in the order of 40 to 100 per year<sup>74</sup>. There is little suitable dugong habitat along most of the west coast of Cape York Peninsula, and hence little or no dugong hunting by Aboriginal communities along this coast. Close to the tip of the peninsula, however, communities of the Northern Peninsula Area (NPA), some of whom are culturally and historically from Torres Strait, participate in the harvest of the Torres Strait dugong population.

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<sup>70</sup> Saalfeld and Marsh (2004) and Marsh et al. (2002)

<sup>71</sup> Bayliss and Freeland 1989

<sup>72</sup> Bradley (1997); Coates (2002)

<sup>73</sup> Reported in Marsh et al. (2002)

<sup>74</sup> Marsh et al. (2002)



### Queensland, Torres Strait

People from the Eastern Islands of Torres Strait, where the relatively deep water provides little suitable dugong habitat, have little or no involvement in dugong hunting. Small numbers of dugongs are hunted by people from the Central Islands of Torres Strait. However, most dugong hunting is carried out by people from the Western Islands (particularly Mabuiag and Badu), Top Western Islands (especially Boigu) and the Inner Islands Group. A survey undertaken by CSIRO<sup>75</sup> concluded that the average catch for the Protected Zone during the period 1991 to 1993 was 645kg of dugongs per day, which is equivalent to 1,226 dugongs per year. Based on this and other surveys undertaken between 1973 and 2001, researchers have concluded that the annual average Indigenous harvest in Torres Strait approaches or exceeds 1000 dugongs per year, not including dugongs taken by Indigenous communities in the Inner Islands, the NPA or on the nearby coast of Papua New Guinea<sup>76</sup>.

### **Concerns**

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

Researchers have expressed particular concern about the future of dugong populations in Torres Strait and off eastern Cape York Peninsula, due to apparently unsustainable levels of harvesting<sup>77</sup>. Current research indicates that dugongs could become extinct in Torres Strait sometime between 40 and 120 years from now if current levels of dugong harvesting continues<sup>78</sup>.

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<sup>75</sup> Harris et al. (1994)

<sup>76</sup> Marsh et al. (2003)

<sup>77</sup> Heinsohn et al. (2004); Marsh et al. (2004).

<sup>78</sup> Heinsohn et al. (2004)

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