UNUSUAL MORTALITY EVENTS OF WHALES OF THE GENUS *KOGIA* ALONG THE SOUTH AFRICAN COASTLINE

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For external distribution

Authors

Seakamela S.M., McCue S.A. and Kotze P.G.H

Top Predators Research Programme
Directorate: Biodiversity and Coastal Research
Chief Directorate: Oceans and Coasts Research
Branch: Oceans and Coasts

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Objectives and limitations

This report is not peer-reviewed but includes inputs from at least one external Specialist. It has been prepared for the exclusive use and benefit of the DEFF and coastal Municipalities affected, in relation to strandings management.

Introduction

South Africa is bordered by contrasting ocean currents, which drive temperatures and productivity of these waters (Elwen et al., 2014): the cold Benguela current (West coast), the warm Agulhas current (East coast) and the colder water mass of the Southern Ocean to the South. This complex ecosystem with contrasting oceanographic conditions influence stranding patterns of many cetaceans (Findlay et al., 1992; Ansorge and Lutjeharms, 2007). Stranding generally refers to a live animal beaching itself for one reason or another but the term is used for any animal found ashore dead or alive (Cordes, 1982). The pygmy (*Kogia breviceps*, de Blainville 1838) and the dwarf (*Kogia sima*, Owen 1866) sperm whales are the only two members of the family Kogiidae (Plön and Relton, 2016). They occur worldwide in offshore temperate and tropical waters with few sighting records of live animals in their natural habitat (McAlpine, 2017). Their distribution and general ecology are mainly derived from stranding records (Moura et al., 2016). Strandings are rare and thus elicit much community and scientific interest (Evans et al., 2005), whilst providing an opportunity to collect much needed information. Scientists view strandings as a window into the complex world of cetaceans and factors that affect their survival (Jacques, 1997). The frequency of stranding events can provide a real-time signal of environmental problems. The signal should be amplified if strandings involve members of similar species. One such case in point being the recent strandings of diminutive relatives of the sperm whale, *kogid* whales.

The two species of the genus *Kogia* have been assessed as 'Least Concern' globally, in terms of IUCN Red List criteria (Kiszka and Braulik, 2020a, b). The authors of the assessment report, however, concede that there are no global population estimates and few local estimates. Abundance and population trends are unknown for South Africa's EEZ and the southern African region which resulted in a regional conservation assessment of 'Data Deficient' (Plön and Relton, 2016). Dwarf sperm whales may prefer warmer waters than pygmy sperm whales, with the exact distributions still unknown (McAlpine, 2017). Both species frequent deep oceanic waters (Caldwell and Caldwell, 1989), feeding mainly seaward of the continental shelf (pygmy sperm whale) and shallower waters over the continental shelf and slope (dwarf sperm whale). Strandings suggest the diet is dominated by deep water cephalopods such as *Histioteuthis* sp. and *Lycoteuthis diadema* (Plön, 2004).

Strandings of marine mammals have been recorded along most of the South African coastline, with a varying degree of effort depending on location. Members of the genus *Kogia* stranded in alarming frequency during the period of lock down (March-July 2020) imposed under the Disaster Management Amendment Act 16 of 2015. *Kogia* spp. are protected by law.

Analyses of stranding data, however, can assist government, scientists, management authorities and policy makers to understand patterns of change, which can be linked to both biotic and abiotic environmental factors. This report provides spatio-temporal trends in strandings of *Kogia* spp. reported in areas covered by the Chief Directorate: Oceans and Coastal Research (CD: OCR) within the South African National Strandings Network (SANSN).

Materials and Methods

Strandings events that occurred between Strandfontein on the West Coast and Grootbrak River on the South Coast (Figure 1) were responded to by officials of the Department or their collaborating institutions (e.g. S.M.A.R.T, SANParks, Cape Nature, Municipalities etc.) and individuals. The methods provided below are general practices.

