

Title

Dugong dugon (New Caledonia subpopulation), Dugong

Assessment by

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Classification

Endangered

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Sirenia	Dugongidae

Taxon Name

Dugong dugon (New Caledonia subpopulation)

Parent Species

Dugong dugon (Müller, 1776)

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Common Name(s)

- English: Dugong, Sea Cow
- French: Dugong, Vache Marine
- Jawé: Mudep
- Cââc: Mudip
- Nyelâyu: Modap
- Néku: Kawin
- Ajië: Pokanéra

Assessment Information

Red List Category & Criteria

Endangered C2(a)(ii) [ver 3.1](#).

Justification

The New Caledonian Dugong subpopulation (*Dugong dugon*) is geographically and genetically isolated from other subpopulations within the Dugong's large range. The number of mature individuals in the subpopulation was estimated to range between 149 and 896 individuals (well under 2,500 and possibly fewer than 250) based on aerial surveys of New Caledonia from 2003 to 2012. Illegal hunting, boat strikes, and incidental capture in gillnets, likely the main anthropogenic pressures on this subpopulation, were not sufficiently addressed by current conservation and management actions during the time of surveys and continue to threaten New Caledonian Dugongs. Moreover, genetic studies suggest that the New Caledonian Dugongs are one homogenous subpopulation throughout their entire New Caledonian range, thus harbouring 100% of the mature individuals and confirming their isolation. As a result, repopulation after a catastrophic event such as a disease or widespread seagrass die-off is unlikely. Based on available evidence, we consider this species as Endangered under IUCN criterion C2(a)(ii).

Geographic Range

Range Description

The Dugong is listed as Vulnerable at a global scale (Marsh and Sobtzick 2019). Dugongs are found in coastal and island waters from East Africa to Vanuatu between approximately 27°N and 27°S (Marsh and Sobtzick 2019). The Dugong's regional status is heterogeneous across its large range (Marsh *et al.* 2011). New Caledonia, a French archipelago, is located at the south-eastern edge of the Dugong's range in the southwest Pacific and supports a globally important Dugong population (Cleguer *et al.* 2017; Garrigue *et al.* 2008).

Dugongs in New Caledonia are mainly found inside the barrier reef lagoons, around Grande Terre, the main island of New Caledonia. Grande Terre stretches over 400km from the south-east to the north-west. The lagoons, covering over 23,400km², are surrounded by a barrier reef of more than 1,600km (Testau and Conand 1983), and extend from ~18.5N to ~23°S. This range does not include the Entrecasteaux reefs, further north outside the lagoons, nor the Chesterfield Islands to the West, where Dugongs have never been recorded. Two vagrant individuals were recently recorded in the Loyalty Islands, outside the lagoons to the East of Grande Terre. A model of Dugong distribution and relative density in New Caledonia based on a 10-year time series of aerial surveys (Cleguer *et al.* 2015) indicated that Dugongs are mostly found on the west and north-east coast of Grande Terre and that their distribution is heterogeneous and clustered within the lagoons. The highest densities of Dugongs were found in the Cap Goulvain region on the central-west coast, across the jurisdictions of province Sud and province Nord (Figure 1, supplementary material). High Dugong densities were also observed at various locations on the west coast and on the north-east coast between Pouebo and Touho (Figure 1, supplementary material).

The Extent of Occurrence (EOO) of Dugongs in New Caledonia was calculated as approximately 11,268 km². The Area of Occupancy (AOO) of Dugongs in New Caledonia was calculated as approximately 874 km². Both EOO and AOO were calculated based on 344 Dugong sightings during dedicated, standardised aerial surveys between 2003 and 2012

(Cleguer *et al.* 2017; Garrigue *et al.* 2009; Garrigue *et al.* 2008), using the standard IUCN techniques. Given that the AOO is < 2000 km² and that more than 90% of the region's mature individuals occur at a single location and the evidence for continuing decline, the New Caledonia subpopulation of the Dugong is eligible for listing as vulnerable under Criterion B2(a, b).

