ANNEXURE B2 : MARINE MAMMALS STUDY

Proposed Granger Bay Land Reclamation and Revetment Construction
Marine Mammal Specialist Report

Report prepared for:
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EXECUTIVE SUMMARY

This report comprises the Marine Mammal Specialist Report for the proposed Granger Bay revetment upgrade and should be read in conjunction with the Marine Impact Assessment Report (Wright A et al 2025) available from Anchor Environmental Consultants, Infinity Environmental (Pty) Ltd, and the V and A Waterfront Holdings (Pty) Ltd (V&AW). Not that this is a desktop only study to update an original report completed in 2014 (Elwen 2014).

The proposed development, which includes construction of two new breakwaters into Granger Bay and a mix of open space, residential and retail uses within the precinct.

Contents

EXECUTIVE SUMMARY 2
Specialist Expertise and Declaration of Independence 4
Project Background 5
Approach to Study 6
Assumptions and Limitations 6
Description of Affected Environment 6
The Granger Bay Environment 6
Marine Mammals of Granger and Table Bay 7
Odontocetes (Dolphins and toothed whales) 10
Economic importance of cetaceans in Table Bay 15
Impact Identification and Assessment 16
Conclusions and Recommendations 21
References 22

Specialist Expertise and Declaration of Independence

Sea Search Research and Conservation NPC ("Sea Search") is a Cape Town based non-profit company that specialises in marine mammal and acoustic research and the provision of specialist input to environmental and conservation management plans. Sea Search is led by Dr Simon Elwen and Dr Tess Gridley who have over 20 and 18 years of experience working with cetaceans and other marine species respectively. Our work has taken place in multiple countries and study sites both globally and in Africa and covered a wide range of research, conservation and impact assessment scenarios. Drs Elwen and Gridley conduct scientific research that is relevant to and informs meaningful conservation actions with over 70 and 50 peer reviewed publications respectively.

We engage at a variety of levels from on-the-ground training (e.g. marine tourism operators), through the provision of specialist advice for environmental impact assessments which can directly mitigate harmful activities and at higher policy levels. Elwen and Gridley are both invited members of the IUCN Species Survival Commission, Cetacean Specialist Group and the South African Marine Mammal Top Predator Working Group. Elwen has been a member of the International Whaling Commission Scientific Committee since 2017 and Gridley is the African representative for the Ocean Sound Essential Ocean Variable subcommittee of the Global Ocean Observing System

Project Background

The V&A Waterfront Holdings co are seeking to expand their holdings through a proposed new development scheme for the Granger Bay Precinct which includes three main components:

1. Replacement of coastal defence structures: associated revetment, breakwaters, and Land Reclamation.
2. Mixed-use development packages.
3. Adjacent mixed-use (primarily residential with some retail and commercial use) development.

Of relevance to this report is component 1 which incorporates land reclamation and construction into the ocean spaces of Granger Bay. For the remainder of this report, we will thus only focus on this component of the broader project.

Note that impacts are to be evaluated against a 'no-go' alternative in which the proposed development would not be implemented (see Rose et al. 2025).

The maps below (Figure 1) provide a broad idea of the planned expansion into the ocean space. The Environmental Impact Assessment documentation and Marine Ecology Assessment (Wright et al. 2025) documents provide full details of the project.

Figure 1. The planned expansion into the ocean space.

Approach to Study

This report constitutes a ‘desktop only study’ in that no new field data were collected. Information used in this study on marine mammal presence, behaviour and response to human activities arise from the scientific literature, academic theses, ‘grey literature’ (non-peer reviewed reports and impact assessments) and the specialists own data collected in this region including both boat-based surveys and passive acoustic monitoring data.

Assumptions and Limitations

Available published data on marine mammal presence is mostly limited to the period 199-2012 but some newer unpublished data are available through the authors own surveys. Marine mammal presence and the marine environment in general have shown significant changes over the last 2 decades and these are likely to continue into the future, so information and impacts must be assessed with dynamic nature of the environment in mind and seek to minimise impacts at all levels and not assume ‘no whale presence’ based on outdated information.

As the construction project has not started, there are no direct measures of the sounds produced during the construction or operational phases. Therefore, any values used are based on best estimates from the literature and relevant reports.

All data on the hearing thresholds of animals and how they will be affected and respond is based on literature and general assumptions of likely behaviour in relatively broad categories of animal group by ‘hearing frequency range’. It is widely acknowledged that there are considerable species, population, and even individual differences in how animals respond to perceived threats, and that even within individual animals, responses will vary with behavioural and physiological state (Southall et al. 2019; 2023). For example a female whale may respond very differently to a perceived threat if travelling by day in calm conditions in a group, or resting in shallow waters with a newborn calf.

For these reasons and others - it is important to recognise that the calculated areas of impact, the likely responses of animals and the mitigation options put forward here should be considered guidelines and not definitive answers and that wherever possible all actions should be taken to reduce noise, pollution and impact on marine wildlife and the marine environment in general.

Description of Affected Environment

The Granger Bay Environment

Granger Bay forms a small part of the larger Table Bay. It lies immediately to the west of the port of Cape Town commercial harbour and to the east of the Table Mountain Marine Protected Area. A broader description of the oceanography and physical characteristics are available in the Marine Impact Assessment report (Wright et al. 2025). The area is already highly impacted by human activities due to the proximity to the Port of Cape Town, Oceana Power Boat Club slipway for small power vessels and the Waterclub/Granger Bay marina for medium sized private vessels. In fact, a largely artificial ecosystem in that it is already a ‘reclaimed’ shoreline. Notwithstanding this - the area is very rich in marine wildlife, especially coastal dolphins and most notably the Heaviside’s dolphin,

which is iconic to the Granger Bay area and the focal subject of many marine-based tours and private sea trips, especially from the kayak clubs in the area.