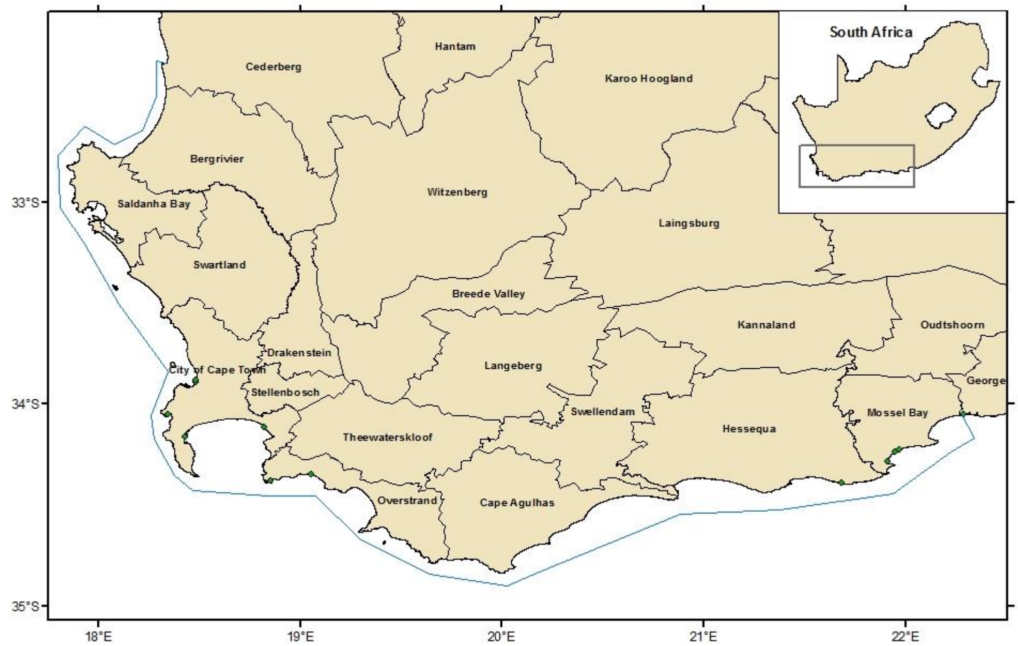

Figure 1. The extent of stranding response area covered by the DEFF (blue line).

1. *Strandings reporting and response*
    1.1. *South African National Stranding Network*

Marine mammal stranding events occur along the entire ~2800 km stretch of coastline of South Africa. Local institutions are thus the centres of reporting and response. The efforts are carried out under the informal South African National Stranding Network (SANSN), a network of institutions spread along the coast to maximise coverage. Due to the unpredictable nature of strandings, organisations within the network ensure prompt interventions at the local level.

1.2. Reporting

Local authorities tend to be the first point of contact for strandings within the SANSN. They receive reports and depending on the nature of the stranding (live or dead), appropriate action can be taken following specialist guidelines and protocols. Some participating institutions in SANSN do not have marine mammal biologists in their organisation. The network members with biological expertise (e.g.

DEFF) provide technical support when dealing with stranding events in remote areas with little or no expertise and/or resources. This is done mostly telephonically.

1.3. Response and Intervention

Live stranding are reported and responded to with an aim to assess the health and well-being of the animal and, if appropriate, assist the animal back into the water. Strandings involving a single individual, and/or cow-calf pairs, are the most common in South Africa and are most likely caused by illness or injury that compromise navigation or ability to swim (Simmonds 1997). Stranding induced stress may cause further medical complications to pre-existing conditions that led to the stranding (Ells et al, 2013). A lack of suitable facilities in South Africa eliminates rehabilitation as an option in the majority of live strandings. Rehabilitation attempts may, however, lead to further stress induced medical complications, such as myopathy (muscle disease) and stress cardiomyopathy (severe heart muscle weakness; Câmara et al, 2020).