The likelihood of Dugongs moving between New Caledonia and other areas within the Dugong's range is extremely low. First, the lagoons around Grande Terre are separated from the closest neighbouring island in Vanuatu by ~350 km of open water and the New Hebrides oceanic Trench extending up to 7.6km deep, and from the large Australian Dugong populations by ~1,330 km of deep oceanic waters to the west. Although Dugongs have been recorded travelling long distances up to several hundreds of kilometres (Deutsch *et al.* 2022; Sheppard *et al.* 2006), movements across deep ocean trenches are rare and attributed to vagrant animals. Oceanographic currents in the vicinity of New Caledonia indicate the possibility of facilitated travel between Vanuatu and the east coast of Australia (Cravatte *et al.* 2015). Nonetheless, genetic studies indicate that the Dugongs in New Caledonia are genetically differentiated from all genetically documented populations (Garrigue *et al.* in press; Oremus 2011, 2015). In addition, neighbouring regions harbour small fragmented Dugong populations (e.g. Vanuatu (Chambers *et al.*, 1989; Marsh *et al.*, 2011)) or occasional vagrant individuals (e.g. Fiji (Hill-Lewenilovo *et al.* 2019)).

Country Occurrence of this Local Subpopulation

Native: New Caledonia

FAO Marine Fishing Areas

Native: Pacific – western central

Distribution Map

Dugong dugon (New Caledonia subpopulation)

[provide shapefiles when submitting to IUCN]

Population

The most recent systematic aerial surveys of the lagoons around Grande Terre yielded abundance estimates of 1166 ± SE 293 (cool season) and 792 ± SE 212 (warm season) for the New Caledonian Dugong population (Cleguer *et al.* 2017; Hagihara *et al.* 2018). The Loyalty Islands have never been surveyed because there were no reports of Dugong sightings in this area at the time of the surveys. However, two Dugong sightings have recently been reported in Lifou and, a month later, in Ouvéa by local residents (Cleguer and Garrigue 2018; Gallo 2022). Acknowledging that future surveys should probably cover the Loyalty Islands, we conclude that Dugong numbers in the Loyalty Islands are almost certainly very low and unlikely to make a substantive difference to this assessment of the status of the Dugong in New Caledonia.

Proportion of mature individuals

Accounting for the range of abundance estimates from the 2003-2012 time series described above, from $426 \pm \text{SE } 134$ to $1588 \pm \text{SE } 407$ individuals in total, we conclude that there are less than 2,500 mature individuals in New Caledonia. This conclusion is robust to sensitivity analysis using a range of values for percentage of mature individuals (Table 1, Supplementary Material). Deutsch et al. (2008) estimated from population modelling and carcass recovery that $\sim 45 - 70\%$ of a Florida manatee, *T. manatus manatus*, population were mature. Other authors had previously estimated 54% (Marsh, 1980), and 60% (Bertram and Bertram 1973) mature individuals for Dugong populations using different methods. Assuming a similar range of proportions of mature individuals in the New Caledonian Dugong subpopulation, we estimated that there are between 149 and 896 mature individuals in New Caledonia waters. Indeed, our estimate of the proportion of mature individuals may be too high, as manatees reach sexual maturity at a younger age than Dugongs (Marsh *et al.* 2011). We conclude that more than 95% of New Caledonian mature individuals are found in the New Caledonian lagoons around Grande Terre based on the following lines of evidence: (1) the susceptibility of the coastal waters of the whole Grande Terre region to impacts such as high intensity cyclones or disease outbreak; (2) the absence of evidence for distinct subpopulations within the New Caledonian Dugong population (Garrigue *et al.* in press; Oremus 2011, 2015); and the extremely low occurrence of individuals in more remote sites such as Loyalty islands.

The subpopulation is eligible for listing as Vulnerable under Criterion D1 because the number of mature individuals is under 1000 (Supplementary Table 1). The data are insufficient to determine the eligibility of this subpopulation of dugongs under Criteria A or E.