Three species of whale and three species of dolphin are known to occur in Table Bay at various times of the year, all of which may come within a few km of, or into Granger Bay. In Table Bay and the rest of the west coast, the large baleen whales are typically more prevalent in spring and summer months, in contrast to the standard paradigm of winter presence that is typically of the 'south coast' of South Africa (i.e, east of Cape Point, especially areas like Hermanus and De Hoop). In addition, the area of Table Bay lies close to a major biogeographic boundary and significant changes in the presence, abundance and seasonality of several species have been observed over the last two decades, associated with both anthropogenic impacts e.g. collapse of the small pelagic fishery, e.g.(Watermeyer et al., 2016)) and broader environmental changes (Blamey et al., 2015; Moloney et al., 2013). Species specific details are provided below:

Marine Mammals of Granger and Table Bay

Humpback whales (*Megaptera novaeangliae australis*)

Encounter frequency in Table Bay: Year-round at some level, with feeding peaks and likely daily presence during Nov-Feb

The humpback whale is the most common baleen whale around the coast of South Africa. The South African west coast is along the migration route of humpback whales moving between Antarctic feeding grounds and breeding grounds in the tropical waters off West Africa (Elwen et al., 2014). The population or stock to which these animals belong is well recovered from the depredations of commercial whaling in the 20th century and was last estimated to number in excess of 9000 individuals (IWC, 2011). Given a population increase in the 8 -10% per annum range (Zerbini et al., 2010) it is likely at least double that in 2025. The Benguela Ecosystem along the west coast of Southern Africa is very rich in nutrients and acts as an important feeding ground for several whale species, most notably the humpback which feed in large tight aggregations called 'super-groups' which can consist of hundreds of individuals. Although historically there was clear seasonality in whale presence around our coast, due to the increase in populations, some humpback whales may be encountered in any month of the year although numbers still peak seasonally from late winter (August) through to late summer (February) with feeding mostly seen Nov-Feb (Barendse et al., 2011; Seyboth et al., 2025.). While solitary or small groups of humpback whales may be undertaking normal migration movements and largely passing through the area, feeding whales hang around for days, weeks and even months. While the supergroups themselves are relatively short lived, typically lasting hours to less than a day - the sheer number of animals involved and their active behaviour makes them especially vulnerable to human impacts like entanglement and ship strike.

The majority of humpback whales passing through the Benguela are migrating to breeding grounds off tropical west Africa (Rosenbaum *et al.* 2009; Barendse *et al.* 2010), but recent photographic matches of individuals using the west coast feeding ground that it may act as a feeding ground for many animals from the East African population too, highlighting the regional importance of this globally unique feeding ground .

Figure 2. A feeding humpback whale dives for more food. Part of a supergroup of whales feeding off the Cape Peninsula. These groups are common in the area in Nov-Feb each year. Photo: Simon Elwen, Sea Search.

Southern right whales (*Eubalaena australis*)

Encounter frequency in Table Bay: Year-round with peaks in Jul-Sep (breeding) and Feb-April (feeding)

The southern African population of southern right whales historically extended from southern Mozambique (Maputo Bay) to southern Angola (Baie dos Tigres) and is considered to be a single population within this range (Roux *et al.* 2011). The most recent abundance estimate for this population is available for 2017 which estimated the population at ~6 100 individuals including all age and sex classes, and still growing at ~6.5% per annum(Brandão et al., 2018; Charlton et al., 2021). When the population numbers crashed in 1920, the range contracted down to just the south coast of South Africa, but as the population recovers, it is repopulating its historic grounds including Namibia (De Rock et al., 2019; Roux et al., 2015) and Mozambique (Banks 2011)..

During winter months, southern right whales are inhabit the south coast breeding and calving grounds of south Africa, notably Walker Bay (Hermanus), Struis Bay and De Hoop but as far east as Algoa Bay (Port Elizabeth) where calves are born and nursed and mating was historically prevalent (Elwen and Best, 2004a, 2004b). During the summer months the whales are largely seen on the west coast feeding ground in the Southern Benguela, especially between Table Bay and St Helena Bay, with numbers peaking usually later than the humpback whale peak, from February to April. Some animals seem to move there directly along the coast while others may undergo a partial migration and return (Mate *et al.* 2011, MRI Whale Unit satellite tag data, 2020-2022).

The South African right whale population has undergone substantial changes in the demography, and numbers of animals using our coast since ~ 2015. Notably there has been a significant decrease in the numbers of non-mothers at the coast during winter months, and variable presence of mother-calf pairs in any year (Roux et al., 2015; Vermeulen et al., 2020). Recent sightings (2018-2021) confirm that there is still a clear peak in numbers on the west coast (Table Bay to St Helena Bay) in Feb-Apr, mostly of adult and juvenile animals, with few calves (Sea Search unpublished data). Given this high

proportion of the population known to feed in the southern Benguela, and current numbers reported, it is highly likely that several hundreds of right whales can be expected to pass through Table Bay and the west coast feeding area during summer months.

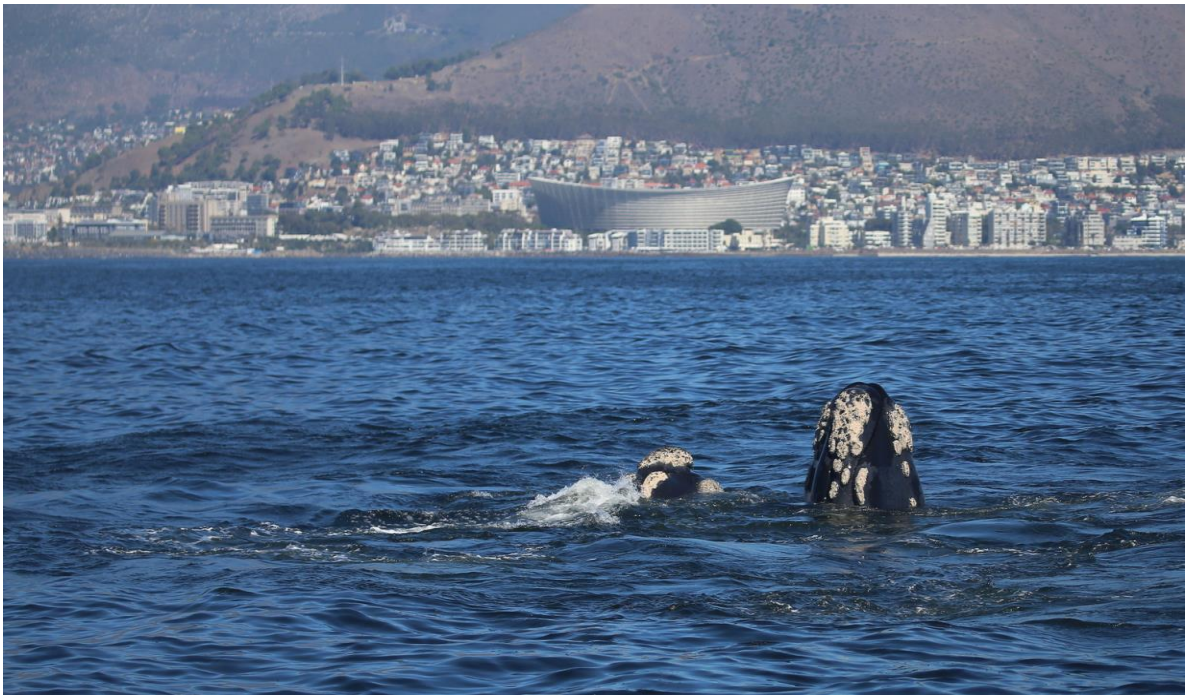

Figure 3. A group of socialising/mating southern right whales directly off Granger Bay, 2021. Feeding and mating right whales are common in the area in Feb- Apr each year. Photo: A Immerz, Sea Search.