Humane euthanasia has been considered an option for severely injured individuals. In less obvious cases where repeated re-floating efforts have failed, euthanasia was conducted. The South African Police Service (SAPS) has been utilised in euthanasia cases under the auspices of the SANSN. This procedure is emotionally challenging and requires strict management of any audience. However, most live strandings occur in populated areas, hence the high reporting rate. They often attract, and have to be conducted in public areas, sometimes resulting in public scrutiny and media attention (Barco et al., 2012).

Dead strandings are of great interest to scientists. Carcasses provide a rare biological sampling opportunity. In rare or uncommon species such as *Kogia* spp., stranding data can be the sole source of information for a given population, species or geographical area (e.g. Elwen et al, 2014). Upon discovery, a carcass is reported to local network institutions (including local authorities) upon which a sampling and removal response is initiated.

2. Sample and Data collection

Data collection is conducted by local academic institutions or their agents within the network. Each incident is given a unique reference number following the responding institution's standards. Due to the majority of stranding incidents involving cetaceans, a standardised cetacean data form is used as a guideline of what samples and data to collect. At a minimum, very basic data is collected for each stranded animal: date, location, species, skin sample (or tooth if decomposed) for genetic studies (Moore et al, 2018). In areas close to academic facilities, carcasses are collected whole for later examination. Every attempt is made to collect carcasses or collect samples of vital organs in areas within the Department's area of response.

3. Data Exploration

Stranding data presented here cover all incidents that were reported between 2010 and 2020. For mapping purposes, only stranding records with geographical coordinates were included. Seasonal trends exclude records with incomplete stranding dates i.e. month not recorded.

The Department's marine mammal research team attempted to conduct full necropsies on all stranded *Kogia* spp. However, inaccessible coastal access and sometimes lack of storage space on the South coast led to loss of carcasses and sampling opportunities. Samples collected during necropsies are stored in line with appropriate preservation methods. No sampling analysis had been conducted by the time of drafting this report, therefore limiting this report to numbers and trends.

Results and Discussions

<u>Results</u>

Between 2010 and 2020 there were 54 records of *Kogia* spp. strandings, of which *K. breviceps* contributed 74% and K. *sima* 26%.

Annual trends

An average of five *Kogia* strandings was recorded per annum between 2010 and 2020, with the highest annual number until 2019 being six in both 2010 and 2011 (Figure 2). Strandings, however, increased in 2020, with 15 standings being reported by the end of July, clearly an unusual mortality event. An unusual mortality event is defined as a pronounced increase in strandings compared with previous records (Yang et al., 2008).

There were an average of three strandings per year of *K. breviceps.* The highest number of strandings were recorded in years 2010 and 2011 when six strandings were reported, respectively. Between 2012 and 2019, numbers remained below five with at least 1 (one) stranding event recorded each year. Three stranding events per year were recorded between 2017 and 2019. A slight increase in the total number of strandings to four animals was reported in 2020, one more than 2019. Trends of *K. breviceps* strandings are shown in Figure 3.

There were relatively fewer strandings (17) of *K. sima* recorded between 2010 and 2020. Stranding events did not occur in each year on record. In fact, the first stranding record during the reporting period was in 2013 with the rest of the records in years 2017, 2018 and 2020. For the period ending in 2019, there was an average of one stranding event per year. This spiked to 15 stranding events in 2020 (seven months of the current year). This is already 14 animals above the annual average for the species and 10 above the genus (*Kogia* spp.) average of five. Annual trends of *K. sima* strandings are shown in Figure 4.