Population trend

To our knowledge, there is no historical record of Dugongs in New Caledonia, although their presence in the past is reported from local elders and fishermen, often stating they witnessed a sharp decline in abundance over time (Cleguer, pers. comm. 2022).

Six systematic aerial surveys of the waters of Grande Terre using trained human observers in light aircraft were conducted in June 2003 (Garrigue *et al.* 2008); January 2008 (Garrigue *et al.* 2009); June and November 2011; June and November 2012 (Cleguer *et al.* 2017). The 2003 cool season surveys yielded a population estimate of $1588 \pm \text{SE } 407$ (mean \pm SE) Dugongs (Garrigue *et al.* 2008; Hagihara *et al.* 2018). Results obtained from this single baseline survey suggested that New Caledonia supports one of the most important Dugong populations globally. However, a second survey conducted during the warm season of 2008 using the same survey design and methodology resulted in a population estimate of $426 \pm \text{SE } 134$ Dugongs (Garrigue *et al.* 2009; Hagihara *et al.* 2018), prompting local concerns and suggesting a seasonal effect. Subsequent surveys were thus conducted during the warm and cool season between 2011 and 2012, producing estimates ranging between $545 \pm \text{SE } 157$ and $1,166 \pm \text{SE } 293$ individuals (Cleguer *et al.* 2017; Hagihara *et al.* 2018). The large differences in estimates between 2003 and the five subsequent surveys could be due to: (1) an actual decline in the population; and/or (2) confounding effects of variations in environmental conditions, animal behaviour and sampling biases (Cleguer *et al.* 2017). While the population appeared stable between 2008 and 2012 (Cleguer *et al.* 2017), new estimates are needed to evaluate the

current abundance of Dugongs. A more recent survey was conducted in November 2018 using an occupied aerial imagery survey approach and using a different survey transect design than previous surveys (Duclos *et al.* 2019). The data collected in this survey are still being analysed and thus not considered in this assessment.

Trends in the Dugong population of New Caledonia are currently difficult to assess due to changes in methodologies between surveys, limiting comparisons between estimates. Nonetheless, given the current threats to Dugongs in New Caledonia, continuing decline is highly likely. Illegal hunting and high vessel traffic, two major threats to this population, are ongoing and current statutory protection appears insufficient. The number of Dugongs killed illegally is unknown, but local knowledge (Cleguer 2010, Resource managers of the province Sud and province Nord, pers. comm.), stranding data available for Dugongs in New Caledonia (Opération Cétacés and Institut de Recherche pour le Développement n.d.) and socio-economic studies suggest that current levels of removal due to anthropogenic pressures are unsustainable (Cleguer *et al.* 2017; Garrigue *et al.* in press). We conclude that a population decline can be strongly inferred.

Population structure

The New Caledonian Dugong population is located at the periphery of the species' range and thus is assumed to face a greater risk of genetic isolation and low level of diversity than populations located centrally within the range (Eckert *et al.*, 2008). Not only is the New Caledonia isolated geographically from large neighbouring populations, studies on Dugong movements also suggest that Dugongs mostly remain within the lagoons (Cleguer 2015; Cleguer *et al.* 2020). The subpopulation was recently found to have a low potential for resilience through incoming gene flow, confirming its vulnerability to anthropogenic threats and diseases. New Caledonian Dugongs were also found to have a strong genetic differentiation from all other genetically documented populations, including Australian populations (Garrigue *et al.* in press; Oremus 2011, 2015). These studies provided no evidence of separate subpopulations within New Caledonia.