Bryde's whale (*Balaenoptera edeni brydei*)

Encounter frequency in Table Bay: Monthly, peak in winter-spring, mainly Aug-Oct

Two genetically and morphologically distinct populations of Bryde's whales live off the coast of southern Africa (Best, 2001; Penry, 2010). The species was first described at the Donkergat whaling station in Saldanha Bay and named after Johan Bryde, a key figure in the local whaling industry at the start of the 20th century. The "offshore population" lives beyond the shelf (>200 m depth) off west Africa and migrates between wintering grounds off equatorial west Africa (Gabon) and summering grounds off western South Africa and is thus not likely to be encountered in coastal waters(Best 2001). There are no current data on population size or stock recovery therefrom and is currently listed as "Data deficient" on the South African Red List

The "inshore population" of Bryde's whale, live mainly on the continental shelf and Agulhas Bank, and are unique amongst baleen whales in the region by being non-migratory. This 'stock' is now recognised as its own sub-species *B. edeni brydei* (Penry et al., 2018) and is the most vulnerable baleen whale in southern Africa. The species is particularly vulnerable to entanglement as it is smaller and weaker than southern right and humpback whales so is more likely to drown (Segre et al., 2022). The published range of the population is the continental shelf and Agulhas Bank of South Africa ranging from Durban in the east to at least St Helena Bay off the west coast, with possible movements further north up the West Coast and even into Namibia during the winter months (Best, 2007). Surveys in the last ~20 years in the Saldanha / St Helena Bay area have not encountered Bryde's

whales very often (only a few times a year typically) suggesting that this area is near the end of the species range. However, in the last ~10-15 years, sightings in Table Bay (just ~100km south) occur regularly in the summer months (along with common dolphins) which did not occur prior to this (e.g. during a bout of surveys during the early 2000s (Elwen PhD). These changes have taken place since the collapse/shift in the sardine stock and show that there is a real but changing biogeographic boundary south of Saldanha Bay and future changes may yet occur.

The inshore stock is regarded as extremely vulnerable and listed as such on the SA red list as it regularly suffers losses from entanglement in trap fisheries and has been subject to significant changes in in its prey base due to losses and shifts in the sardine and small pelagic stocks around South Africa.

Figure 4. Bryde's whales are most common in Table Bay during Aug-Oct each year. They are usually solitary. Photo: E Vermeulen, Sea Search.

Odontocetes (Dolphins and toothed whales)

Killer whales (*Orcinus orca*)

Encounter frequency in Table Bay: < 5 times per year

Killer whales (Figure 28) have a circum-global distribution being found in all oceans from the equator to the ice edge (Best 2007). Killer whales occur year-round in low densities off South Africa (Best *et al.* 2010, Elwen et al. in prep). They are the largest member of the dolphin family and a supreme top predator in the oceans, where they can play an important role in ecosystems. Although no population estimate is available, a growing catalogue of photographically identified individuals ID suggests there are a few hundred animals in SA at most.

Killer whales in South Africa engage in a number of dietary specialisations which affect their general movements and behaviour. Some animals are associated with long-line fisheries which mainly are active along the continental shelf edge including off Cape Point,the majority of killer whales target

dolphins and increasingly whales and sightings have increased during periods of peak cetacean activities such as the sardine run and more recently the feeding aggregations of large whales on the west coast, where 3 to 5 sightings a season have been recorded in the last few years. A third specialisation is limited to 2 individuals which are focused on eating medium and large sharks, mainly in very shallow waters, often < 30m depth. These two (known locally as "Port" and "Starboard") have been seen in the shallow waters of Granger Bay on a number of occasions in the last 3 years and are thus the most vulnerable killer whales in South Africa to any coastal construction activities, although their visits are typically short lived as the animals pass through the area.

Figure 5. Killer whales are usually only encountered a few times per year. There are increasing sightings associated with the 'humpback whale super-group' season ~Nov-Feb. Photo: E Badosa, Sea Search.

Common dolphins (*Delphinus delphis*)

Encounter frequency in Table Bay: Monthly, summer peak

Two forms of common dolphins occur around southern Africa, a long-beaked and short-beaked form (Findlay *et al.* 1992; Best 2007), although they are currently considered part of a single global species (Cunha et al. 2015). The long-beaked common dolphin (formerly *D. capensis*) ranges widely across the temperate shelf waters of South Africa especially east of Cape Point and across the Agulhas Bank. out to waters 500 to 1000 m deep (Best 2007). Although historically reported as far up the west coast as St Helena Bay, sightings west of Cape Point were rare. Similar to Bryde's whales, sightings in Table Bay have increased over the last ~20 years following the shift in the sardine stocks away from in the southern Benguela. Interestly, sightings north of ~Robben Island remain scarce.

Group sizes of common dolphins can be large, averaging 267 (± *SD* 287) for the South Africa region (Findlay *et al.* 1992) but numbering into the 1000s. The species is specialises in eating small pelagic fish like sardine and anchovy (Best 2007) and their movements around the coast tend to mirror those of their prey. Due to their large group sizes, high apparent population size and wide range they are considered least Concern on the SA Red List.

Figure 6. A large group of common dolphins passing through Granger Bay in 2021. These groups are common in the area during summer months. Photo: A Immerz, Sea Search.

