



OPTIONS FOR HANDLING A STRANDED ORPHANED DUGONG CALF

ADVICE TO POLICY MAKERS AND MANAGERS

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Options for Handling a Stranded Orphaned Dugong Calf: Advice to Policy Makers and Managers

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Dugong mother with calf © GBRMPA

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1 Executive Summary

Deciding what to do with a stranded dugong calf is particularly challenging for policy makers and managers, as dugongs generally do not do well in captivity and are highly dependent on their mothers. A dugong calf is dependent on its mother for at least the first 18 months of life. Without their mothers most die within a few weeks. Dugongs are also marine mammals that are not well suited to life in an aquarium. A small number of dugongs have been kept in aquariums for prolonged periods but, to date, none have bred in captivity and there are no records of hand-reared dugongs being

successfully released back to the wild. Keeping a dugong in an aquarium presents many challenges, both from the perspective of the animal's welfare and for the facility. This document presents the advantages and disadvantages of five options for handling a dugong calf stranded without its mother: (1) release back into the sea; (2) hand-rear in captivity in the home country; (3) hand-rear in an unrestricted wild setting in the home country; (4) transfer to an aquarium in another country with the capacity for long-term care; or (5) euthanasia. This document provides information to help policy makers and managers make the decision most appropriate to their circumstances.



Dugong (*Dugong dugon*) © Canva.com

2 Introduction

The dugong is one of only four living species of sea cow. Sea cows are in the order Sirenia, which includes three species of manatees in the family *Trichechidae*, as well as the dugong in the family *Dugongidae*. Sirenians are more closely related to elephants and hyraxes than to other marine mammals.

Marine mammals have been held in captivity for public display for centuries. Today, concerns over keeping marine mammals captive largely focus on cetaceans, rather than other marine mammals such as dugongs (Corkeron 2022). Nonetheless, holding dugongs in captivity, for rehabilitation or for public display purposes, presents considerable challenges for both the welfare of the dugong and for the holding facility. Stranded calves separated from their mothers are particularly challenging because they are dependent on their mothers for at least 18 months in the wild (Marsh et al. 2011).

Aside from water quality standards, most experience in hand-rearing and caring for other captive marine mammals - such as dolphins, seals, and sea lions - is not applicable to dugongs. For example, the herbivorous dugong produces much more waste than the carnivorous dolphin or seal, and dugongs have proven to be far more difficult to hand-rear in captivity than their manatee cousins because of their specialized feeding requirements.

The first recorded attempt at keeping a dugong in captivity was in 1955, when a male dugong was transported from Palau, Micronesia, to San Francisco, USA, where it survived for only 45 days. Since the 1960s, dugongs have

been maintained in zoos, aquariums, and other facilities such as fish-traps and sea pens in at least 11 countries in their range: Australia, India, Indonesia, Japan, Malaysia, Myanmar, New Caledonia, Qatar, Singapore, Thailand, and the United Arab Emirates. Most of these attempts have been short-lived; Marsh (1991) reviewed the fate of 30 dugongs held in 13 institutions since the 1950s and found that nine animals died within one month of arrival, and only 11 lived longer than six months.

Several captive dugongs have attracted considerable publicity. In Japan, the dugong is the symbol for the Toba Aquarium. In Australia, a male dugong named Pig, who has been resident since 2008, features prominently in advertising for the Sydney Aquarium. In Thailand, Mariam, an orphaned dugong calf kept in an unrestricted wild setting and artificially fed, received considerable global attention for a few weeks in 2019 before she died (Ponnampalam et al. 2022).

The few records of dugongs being kept in captivity for prolonged periods, include:

- *Serena*, a female held at Toba Aquarium in Japan since 1987. She was estimated to be less than a year old when found as an orphaned calf in the Philippines in October 1986. She was transferred to Toba in April 1987.
- *Gracie*, a female that was held at Underwater World in Singapore from 1998 to 2014. She was rescued as a suckling calf when her mother drowned in a fishing net. She grew slowly and was very small for her age when she died.
- *Pig*, a male held at Sydney Aquarium in Australia since 2008. He was initially hand-reared at SeaWorld

Box 1: The history of Pig

- 1998: Stranded as a 20kg neonate in north Queensland, Australia.
- Moved 2,000km to SeaWorld, Queensland.
- 24-hour care from marine mammal veterinarians for several months.
- After 3.5 years in captivity, released into a naturally enclosed seagrass habitat, isolated from other dugongs, in Moreton Bay, Queensland.
- Recaptured after several months and released into open seagrass habitat supporting approximately 1,000 dugongs in Moreton Bay.
- Found in very poor condition 8 months later (lost 26% of body weight and injured by another dugong).
- Returned to captivity in SeaWorld.
- Health gradually restored after fecal transplants.
- Returned to public display at SeaWorld.
- 2005: Joined by a neonatal female dugong rescued from the wild, named *Wuru*.
- 2008: Both animals transferred to public display at Sydney Aquarium.
- *Pig* separated from *Wuru* due to his violent behaviour towards her.
- 2018: *Wuru* died after digestive problems.
- 2022: *Pig* still on public display at Sydney Aquarium.

in Queensland, after he was rescued from the wild in 1998 (see Box 1).