Habitat and Ecology

Some differences have been observed between Dugong habitat and ecology in the New Caledonian subpopulation and populations studied elsewhere (Marsh and Sobtzick 2019). In New Caledonia, small groups of Dugongs often use narrow coral reef lagoons ranging in width from a few to tens of kilometres. Cleguer *et al.* (2020) found that New Caledonian Dugongs spend most of their time within the lagoons, using the lagoon's full width from close to shore to the back reef. Where the New Caledonian lagoon is narrow, Dugongs sometimes use the fore reef shelf outside the barrier reef in the open ocean to commute between bays. This behaviour differs from other populations such as in Australia (Zeh *et al.* 2016), known to only travel within lagoon boundaries or following coastline features to travel between locations. Deeper water may provide a safer alternative to minimise exposure to shark predation within New Caledonia's shallow reticulated reefs (Heithaus *et al.* 2002; Hodgson 2004; Wirsing *et al.* 2007a, b). New Caledonian Dugongs may also use the fore reef shelf for thermoregulation

during the cool season when inshore intertidal seagrass resources are inaccessible because of the tide (Cleguer 2015), as also observed in Australia (Zeh *et al.* 2018).

Like other Dugong populations, New Caledonian Dugongs are found in a wide range of depths and the activity space use of individual Dugongs varies greatly with their location. Dugongs tracked with GPS-satellite trackers used very shallow areas intensively at night and high tide (Derville *et al.* 2022).

Dugongs are seagrass community specialists (Marsh *et al.* 2018). Eleven species of seagrass, in 6 genera on which Dugongs are known to feed (Johnstone and Hudson 1981; Marsh *et al.* 1982; Masini *et al.* 2001; Nietschmann 1984; Preen 1992; Sheppard *et al.* 2010), occur in New Caledonia (Payri 2007). However, the basis for food selection by New Caledonian Dugongs is currently unknown.

New Caledonian Dugongs intensively frequent shallow areas with known seagrass patches, but also deeper areas where the presence of seagrass has not yet been verified (Cleguer *et al.* 2020). Although the marine vegetation of New Caledonia in areas shallower than 5m has been mapped using optical remote sensing (Andréfouët *et al.* 2021), data on deeper seagrass meadows are patchy and limited. However, given the evidence of Dugongs' use of areas deeper than 5m in New Caledonia, it is highly likely that extensive deep-water seagrass occurs there. A complete map of species distribution and types of seagrass beds is needed. A theoretical framework using a combination of field data and habitat maps derived from remote sensing (including deep-water seagrass) was recently developed to enhance the quality, resolution, and coverage of spatial information on seagrass in New Caledonia (Andréfouët *et al.* 2021) as a basis for future mapping efforts. An ongoing participatory program ("Science en Herbe") is using citizen science to provide critical information on unmapped Dugong habitats, based on Dugong distribution and movement data (from aerial survey, and tracking studies, respectively) (Gallo 2022; Science En Herbe n.d.).

Systems: Marine

Use and Trade

The Dugong is culturally very important to New Caledonian people. It is an emblem of respect and care of marine wildlife in the territory and, as a result, its conservation is of considerable societal value (Cleguer 2010; Dupont 2015; Garrigue *et al.* 2008). Dugong hunting has been conducted for centuries in New Caledonia to meet the needs of traditional ceremonies for the Kanak people (the indigenous Melanesian inhabitants of New Caledonia) (Leblic 2008), including the ceremony of the New Yam, weddings, bereavements and leaders' inductions. The Dugong is associated with kanak chieftaincy because it is a prestige food, the "meat of the leaders" (Dupont 2015). Dugongs were also hunted by New Caledonians of European origin (Dupont 2015).

Dugong hunting is now restricted in New Caledonia by legislation, which prohibits hunting in the province Sud and requires permits in the province Nord and province des Iles Loyauté (Resolution 68 dated 25 June 1963; Province Nord 2008; Province Sud 2009). Nonetheless, people continue to hunt Dugongs illegally (Garrigue *et al.* 2009; Institut TNS 2005; Louis-Harris

2005) and poaching activities are occasionally reported from Grande Terre locations (see www.rescue.ird.nc).