African dusky dolphins (*Lagenorhynchus obscurus obscurus*)

Encounter frequency in Table Bay: Daily

Dusky dolphins are resident year-round throughout the Benguela ecosystem in waters from the coast to at least 500 m deep (Findlay *et al.*, 1992) and from False Bay to southern Angola (Best, 2007). They are very rarely seen east of Cape Point with only a few sightings into False Bay in any year. A possible hiatus in the population distribution occurs in the region of the Orange River suggests that populations in the Northern and Southern Benguela may be separate (Best and Meÿer 2010), although this has not been confirmed genetically. No information is available on the total size of the population, however, up to 0.9 groups/km were recorded during nearshore small boat surveys in the southern 400 km of the species range in South Africa from Table bay northwards (Elwen et al. 2010). In Southern Namibia dusky dolphins were the most abundant species encountered during line transect surveys in the 400 km long x 30 km wide Namibian Islands Marine Protected Area with a density of 0.16 km^2 and a total abundance estimate 3493 individuals (CV = 26.2%, 95% CI: 2015–6052) in the MPA. It is estimated that the total number of mature animals in the African subspecies exceeds 10,000 (Elwen et al. 2016).

The species does not typically come as close to shore as the Heaviside's dolphin (see below), so although the species likely occurs on a daily basis in the broader Table Bay, encounters close to shore such as in Granger Bay proper are more rare. Results from passive acoustic monitoring of dolphins in Granger Bay in 2010-2012 (Combes MSc thesis 2017) using "CPOD" click detecting hydrophones, revealed regular presence of dusky dolphins during the entire study period with dolphins detected more frequently at night than in the day.

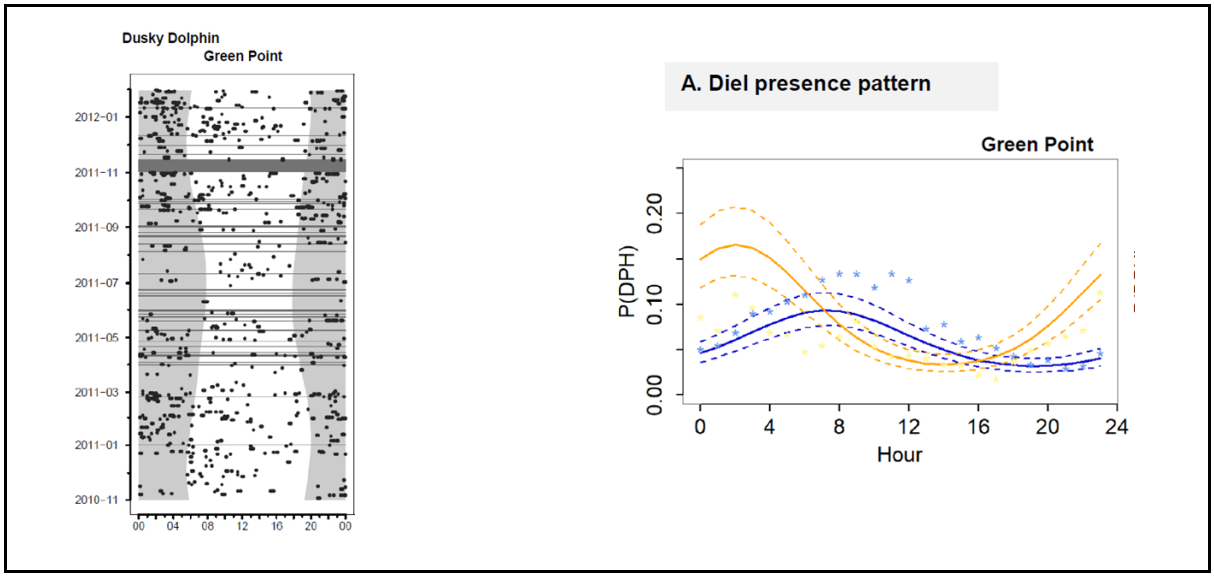

Figure 7. Figures from Combes 2017 MSc thesis investigating dolphin presence in Granger using Passive Acoustic Monitoring. Figure on left shows hourly detections (x-axis, dots) over all days of the field work (y axis). Horizontal stripes indicate now data days. Curved shaded grey areas indicate nighttime. Figure at right side shows modelled diurnal presence (hourly) over the entire study period. Dusky dolphins in Orange, Heaviside's dolphin in blue (see also below).

Heaviside's dolphin (*Cephalorhynchus heavisidii*)

Encounter Frequency in Table Bay: Daily

Heaviside's dolphins are endemic to the Benguela ecosystem ranging between the coast and 200m depth, from Cape Point in the south to approximately Baie dos Tigres in southern Angola (Abernethy and Elwen 2024). Granger Bay is effectively the southernmost limit of regular sightings of the species, and they are seen here on a daily basis, often extremely close to shore along the existing revetments and dollose (*Figure 8*). The species is unusual amongst the coastal dolphins in South Africa in that it mainly forages far offshore, on hake and other species associated with the deep scattering layer (mainly at night) but spends daylight hours resting and socialising close to shore (Elwen et al. 2006, 2010) - this results in a strong diurnal pattern to their inshore presence (highest during the early morning to about noon). Despite their wide habitat range, they show strong site fidelity to relatively small areas of coastline ~50-80 km along shore and it is thus likely that the dolphins using Granger Bay can be considered to be a resident population. The area of highest density is between the harbour wall and the Greenpoint lighthouse (Behrmann MSc thesis, 2012) (Figure 9). Passive Acoustic Monitoring work in Granger Bay (Combes 2017, MSc thesis) has shown that dolphins change their behaviour during periods of high boat traffic (as detected by the presence of depth sounder sonars), with an overall negative relationship between the presence of boat sonars and detections of dolphins, but that their response varies depending on their behavioural state and time of day. Dolphins showed a negative response to boats during the night (fewer socialising 'buzzes' and shifted their daytime socialising to earlier in the morning on days with high boat traffic (see Figure 10 below).

Another unusual feature of this species is that they are the only South African dolphin to communicate only using 'narrow-band high frequency' (NBHF) echolocation clicks where most acoustic energy is > 100 kHz (Martin et al. 2018). Their hearing is thus thought to also be similar

biased towards higher frequency sounds although it has not been directly measured. This may impact their susceptibility to the low frequency sounds typical of construction.

The last available estimate of population size was from a three-year study in the early 2000s between Cape Town and Lambert's Bay, South Africa estimated 527 animals (95% confidence interval (CI) 272–1,020) using 20 km of coastline in western Saint Helena Bay over six weeks of survey effort; 3,429 animals (95% CI 1,721–6,828), using the 150 km of coastline around Saint Helena Bay, over three summer seasons; and 6,345 animals (95% CI 3,573–11,267) using the full ~390 km of coastline from Table Bay to Lambert's Bay (estimated between two summer field seasons; Elwen et al. 2009b).