- *Wuru*, a female held at Sydney Aquarium in Australia from 2008 to 2018. She was initially hand-reared at SeaWorld in Queensland after she was rescued from the wild in 2005. She died in 2018 following digestive problems.

In 1984, Toba Aquarium in Japan initiated a captive breeding programme after a pair of dugongs were observed mating in captivity. Resident dugong *Serena* was introduced into the breeding programme in 1995. However, the programme was unsuccessful and the male dugong died in 2011.

There are no records of hand-reared dugongs surviving for extended periods after release into the wild. This means that holding facilities are generally required to maintain dugongs for many years.

When policy makers and managers confront the difficult decision about what to do with a stranded orphan dugong calf, their final decision should be made on a case-by-case basis and will vary by jurisdiction according to:

- The relevant laws on keeping wild animals in captivity.
- Cultural norms.
- Cost-benefit analysis; resources needed to sustain a single dugong calf in captivity, where the animal is genetically removed and is unlikely to contribute to the population, versus the potential benefits those resources could provide if they were invested into other dugong conservation, management or education initiatives.

The purpose of this document is to help policy makers and managers identify the decision most appropriate to their circumstances by outlining some background information and options.



Dugong calves are highly dependent on their mothers © Mandy Etipson

3 Essential Background

When considering how to handle a stranded orphaned dugong calf, it is essential to note how difficult dugongs are to maintain in captivity and that they require a long-term commitment to their welfare. Providing the environment and diet to maintain appropriate animal welfare levels is challenging and expensive.

Dugongs are long-lived animals. Their maximum lifespan in the wild is more than 70 years (Marsh et al. 2011). Most animals taken into captivity die within weeks, but some may survive for decades.

Even though dugongs in the wild start to eat solid food soon after birth, it is likely that stranded animals less than 1.5m in length will be milk-dependent, and those less than 1.8m in length may still be suckling.

The reasons why dugongs are not ideal aquarium animals include the following:

- They have a high mortality rate in captivity.
- They appear to be particularly susceptible to digestive complications.
- Attempts to breed them in captivity have been unsuccessful, despite prolonged opportunities at Toba Aquarium, Japan.
- Males can display violent behaviour towards females and may need to be separated.
- They may exhibit stunted growth when hand-reared (e.g., Gracie in Singapore). To date, there are no records of hand-reared calves surviving for extended periods after release into the wild (see Box 1).
- They are very expensive to feed (high labour and food costs):
 - » Hand-rearing is a highly labour intensive and prolonged process that should not be undertaken lightly. A captive calf needs to be bottle-fed several times a day for up to nine months before being introduced to solid food. It may also need oral inoculations of faeces from wild dugongs to establish a healthy gastrointestinal microbial community capable of digesting plant food.
 - » Harvesting tropical seagrass, the dugong's natural diet, is expensive and in some countries not permitted.
 - » The high biomass seagrass species that are easiest to harvest tend to be unsuitable food for dugongs as they have difficulty masticating it.
 - » The substitute diet for a captive dugong is cos lettuce. This is very labour-intensive to provide as the individual leaves must be threaded into trays heavy enough to sink to the bottom of the tank.
- The importance of some components of the wild dugong diet is poorly understood:
 - » A substitute diet of cos lettuce may not meet all the nutritional needs of a dugong: in some parts of their range, dugong also eat algae and invertebrates such as thin-shelled burrowing mussels (*Modiolus vagina*), possibly sea pens (*Virgularia* spp.), ascidians (especially *Sycozoa pulchra*) and unidentified chaetopterid worms.



Attempt to hand-rear a dugong calf in captivity © Qatar Ministry of Environment and Climate Change

4 Options for Handling a Stranded Dugong Calf

Five options for handling a stranded orphaned dugong calf are outlined below and summarized in Table 1.

The options considered are: (1) release back into the sea; (2) hand-rear in captivity in the home country; (3) hand-rear in an unrestricted wild setting in the home country; (4) transfer to an aquarium in another country with the capacity for long-term care; and (5) euthanasia.

Option 1: Release back into the sea

An option chosen by some wildlife managers is to return the orphaned calf to a known wild dugong habitat in the hope it will be adopted by a lactating female. There are no data on the outcomes of such initiatives.