Threats

Marsh *et al.* (2011) and Marsh & Sobtzick (2019) concluded that threats to Dugongs differ with location. In New Caledonia, the major threats in order of importance include:

- Hunting: historically legal, currently illegal with exceptions in province Nord (Cleguer 2010; Garrigue *et al.* in press; Garrigue *et al.* 2009; Institut TNS 2005; Louis-Harris 2005; Opération Cétacés and Institut de Recherche pour le Développement n.d.)
- Boat strikes and boating activities (e.g., acoustic pollution) (Bordin 2009; Cleguer 2010; Cleguer *et al.* 2015; ESCAL and A2EP 2011; Opération Cétacés and Institut de Recherche pour le Développement n.d.).
- Incidental capture in fishing gear (e.g., gill nets) (Cleguer *et al.* 2015; Opération Cétacés and Institut de Recherche pour le Développement n.d.);
- Degradation of seagrass habitats (in particular from: urban development, mining and aquaculture; (David *et al.* 2010; Hily *et al.* 2010)).
- Climate change impacts on seagrass communities (extreme weather events, marine heatwaves) (Hily *et al.* 2010; Marsh *et al.* 2022).

Stranding data from 67 events in New Caledonia (Opération Cétacés and Institut de Recherche pour le Développement n.d.) indicated that 24% Dugong deaths were due to illegal hunting, 9% to boat collisions, 3% to fishing nets, 9% to natural causes, and in 46% of the events the causes of death could not be identified.

Despite the ban on hunting, evidence (stranding data, and recent individual reports such as Gallo (2021)) suggests that poaching continues in New Caledonia.

Collisions between Dugongs and vessels also occur (Opération Cétacés and Institut de Recherche pour le Développement n.d.) but are difficult to quantify.

Bycatch is an ongoing issue in New Caledonia, based on reports from local fishermen and traditional owners (Cleguer, pers. comm. 2022). Dugongs are caught in fishnets deployed near the shore and left unattended overnight. However, the number of Dugongs caught and the fate of the captured animals are unknown.

Seagrass are one of the most seriously endangered ecosystems globally (Waycott *et al.* 2009), and their status in the Pacific Islands Countries and Territories, including New Caledonia, is becoming compromised under increasing threats from anthropogenic activities, further exacerbated by pressures related to climate change (Waycott *et al.* 2011). The current state of seagrass in New Caledonia is not currently monitored but McKenzie *et al.* (2021) found no particular trend in their regional analysis (1 site in New Caledonia). In New Caledonia, a workshop led by the French Initiative for Coral Reefs (*IFRECOR*) was held in May 2022 to develop indicators for seagrass monitoring.

The genetically and geographically isolated New Caledonian Dugong population is at great risk in the case of rare but catastrophic events such as a disease, direct and indirect climate change effects including high intensity cyclones, or causes of seagrass die-off such as extreme weather events, disease and harmful algal blooms (Marsh *et al.* 2022).

A project to limit the presence of large sharks in Baie des Citrons using a rigid shark barrier was recently announced by the Nouméa City Council. (Cateau 2022). Although the possible negative impacts of such devices on the Dugong population are poorly known (but see Gribble *et al.* 1998 for baited drumlines and shark nets), it is likely going to affect the resident Dugong population by preventing them to access this area.

With the exception of by-catch in gill-nets and poaching, the anthropogenic threats to Dugongs and their seagrass habitats occur primarily on the west coast of New Caledonia, especially around the capital-city of Nouméa and in the Voh-Kone-Pouembout region (Bordin 2009). A spatial assessment of the risks to Dugongs from anthropogenic activities is lacking.

Conservation Actions

Despite national (Garrigue *et al.*, 2008; Raghunathan *et al.*, 2012; Seddon *et al.*, 2014; Marshall *et al.*, 2018) and international (CITES, 2010; CMS, 2010) legislative protection, Dugong populations have declined or their status is unknown in many parts of the species range (Marsh and Sobotzick, 2019).