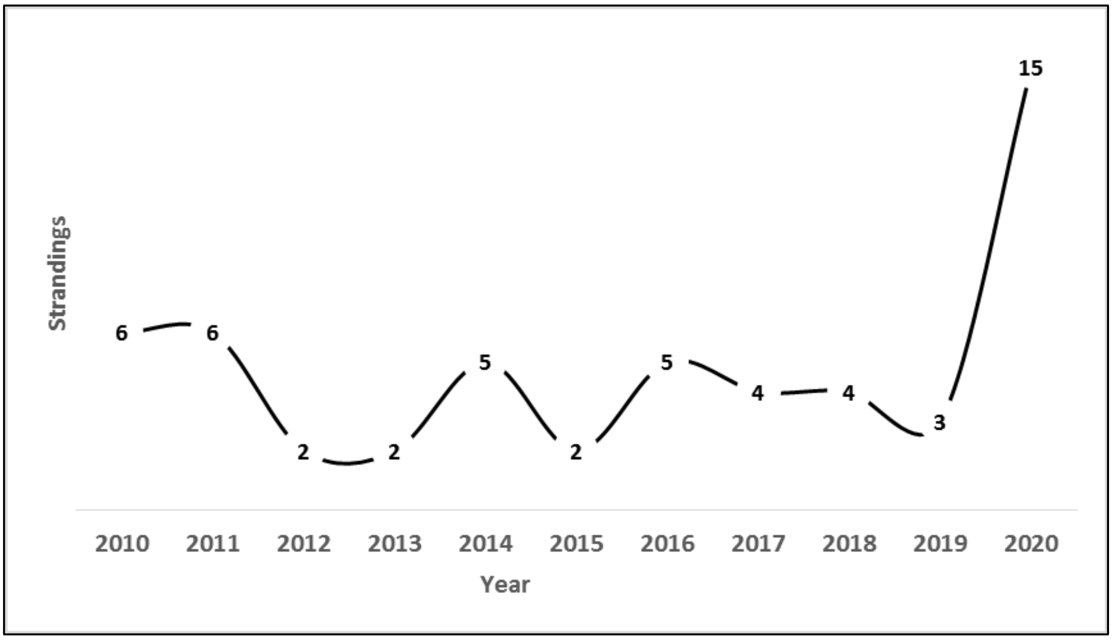

Figure 2. Year to year trends in reported strandings of all *Kogia spp*. within the DEFF response area 2010-2020.