Adoptions have never been documented in dugong populations, although female manatees in Florida have been observed nursing adopted calves for prolonged periods at some aggregation sites. Some captive Florida, Antillean and Amazonian manatees have also been reported to nurse calves that are not their direct descendants.

It is believed that dugong calves released into the wild have a very low rate of survival and commonly starve or are attacked by other dugongs, sharks or crocodiles.

If the option of release to the wild is considered, the waters adjacent to where the calf stranded should be checked to see if there are other dugongs present, and if the mother is likely to be in the vicinity. If not, the animal may be transported and released to the nearest known dugong habitat. After release, the surrounding beaches should be monitored in case the animal strands again. The Standard Operation Procedure of the Queensland Parks and Wildlife Service is to release stranded dugong calves in good condition and monitor for re-stranding. Re-stranded or orphaned calves in poor condition are euthanized (See Option 5).

Dugongs should always be transported out to sea or between land locations on a stretcher with thick foam padding (Geraci and Lounsbu, 1993; Dixon et al, in prep). During transport, the dugong should be kept cool (23-28°C), moist, calm, and shaded from the sun. Care should be taken not to overheat or overcool the dugong, and to minimize its exposure to exhaust fumes. Noise and transport time should be limited as much as possible. Sedatives prescribed by a veterinarian may be useful when transporting an anxious dugong.

So that a calf that has been returned to the wild can easily be identified, it is important to tag it using either: (1) a Passive Integrated Transponder tag inserted at a

ninety-degree angle into the musculature of the neck, or (2) a titanium turtle tag in the tail fluke. Fitting a dugong calf with a tailstock mounted VHF or satellite transmitter is not recommended for animal welfare reasons. The transmitter is likely to be too large for the calf to tow safely, and the animal is likely to grow out of the tailstock belt before it detaches.

Option 2: Hand-rear in captivity in your home country

Most attempts to hand-rear dugong calves in captivity have been unsuccessful.

Dugongs learn the skills and knowledge required to survive in the wild from their mothers during the long period of calf dependency. Captive-reared dugongs do not benefit from this experience, and there are no records of any surviving for prolonged periods following release back into the wild. Therefore, the decision to attempt to hand-rear a dugong in captivity generally represents a commitment to look after it for the remainder of its life. It should only be attempted if the following conditions can be met:

- Funds are available to provide 24-hour expert care, including specialist veterinary care, for at least 18 months while the dugong is hand-reared, gradually weaned and taught to eat vegetation (seagrass or substitute).
- Expert care remains available even after the dugong is weaned.
- Suitable holding facilities are available, acknowledging that needs will change as the animal grows. Enclosures can be either natural (fenced area of sea) or artificial (purpose-built on land). Artificial pools have the advantage of being able to maintain water parameters better than natural pools. However, natural pools cost less to construct than artificial pools of similar size.
- An artificial enclosure must have walls that are durable, watertight, non-porous, non-abrasive, non-toxic, and easily cleaned and disinfected (dugongs are very messy eaters and generate a lot of fecal waste).
- The water temperature must be > 20°C.
- The surface area of an artificial enclosure should be large enough to accommodate the natural behaviours of each animal, and deep enough (≥4 m) to allow a dugong to dive and avoid potential effects of ultraviolet radiation.
- The tank should provide a varied environment and opportunities for visual and tactile stimulation, including toys of varying size and texture, moving water and bubbles, swim-throughs, and non-hazardous exhibit furniture. Staff should carry out short training sessions with the dugong.
- Shade and shelter from strong winds or rain should

be provided.

- The dugong should be protected from loud and continuous noise.
- The enclosure should include an area where the dugong can be captured easily, such as a submerged platform that can be raised to lift the dugong out of the water.

Option 3: Hand-rear in an unrestricted wild setting in your home country

This option was trialled with *Mariam*, a dependent dugong calf, found without its mother in April 2019 on the coast of Krabi, Thailand (Ponnampalam et al. 2022). *Mariam* was relocated to a sheltered area around Koh Libong, Trang Province, where she was released in the hope that she would meet and interact with other dugongs. *Mariam* imprinted on the orange kayak used by the attendant marine veterinarians and, although left to roam freely, was bottle-fed by her carers. She was also fed seagrass daily and apparently grew fond of her carers, playfully interacting with them. However, she beached nightly during the lowest tide, suggesting a lack of knowledge of when to swim into deeper waters. *Mariam* died in August 2019 from infections resulting from plastic ingestion, despite considerable efforts to nurture her back to health. This experience illustrates the challenges associated with attempting to hand-rear a dugong, particularly in an open environment.