In New Caledonia, Dugongs are legally protected at a national level. Dugong hunting is now restricted in New Caledonia by strict legislation rules which prohibit hunting in the province Sud and require special permits in the province Nord and province des Iles Loyauté (Resolution 68 dated 25 June 1963; province Nord 2008, province Sud 2009). The province Sud, the province Nord and the Province des Iles were all granting exemptions to the hunting ban prior to the total ban in the province Sud in 2009. However, the number of exemptions granted was low (15 between 1995 and 2004) and none has been granted since 2004. Nonetheless, people continue to hunt Dugongs illegally in New Caledonia (Garrigue *et al.* 2009; Institut TNS 2005; Louis-Harris 2005) and poaching activities are reported from time to time around Grande Terre.

There are 33 MPAs in New Caledonia: seven in the province Nord and 26 in Province Sud. These areas are divided into five types, all corresponding to different levels of restrictions ranging from highly restricted-no access areas to areas with very few limitations on human activities: Integral reserves (IUCN Ia), wilderness reserves (IUCN Ib), natural reserves (IUCN IV), sustainable management reserves (IUCN VI) and Province parks (IUCN II). Each Province is responsible for managing the MPAs within its administrative boundaries. The extent to which the regulations benefit Dugongs and their seagrass habitats varies among each type of MPA. New Caledonia's MPAs were not originally designed to protect Dugongs and their habitat (Service de l'environnement de la Province Sud, pers. comm.; David *et al.* 2010). Cleguer *et al.* (2015) found the system of MPAs in New Caledonia to be inadequate to protect important Dugong areas: MPAs with restrictions on anthropogenic activities were located outside most higher Dugong density areas. Despite a change in MPA design objectives in the early 2000s to target the protection of biodiversity supported by scientific information, newly

available data on Dugong relative abundance and distribution (Garrigue *et al.* 2008) has not been not used in subsequent MPA design. Some important seagrass habitats fall within those MPAs and best practice is regularly communicated to the community to contribute to their conservation.

The Lagoons of New Caledonia were listed on the World Heritage List in 2008. The World Heritage Statement of Outstanding Universal Value explicitly mention Dugongs: “They [the Lagoons of New Caledonia] provide habitat to a number of emblematic or threatened marine species such as turtles, whales or Dugongs whose population here is the third largest in the world.” (UNESCO 2009). ‘New Caledonian Lagoons and Shelf Waters’ were declared an Important Marine Mammal Areas (IMMA) in 2008 (IUCN-Marine Mammal Protected Areas Task Force 2021). IMMAs are not legal entities. Instead, they highlight important zones (habitats) for marine mammal species that have the potential to be delineated and managed for conservation.

New Caledonia has had a dedicated national action plan for the conservation of Dugongs since 2010. In 2010, a technical group administered by the French Marine Protected Area Agency (now *Office Français de la Biodiversité* or French Office for Biodiversity) and involving the three provincial authorities, the government of New Caledonia, the customary senate, the State, WWF-NC and the association *Opération cétacés*, launched the first five-year Dugong action plan (Plan d’Actions Dugong 2010-2015). The plan focused on undertaking baseline research on several aspects of New Caledonian Dugong ecology (Cleguer 2015) and societal importance (Dupont 2015). Two additional research projects assessed genetic diversity of the subpopulation and connectivity with neighbouring populations (Oremus 2011, 2015). Results from the different studies confirmed the fragility of the New Caledonian Dugong population and highlighted the areas where conservation and management measures must be implemented to improve the protection of the species. The first action plan also focused on raising awareness of Dugongs’ conservation value, and adapting local governance as well as developing international collaborations to mitigate threats to the New Caledonian subpopulation. The second action plan (2016-2021) led by the Conservatory for natural landscapes (CEN, Conservatoire d’Espaces Naturels) aimed to improve governance to tackle major issues such as Dugong poaching and bycatch (Conservatoire d’Espaces Naturels de Nouvelle-Calédonie n.d.). The plan was also dedicated to continue studying Dugong ecology to improve protection actions, evaluate the status of the Dugong population, and monitor the effectiveness of conservation actions. Communication and awareness campaigns were sustained. This plan is yet to be reviewed and a third action plan to be launched for 2022-2027.