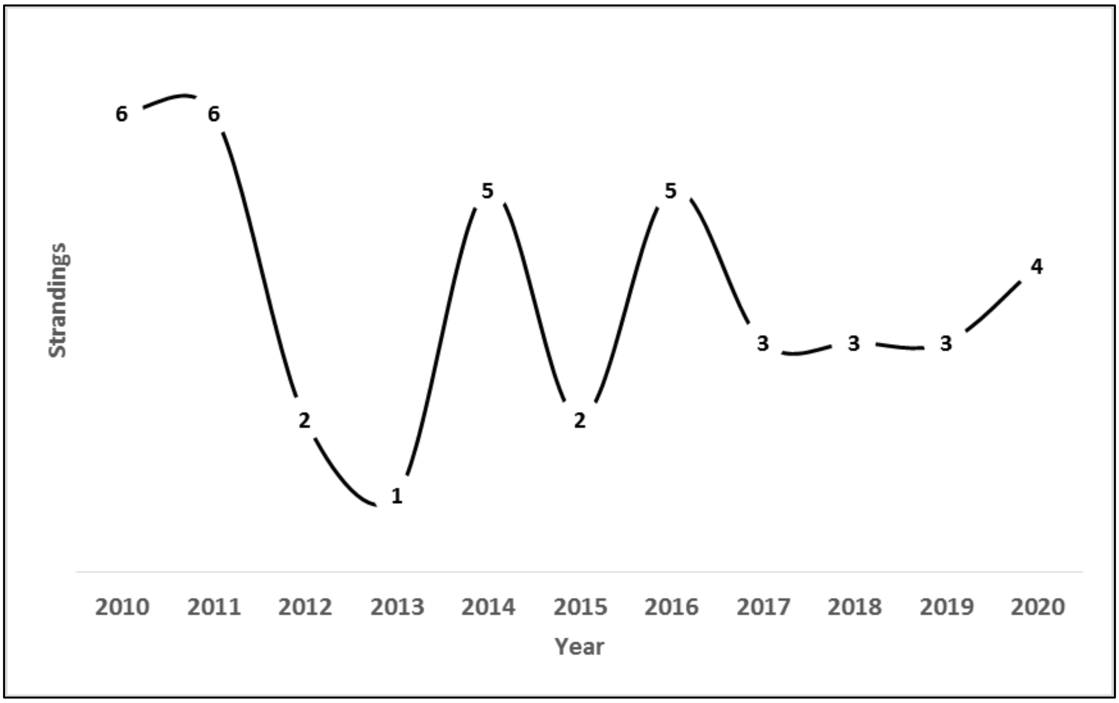

Figure 3. Annual numbers of *K. breviceps* stranded within the DEFF response area, 2010-2020.

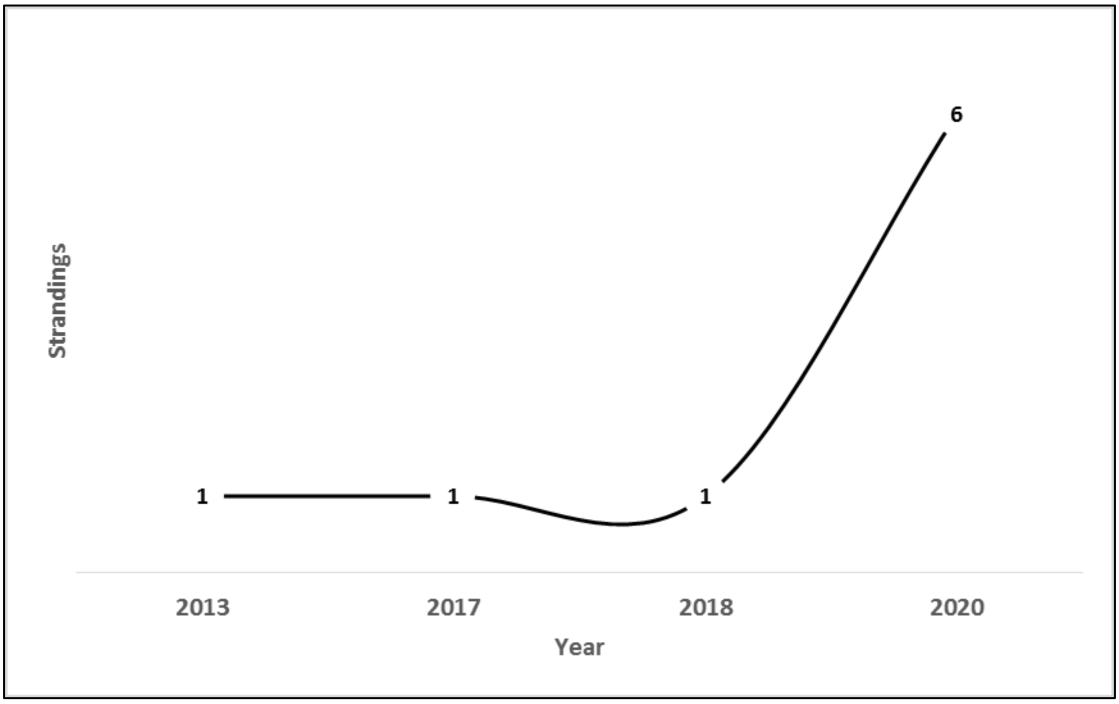

Figure 4. Annual numbers of *K. sima* stranded within the DEFF response area, 2010-2020.

Seasonal trends

The exploration of decadal data indicated that 44% (24) of strandings occurred in winter during the period 2010-2020 (Figure 6). The second highest number of strandings (16) were recorded in autumn while there were seven strandings during both spring and winter. There was a marked difference in peaks between the two members of the genus *Kogia*. *K. breviceps* strandings peaked in winter, while those of *K. sima* peaked in autumn (Figure 7).