Figure 8. Heaviside's dolphins can be found in a small area between the harbour wall in Granger Bay as far as the Three Anchor Lighthouse on a daily basis. They are typically resting and socialising in the area. Photo: Jack Fearey, Sea Search

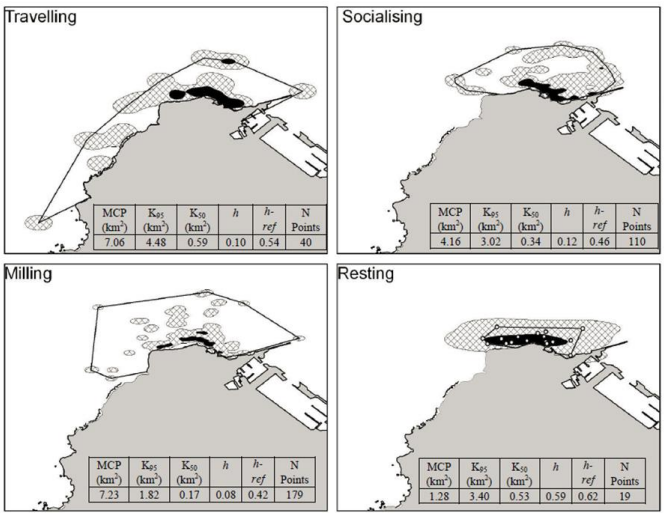

Figure 9. Maps from Behrmann Msc thesis (2012) showing density of Heaviside's dolphins in and around Granger Bay based on three years of boat-based sightings. Maps split to show areas of different behaviours

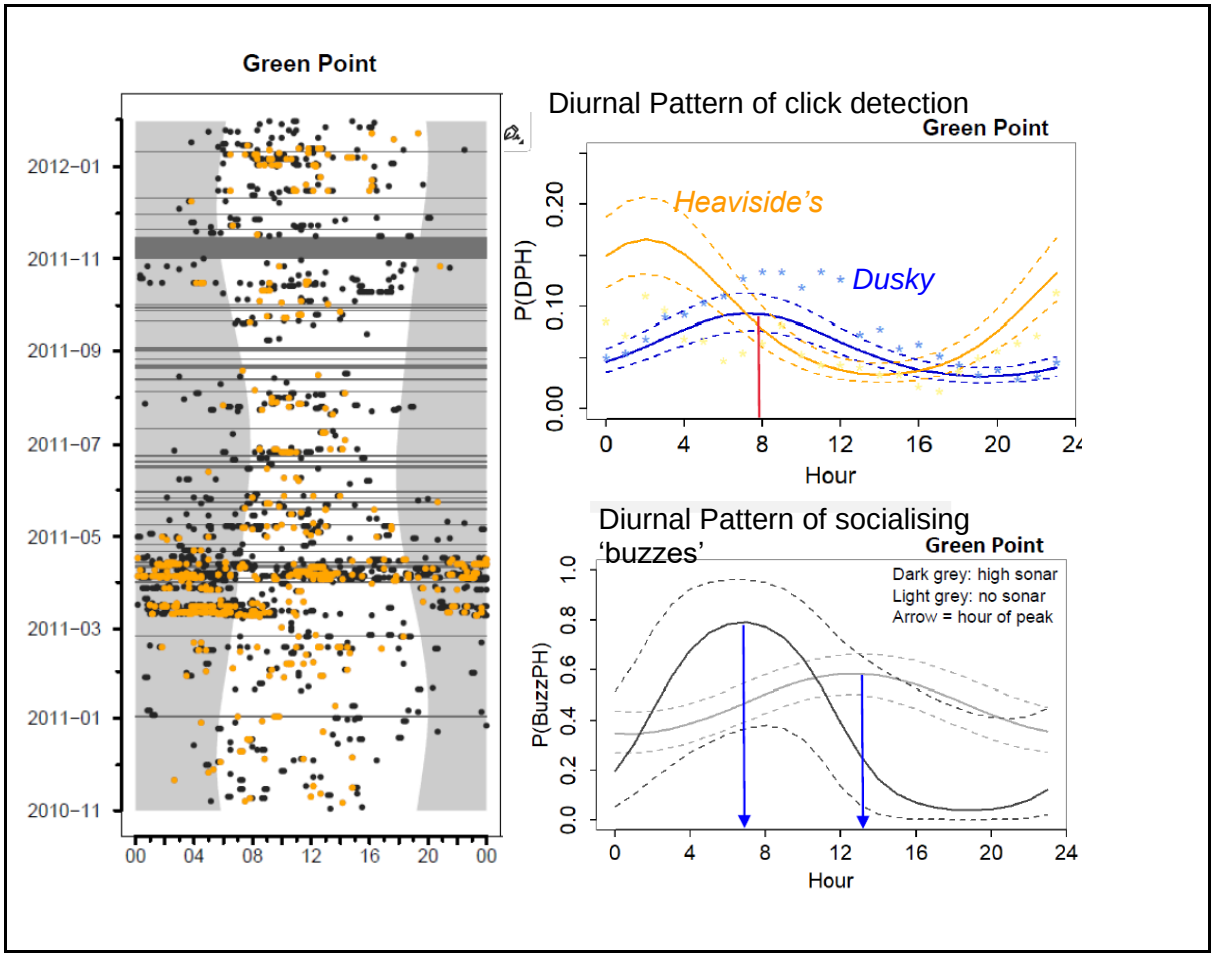

Figure 10. Figures from Combes 2017 MSc thesis investigating dolphin presence in Granger using Passive Acoustic Monitoring. Figure on left shows hourly detections of Heaviside's dolphins (x-axis, dots) over all days of the field work (y axis). Horizontal stripes indicate now data days. Curved shaded grey areas indicate nighttime. Figure at right side shows modelled diurnal presence (hourly) over the entire study period. Heaviside's dolphin in blue, dusky dolphins in orange (see same plot above in dusky dolphin section).

Economic importance of cetaceans in Table Bay

While not formally evaluated here, the marine wildlife and Heaviside's dolphins in particularly play a central role in the attractiveness of the Granger Bay area to boaters and kayakers. Those operators running commercial kayak/SUP tours are not doing it as an official whale watching business and thus may legally not advertise approaches to whales or dolphins. However, it is clear from company branding, websites and social media sites that the presence of marine wildlife, especially dolphins is fairly central to their marketing.

The economic impact on these companies if the construction activities result in a medium - long term avoidance of the area, must be considered.