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Supplementary material

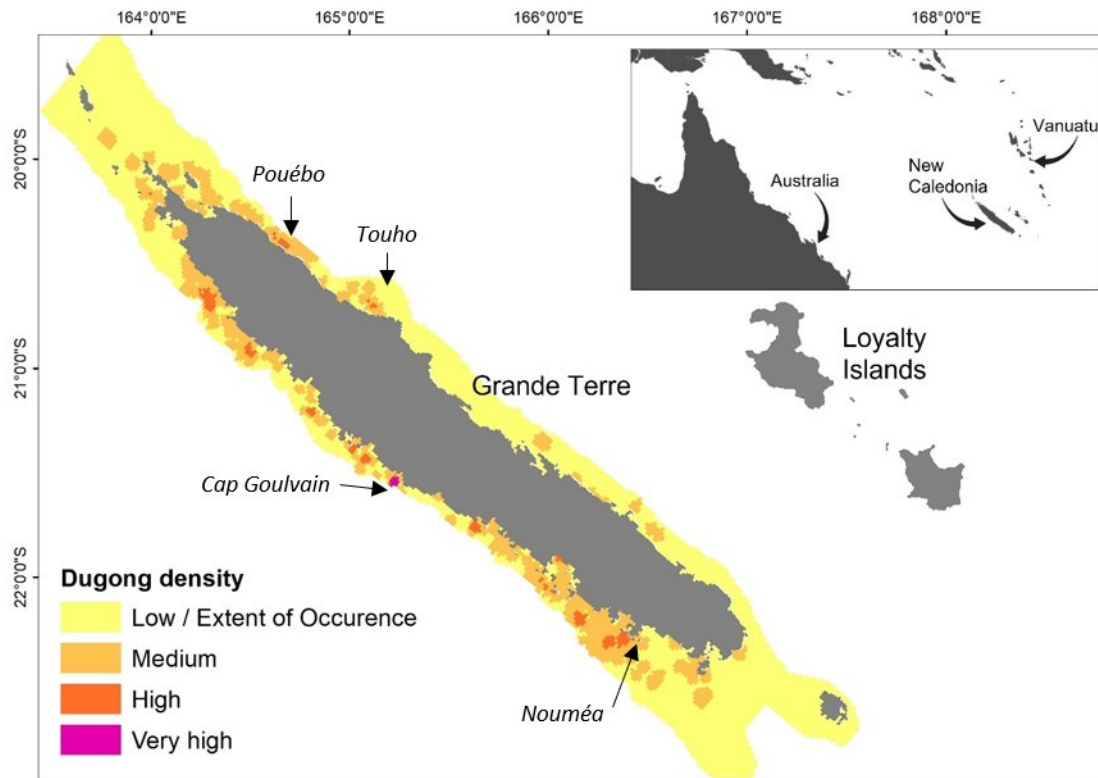


Figure 1. Dugongs distribution and density in New Caledonia based on a 10-year time series of aerial surveys (Cleguer *et al.* 2015).

Table 1. Sensitivity analysis of the total number of mature Dugongs in the New Caledonian Dugong subpopulation. The Minimum Population Estimates (N_{min}) (Wade 1998) were calculated for each Dugong subpopulation abundance estimated from the six aerial surveys conducted between 2003 and 2012 (Hagihara *et al.* 2018). These surveys used comparable standardised methods to record Dugong sightings and estimate Dugong abundance. The total numbers of mature individuals were calculated based on different published methods proposed to estimate the percentage of mature individuals in sirenian populations (Marsh *et al.* 2011).