A fine scale exploration of combined monthly data indicated that *K. sima* strandings occurred in only six of the 12 calendar months (February, March, May, June, July and September). *K. sima* consistently stranded less that *K. breviceps* except in March when five and one strandings were recorded for *K. breviceps* and *K. sima*, respectively. Stranding peaks were in March for *K. sima* and July for *K. breviceps.*

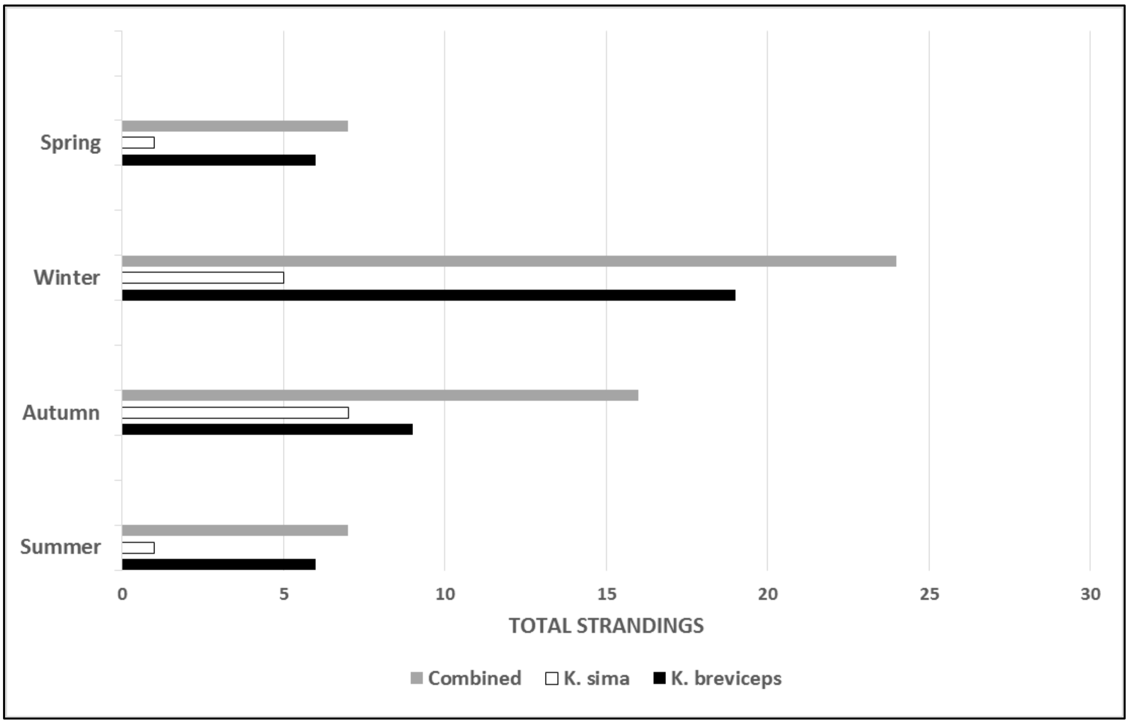

Figure 5. Seasonal total number of strandings for *K. breviceps* and *K. sima.*

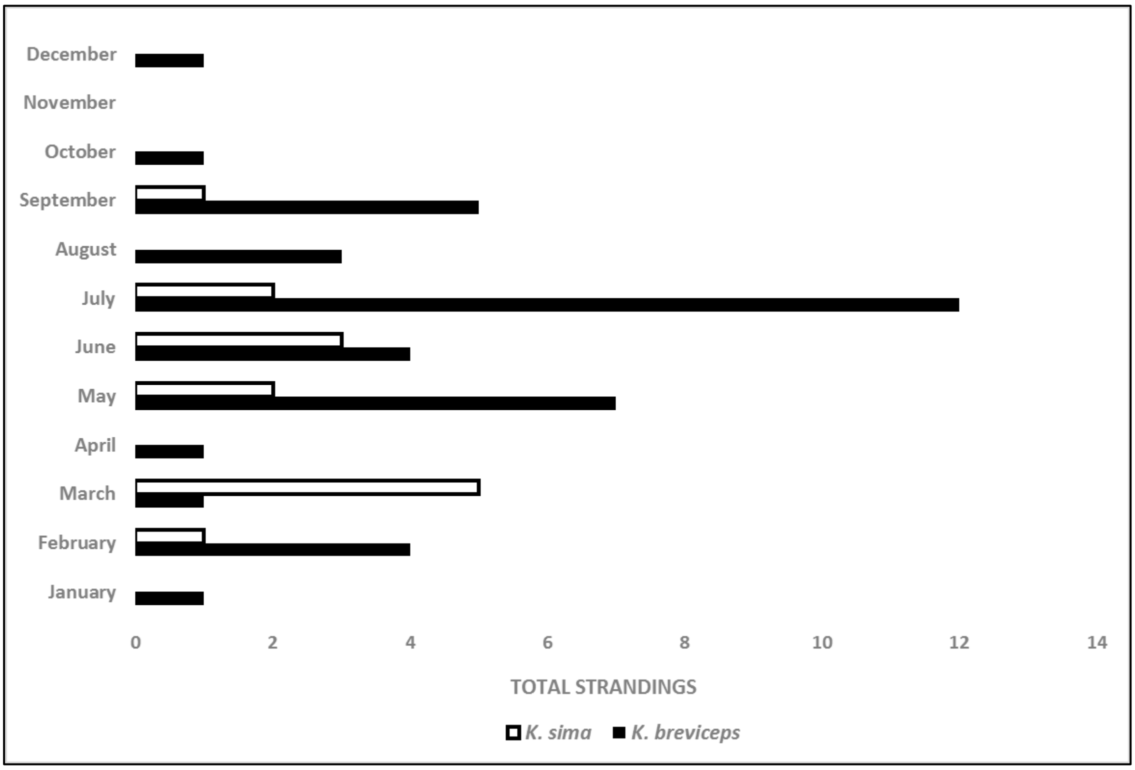

Figure 6. Monthly total number of strandings for *K. breviceps* and *K. sima* from aggregated data during the period 2010-2020.

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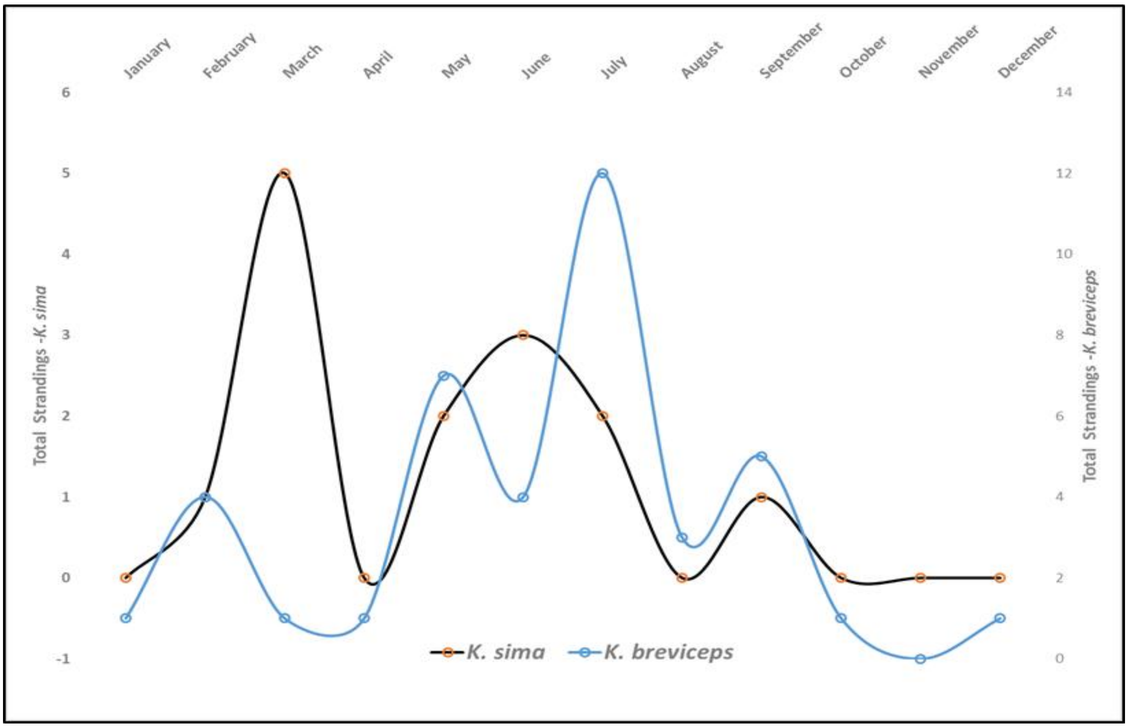