Option 4: Transfer to an aquarium with the capacity for long-term care

Globally, there are a small number of aquariums that have successfully hand-reared and maintained dugongs for extended periods of time. These institutions may be interested in undertaking the long-term care of an additional dependent dugong, although this option would have to be explored on a case-by-case basis.

The time required to obtain the permits needed for transferring a dugong to another jurisdiction can be

lengthy and prohibitive. If this option is considered, the dugong would require expert care for several weeks prior to transport.

Dugongs are listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which has developed guidelines for transporting marine mammals: <https://cites.org/eng/resources/transport/mm4.shtml>.

These guidelines advise that:

- Only dugongs in good health should be transported: a veterinary assessment including serology for transmissible diseases is required, which can be expensive.
- Infant dugongs incapable of feeding themselves should not be transported if the travel time will take longer than the infant's normal feeding cycle, unless arrangements have been made to feed it during transit.
- Since dugongs require constant attention, it is essential that at least one trained attendant accompanies them during transport.

Option 5: Euthanasia

A pragmatic option may be to euthanize the calf either by using ballistics or by chemical euthanasia administered by a veterinarian. This approach is culturally unacceptable in many dugong range states but may be the most humane option from an animal welfare perspective and has been applied in Australia.

Euthanasia is the standard technique for maternally dependent cetacean calves (Boys et al. 2022) and provides a posthumous opportunity to learn more about the animal and any underlying conditions that may have caused it to require rehabilitation in the first place.

Table 1. The advantages and disadvantages of each option

#	Option	Advantages	Disadvantages
1	Release back into the sea in a known dugong area	Expedient	Fate of animal will likely be unknown; death from starvation or predator is likely
2	Hand-rear in captivity in your home country	Available for public education	Likely requires life-long commitment to expensive care; animal welfare challenges; high risk of mortality
3	Hand-rear in an unrestricted wild setting in your home country	No need for expensive facility; potential for dugong to contribute to wild gene pool if it survives to maturity	Exposed to local threats; likelihood of escape and/or survival uncertain; costs of hand-rearing are substantial
4	Transfer to an aquarium with the capacity for long-term care	Higher likelihood of long-term survival than Options 2 or 3	Transfer bureaucracy and costs may be prohibitive; costs of hand-rearing are substantial; dugong will not contribute to wild gene pool
5	Euthanasia	Rapid; opportunity for post humous learning	Unacceptable in some countries; no opportunity for public education; dugong will not contribute to wild gene pool



Rescued orphaned dugong calves © Qatar Ministry of Environment and Climate Change

6 Further Reading

Bachman KC, Irvine AB (1979) Composition of milk from the Florida manatee, *Trichechus manatus latirostris*. Comparative Biochemistry and Physiology Part A: Physiology 62:873-878

Blanshard W (2000) Current achievements and future challenges in dugong rehabilitation. In Achievements and Challenges. Australasian Regional Association of Zoological Parks and Aquaria & Australasian Society of Zoo Keeping 2000 Conference Proceedings, Sea World, Gold Coast.

Boy, R M, Beausoleil NJ, Betty EL, et al 2022 When and how to say goodbye: An analysis of Standard Operating Procedures that guide end-of-life decision-making for stranded cetaceans in Australasia. Marine Policy, 138: 104949. <https://doi.org/10.1016/j.marpol.2021.104949>.

Corkeron P 2020. Marine mammal captivity, an evolving issue. Chapter 7 in Marine Mammals: The Evolving Human Factor (G Notarbartolo di Sciara, B Würsig Eds). Springer, Berlin.

Dixon K, Blyde D, Marsh H et al (in prep) Dugongs, in S Jackson ed. Australian Mammals: Biology and Captive

Management. CSIRO Publishing, Melbourne. Second Edition.

Geraci JR, Lounsbury VJ (1993). Marine Mammals Ashore: a field guide for strandings. pp 145–158 Texas A&M Sea Grant Publications, Galveston Texas USA.

Marsh H (1991) Our tropical siren. Australian Geographic 21: 42-57.

Marsh H (2022) Ethology and Behavioural Ecology of Sirenia, Springer, Berlin

Marsh H, O'Shea TJ, Reynolds JE (2011) Ecology and Conservation of Sirenia: Dugongs and Manatees. Cambridge University Press.

Ponnampalam. LS, Keith-Diagne LW, Marmontel M et al (2022) Historical and current interactions with humans. Chapter 7 in Ethology and Behavioral Ecology of Sirenians. (Ed H Marsh). Springer, Berlin.

von Fersen L, Walb R (eds.) (2018) EAZA Best Practice Guidelines: Antillean Manatee (*Trichechus manatus manatus*). European Association of Zoos and Aquaria. Tiergarten Nürnberg, Germany.



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