E.g.:
https://www.kayakadventures.capetown/
https://kayak.co.za/
https://www.atlanticoutlook.com/
https://kaskazi.co.za/

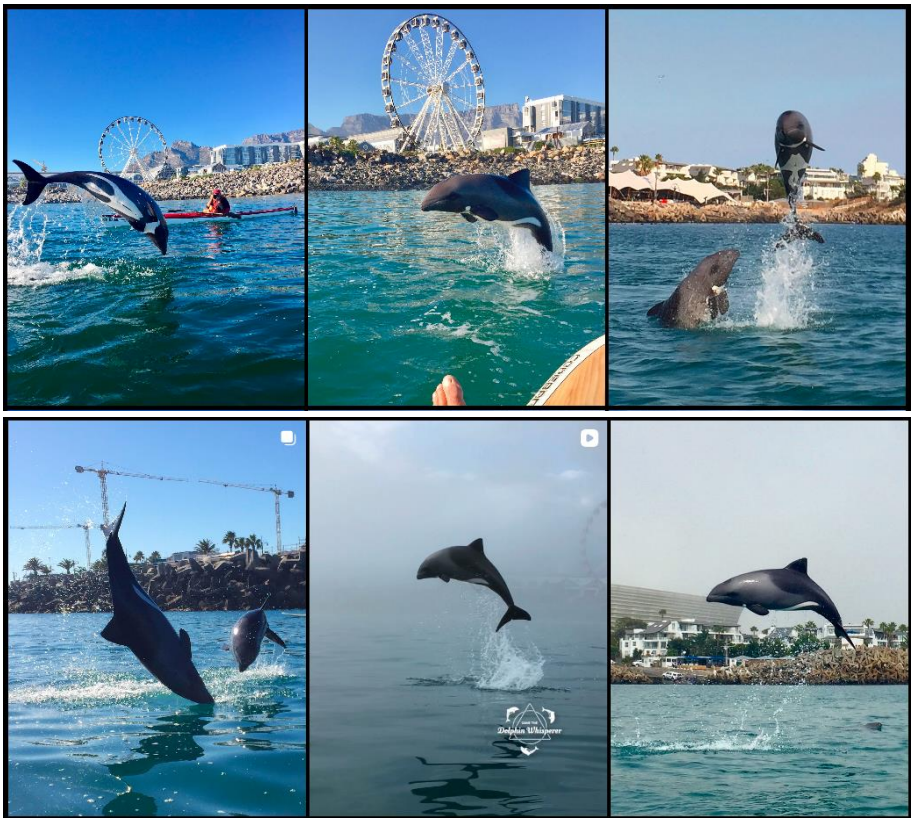

Figure 11. From: https://www.instagram.com/dave_thedolphinwhisperer/

Impact Identification and Assessment

The following aspects of the marine component of the Granger Bay precinct have been identified as potentially having impacts on marine mammals:

1. **Increased vessel presenc**e: Noise from vessels (engine and depth sounders), physical presence of vessels, potential ship strikes.

2. **Construction noises:** including noises of machinery (engines, excavators striking rock near shore), in water-noises from moving and dumping rocks/dollose.

3. **Turbidity and pollution** associated with rock dumping and construction (short lived).

4. **Habitat loss** from ‘reclamation’ of land into the marine environment.

The details and potential impacts thereof are discussed below.

1. **INCREASED VESSEL PRESENCE**: The construction plans available make little mention of vessels and the majority of the planned construction approach will be land based through the use of excavators or similar incrementally moving rock/dollose/fill into the ocean space. It is likely that small vessels will be used at some level for observation and survey work.

Nature of Impact: Cetaceans are highly acoustically orientated and reliant on sound channels for feeding, social communication and orientation within their environment, and are thus particularly vulnerable to the impacts of human generated sounds (Tyack and Clark, 2000). The observed effects of noise on cetaceans include changes in vocalization, respiration rate, swim speed, migration routes, diving and foraging behaviour, physical and auditory damage (either temporary or permanent) and in extreme cases, death and/or strandings (Weilgart, 2007). In the long term, exposure to low-frequency noise may be a chronic cause of stress (Rolland *et al.*, 2012). Chronic stress from man-made noise can be detrimental to marine mammal health and reproductive success. The Granger Bay area is already highly industrialized/impacted by human activity already lying between three harbours/slip ways. There is already a significant level of boat traffic in the area ranging from paddle craft to jet skis, small power boats with outboard motors, medium sized power craft with inboard diesels, and sailing vessels, while larger commercial craft further from shore (typically leaving the port of Cape Town in the northerly direction). Most of the smaller craft leaving the Oceana Power Boat Club in Granger Bay are recreational and thus numbers vary considerably with day of the week and weather conditions.

Likely response: Given the high level and diversity of existing vessel traffic in Granger and Table Bays, the addition of a few extra small vessels to this milieu is unlikely to have any significant impact on the resident dolphins or other species of cetaceans. If a large vessel or barge is installed (e.g. for a crane, dredging, etc) it is more likely to impact animals due to the larger physical presence, and potentially louder and more consistent sound levels.

Direct Impacts on marine mammals from vessels include measurable changes in vocalization, respiration rate, swim speed and route, diving and foraging behaviours and physical and auditory damage from either ship strikes or loud noises (either temporary or permanent) in extreme cases, death and/or strandings.

Cumulative impacts: The impact of new vessels acts on top of the existing and other threats in the area and will result in an increased probability of ship strike type injuries and may result in temporary or permanent abandonment of the area by dolphins (notably the Heaviside's dolphins) and general avoidance of the area by other species.

Mitigation actions: Any vessels used for this project should be driven in a slow and responsible manner, keep gear changes and acceleration to a minimum to minimise rapid changes in noise levels, and a lookout must be kept for dolphins and whales at all times and groups should be avoided where possible. If any impacts are observed (vessel strike, entanglement, strong avoidance responses) these should be report to the relevant environmental authority as soon as possible (e.g. DFFE).

2. **CONSTRUCTION NOISES:** Noise transmits from the air and from land into the water where it may impact marine mammals. Likely noises include sounds from machinery (engines, excavators striking rock near shore, concrete pouring etc) and in water-noises from moving and dumping rocks/dollose.