		Percentage of Mature Individuals			
		0.45 (Deutsch <i>et al.</i> 2008)	0.54 (Marsh 1980)	0.6 (Bertram and Bertram 1973)	0.7 (Deutsch <i>et al.</i> 2008)
Minimum Population Estimate (N_{min})	330	149	178	198	231
	429	193	232	257	300
	633	285	342	380	443
	655	295	353	393	458
	948	426	512	569	663
	1280	576	691	768	896

Appendix

Habitats

Habitat	Season	Suitability	Major Importance?
9. Marine Neritic -> 9.1. Marine Neritic - Pelagic			
9. Marine Neritic -> 9.4. Marine Neritic - Subtidal Sandy	-	Suitable	Yes
9. Marine Neritic -> 9.5. Marine Neritic - Subtidal Sandy-Mud	-	Suitable	Yes
9. Marine Neritic -> 9.6. Marine Neritic - Subtidal Muddy	-	Suitable	Yes
9. Marine Neritic -> 9.8. Marine Neritic – Coral Reef			
9. Marine Neritic -> 9.8. Marine Neritic – Coral Reef -> 9.8.1. Outer Reef Channel	-	Suitable	Yes
9. Marine Neritic -> 9.8. Marine Neritic – Coral Reef -> 9.8.3. Foreslope (Outer Reef Slope)	-	Suitable	Yes
9. Marine Neritic -> 9.8. Marine Neritic – Coral Reef -> 9.8.4. Lagoon	-	Suitable	Yes
9. Marine Neritic -> 9.9. Marine Neritic - Seagrass (Submerged)	-	Suitable	Yes
9. Marine Neritic -> 9.10. Marine Neritic - Estuaries	-	Suitable	Yes
12. Marine Intertidal -> 12.2. Marine Intertidal - Sandy Shoreline and/or Beaches, Sand Bars, Spits, Etc	-	Marginal	-
12. Marine Intertidal -> 12.7. Marine Intertidal - Mangrove Submerged Roots	-	Marginal	-

Threats

Threat	Timing	Scope	Severity	Impact Score
1. Residential & commercial development -> 1.1. Housing & urban areas	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
11. Climate change & severe weather -> 11.4. Storms & flooding	Ongoing	Whole (>90%)	Rapid declines	High impact: 8
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
4. Transportation & service corridors -> 4.3. Shipping lanes	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale) [harvest]	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7

	Stresses:	2. Species Stresses -> 2.1. Species mortality		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.3. Unintentional effects: (subsistence/small scale) [harvest]	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
6. Human intrusions & disturbance -> 6.1. Recreational activities	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	2. Species Stresses -> 2.2. Species disturbance		
8. Invasive & Other Problematic Species, Genes & Diseases -> 8.6 Diseases of Unknown Cause	Unknown	Unknown	Unknown	Unknown
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.4. Type Unknown/Unrecorded	Ongoing	Minority (50%)	Slow, significant declines	Medium impact: 5
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

Conservation Actions in Place
In-Place Land/Water Protection and Management
Conservation sites identified: Yes, over entire range
Occur in at least one PA: Yes
In-Place Species Management
Harvest management plan: Yes
In-Place Education
Subject of any recent education or awareness programmes: Yes
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Conservation Actions Needed

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
2. Land/water management -> 2.1. Site/area management
4. Education & awareness -> 4.1. Formal education
4. Education & awareness -> 4.2. Training
4. Education & awareness -> 4.3. Awareness & communications
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.1. International level

5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.2. National level
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.3. Sub-national level
6. Livelihood, economic & other incentives -> 6.1. Linked enterprises & livelihood alternatives

Research Needed

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.3. Life history & ecology
1. Research -> 1.4. Harvest, Use and Livelihoods
1. Research -> 1.5. Threats
1. Research -> 1.6. Actions
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
2. Conservation Planning -> 2.2. Area-based Management Plan
2. Conservation Planning -> 2.3. Harvest & Trade Management Plan
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.2. Harvest level trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Population
Population severely fragmented: No
Habitats and Ecology
Generation Length (years): 22-25
Movement patterns: Nomadic