Nature of Impact:
The hearing sensitivity of cetaceans varies considerably between taxonomic groups (Southall et al., 2019, 2007 for details) with large baleen whales more sensitive to lower frequency sounds (thus falling into the "Low Frequency" hearing group) which overlap their vocalisation frequencies (mostly below 10 kHz) while dolphins (e.g. common dolphins, dusky dolphins) much more sensitive to higher frequency sounds (especially above 1000 Hz) falling into the "High Frequency" hearing group. The Heaviside's dolphin is even more of an acoustic specialist with most of its vocalisations occurring above 80 kHz and its hearing thought to be similarly higher in sensitivity, thus being grouped as a "Very High Frequency" hearing group cetaceans, along with porpoises (Southall, 2007, 2019).

There is little available information on noise emissions from rock placement in marine environments. However, the underwater noise emissions for rock dumping activities during marine cable laying operations are low compared to vessel propulsion noise and pile driving (Nedwell et al., 2012). The majority of these sounds will be low frequency (< 1000 Hz) which by their nature travel well through the water so may be detectable at longer distances.

Likely response: As sound source levels for these types of sound are not available it is difficult to predict the responses of cetaceans in the area. However, given the general low frequency nature of these types of sounds, it is likely that their impact will be greater on baleen whales than on the dolphins in the area whose hearing is likely not very sensitive below 1000 Hz.

Direct Impacts: Existing reports suggest that noise from rock dumping is lower than that typical from boat engines, so direct impacts on hearing thresholds are unlikely. The most likely response is a startle and or avoidance response from animals in the area.

Cumulative impacts: The impact of new vessels acts on top of the existing and other threats in the area and may results in temporary or permanent abandonment of the area by dolphins (notably the Heaviside's dolphins) and general avoidance of the area by other species.

Mitigation actions: Ensure all machinery is in good working order to reduce in in-air noise levels and transmission into the marine environment.

Where rock placement/dumping/construction is planned, aim to work from the ocean space backwards towards shore to create a physical barrier to sound in the initial stages of work, then all other fill work will be effectively 'on land'

Before engaging in any rock dumping or similar actions where material is dumped directly into the ocean - ensure no baleen whales are within ~500 m of the impact site (in the absence of direct measures of sound levels and hearing thresholds, 500 m is widely used as a typical distance for safe avoidance of noise impacts). As far as possible, ensure no dolphins are within 500m of the impact site. A dedicated marine mammal observer should be used for these phases of work.

3. **TURBIDITY AND POLLUTION:** associated with rock dumping, dollose placement etc.

   Nature of impact: When rocks and dollose etc are placed into the ocean and rocks/sediment moved around as part of the construction project, it will result in plumes of sand/mud increasing turbidity and potentially releasing pollution from in the substrate.

   Likely response: As dolphins breathe air they will not have any issues with blocked gills like fish do. Additionally transfer of pollutions through the food chain is unlikely as Granger Bay is not considered a feeding area for any marine mammal species (the most resident, the Heaviside's dolphins use the area largely for socialising and resting), other marine mammal species tend to transit the area rapidly the area.

   Direct impact: None

   Cumulative impacts: None

   Mitigation actions: None

4. **HABITAT LOSS** the project involves 'reclamation' of 3.2 ha (or 0.032 km^2) area of current marine habitat in Granger Bay.

   Nature of impact: expansion of rocks and concrete into the ocean represents complete and irreversible habitat loss. Given the known distribution and habitat use of cetaceans in Table Bay, the habitat loss component of this project can be considered as limited to Heavisides' dolphins, as all other cetaceans tend to occur further from shore and visits are typically short lived.

   Even though the project is limited to a relatively small area compared to the broader Granger Bay and Port of Cape Town areas, it falls within one of the highest density areas for Heaviside's dolphins known along the Cape Coast. The high density area used by these dolphins on a daily basis extends from approximately the middle of the mainly port breakwater to adjacent to the Three Anchor Bay lighthouse (see maps above from Behrmann thesis and Sea Search surveys). Even the small area where the revetment/expansion will occur is used on a near daily basis by Heaviside's dolphins. This specific area is highly popular with kayakers and paddle boarders as a place in which to interact with these dolphins. With the added benefit of the visually striking backdrop of Ferris Wheel Table Mountain, the area is well publicised on social media channels. The next known coastal aggregation sites for the species are Hout Bay (far fewer dolphins) and along the coast north of ~Blouberg (Elwen et al. 2010).

   Due to the impacts of noise, turbidity and added vessels, the area of impact will extend beyond the immediate planned construction site. The area of impact is challenging to judge but assuming underwater noise is the largest impact (see above), the impacted habitat will potentially extend 100s of metres out to sea from the site during the construction phase. Once completed, the impact site will be confined to the immediate land reclamation area itself. Note that the area has been reclaimed and highly modified and the dolphins regularly occur and socialise extremely close to the existing break water and piers (see images below).

Likely response: as the area will no longer be ocean, dolphins will be completely excluded from it, and they may also avoid the surrounding waters of the new precinct area.

During construction it is likely that there will be movement away from the impacted area, especially during noisier periods (rock dumping etc) and this may result in a temporary emigration from this site during the entire study area. This type of short term emigration / avoidance during construction but an ultimate return has been seen in a number of other species of dolphin and porpoise during construction projects (Benhemma-Le Gall et al., 2021; Huang et al., 2024; Piwetz et al., 2021; Weaver, 2021).

However, as this is effectively the end of the species range and the only aggregation site for the species for 10s of km in any direction, there is a chance that emigration could be permanent if the responses of the animals is the 'reduce' their range towards more preferred habitat to the north. It is not possible to predict the response with the available data / knowledge.

Direct impact: Complete loss of habitat of the area which becomes land. Possible abandonment of area entirely

Cumulative impacts: Habitat loss combined with other impacts (noise, vessels etc) may result in a cumulative impact resulting in partial abandonment of the Granger Bay area over time (reduced use during highest vessel traffic periods of which there is already evidence, see species discussion above) or space (movement away from the project site area to the west) or even complete abandonment (e.g. species range contracts to the north)

Mitigation actions: No go.

Figure 12. Heaviside's dolphins can be found in a small area between the harbour wall in Granger Bay as far as the Three Anchor Lighthouse on a daily basis. They are typically resting and socialising in the area. Photo: Jack Fearey, Sea Search.

Conclusions and Recommendations

The proposed Granger Bay Precinct project represents a. significant and irreversible loss of the marine environment in Granger Bay, albeit over a relatively small area (3.2 ha, or 0.032 km^2). The marine mammal species of highest concern in the area is the Heaviside's dolphin, which is endemic to the Benguela Ecosystem. The species aggregates close to shore along open sandy coastlines and on the exposed end of most bays along the west coast of South Africa. The area between Granger Bay to the Three Anchor Bay lighthouse (~ 2.8 km coastwise) represents the southern most known aggregation site, and it is used on a daily basis by these dolphins for resting and socialising, mainly in the mornings. The dolphins (and marine wildlife in general here) are a major attraction to commercial and private water users in Granger Bay.

The main impacts on marine mammals during the construction phase will be through noise from construction activities (rock dumping, excavator noises as they strike/move rock, and engine noises, from machinery), and potentially increased boat traffic (engine and sonar noise, boat strikes). The potential impacts of increased turbidity are felt to be negligible for air breathing mammals. The majority of sounds produced during construction will be below the main communication and hearing ranges of dolphins (especially the Heaviside's dolphin) but will overlap with the communication and hearing ranges of any baleen whales in the area. Baleen whales mostly remain at least 1000 m from shore off Granger Bay but can be spread widely across Table Bay.

The most likely response of Heaviside's dolphins and other marine mammals to the construction phase is immediate avoidance of impact noises (scale of 100s of metres where sounds are loud) but potentially a general avoidance of the broader Granger Bay area (scale of hundred metres to potentially 1 or 2 km, at which distance construction noises would likely merge with the background soundscape). The larger distance could encompass the entire Granger Bay / Three Anchor Bay aggregation area of Heaviside's dolphins. Avoidance of construction sites with later return once construction was finished, has been observed in multiple species and projects. However, long term or permanent abandonment of sites has also been reported in several marine mammal species in response to long term stress, including Heaviside's dolphins in Walvis Bay, Namibia. Heaviside's dolphins already show changes in behaviour in the Granger Bay area in response to boat traffic suggesting a degree of cumulative stress already exists for these animals.

Once built, the precinct will result in irreversible habitat loss over a small area of Granger Bay. This will mainly affect Heaviside's dolphins which aggregate very close to shore there on a daily basis. Other marine mammal species tend to move through the area fairly rapidly and visit less frequently.

It is likely that there will be short term displacement of Heaviside's dolphins during the construction period from the Granger Bay construction area, with possible displacement from the broader Granger Bay / Three Anchor Bay aggregation area. Given existing signs of stress in the population, and the nature of the area at the southern limit of the species range, it is possible that there will be long term avoidance/abandonment of the area by these dolphins once construction is completed (essentially a range constriction to the north). However, given that the entire Granger Bay area is already highly impacted and artificial (existing dollose, harbour walls etc), it is deemed unlikely.

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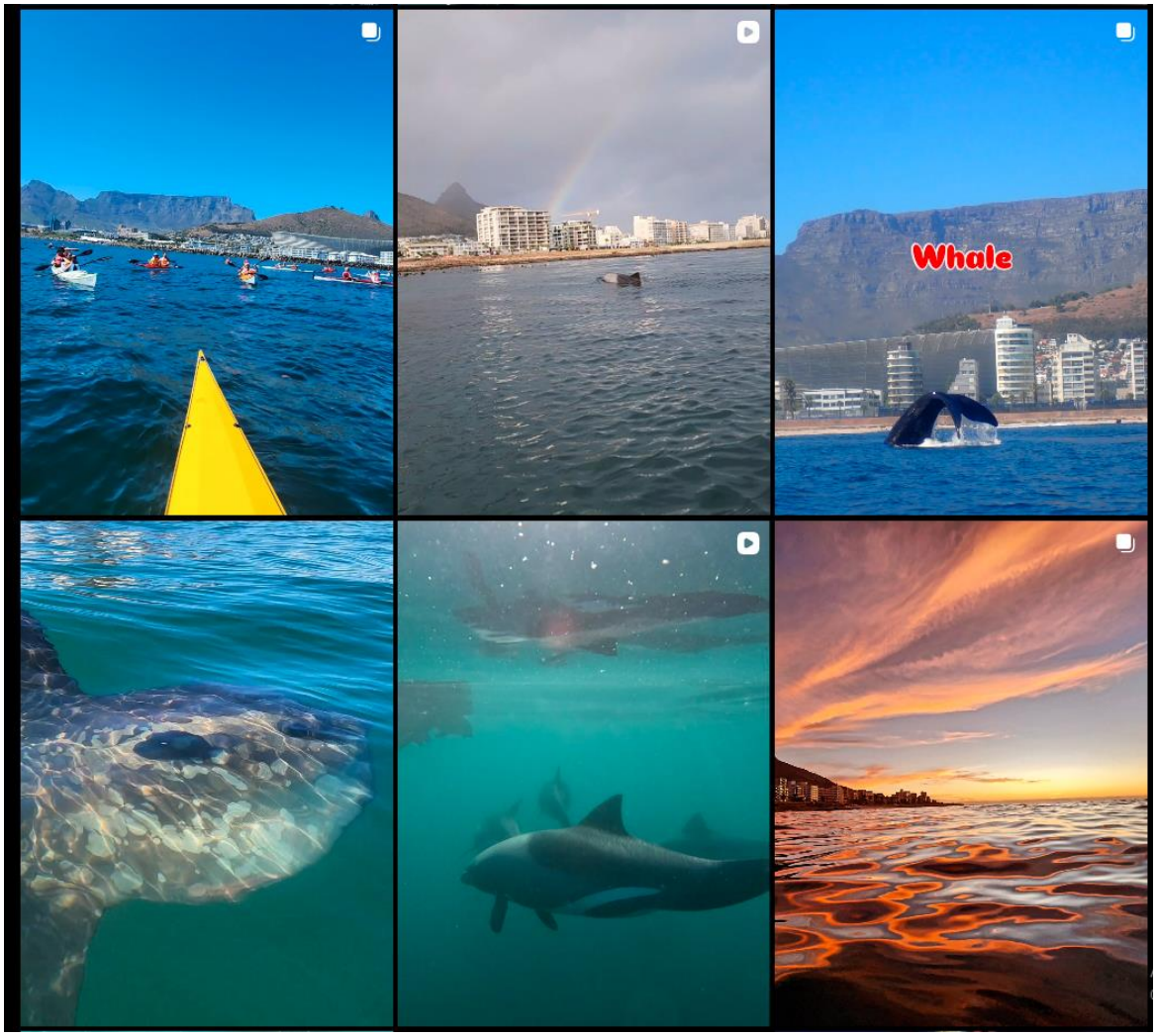

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