Figure 7. Monthly trends of *K. breviceps* and *K. sima strandings* from aggregated data during the period 2010-2020.

Discussion

Studying stranding patterns of cetaceans can assist with providing a window into the world of marine mammals. This opportunity is critical for studying cryptic and rare species that are distributed in inaccessible areas or are difficult to spot during dedicated surveys (Danil et al., 2010). This is especially true for *Kogia* spp. in Southern African waters. The genus is rarely observed in the wild, however, it is one of the most commonly stranded cetaceans in the world (Findlay et al., 1992; Plön, 2004). Strandings data can therefore provide critical insights into their distributions, possible population structuring, threats and phylogeny including discovery of new species or morphotypes (Best et al., 2014; Leeney et al., 2008; Pikesley et al., 2012). However, maximum value can only be derived by conducting detailed post-mortems (Thompson et al., 2013).

It is acknowledged that the occurrence of strandings of *Kogia* along a coastline indicates that there must be a minimal population present in the area (Credle, 1988 in Plön, 2004). Stranding patterns of *K. breviceps* and *K. sima* were chiefly consistent with published accounts (e.g. Plön, 2004). *K. breviceps* consistently stranded during the reporting period, while *K. sima* strandings occurred in 2013, 2017, 2018 and 2020. It can thus be inferred that there are relatively greater densities of *K. breviceps* in offshore waters of the south coast.

K. breviceps seasonality showed a gradual seasonal increase leading to a peak in winter (Fig 7). *K. sima* strandings were notably high in autumn. Aggregated monthly data shows a clear peak in strandings for *K. breviceps* in July (winter) whereas *K. sima* strandings had a bimodal peak in March (autumn) and June (winter) (Fig 8). Compared to patterns in Plön (2004), similarities in peak season (i.e. winter) indicate that strandings of *Kogia* spp. increases in winter. Worthy of note is that there were no strandings of any of the two *Kogia* species in November during the reported period. There was at least one stranding of *K. breviceps* for each month, suggesting that the species has a year-round presence in South African waters with numbers peaking in winter. These patterns have implications for planning of seismic surveys and other human activities that may have impacts on the genus *Kogia*.

The lack of speedy analysis of samples from strandings of uncommon species may delay critical management interventions where necessary. Uncommon species do not yield as much conservation influence as do "charismatic" coastal species (Mazzoldi et al., 2019). The genus *Kogia* is not as commonly seen in coastal areas and therefore little is discussed on the threats faced by their populations. This is evident in the lack of public outcry over the recent spikes in mortalities of *Kogia* spp. compared to the 2019 bycatch mortalities of large charismatic whales in False Bay. The regional conservation status of "Data Deficient" is primarily due to the lack of regional estimates of population size or trends (Plön and Relton, 2016). Unfavourable attitudes towards less charismatic species have potential to limit policy makers' ability to implement biodiversity conservation measures. A new cost effective approach to analysis of sampling is therefore needed.

Distribution of strandings relative to municipalities

Strandings, particularly of dead animals, evoke a multi-level governmental response. The handling of carcasses and sampling require a TOPS or Research Permit which are issued by the DEFF. Dead animals are also solid waste and the removal thereof is the competence of local municipalities in terms of Part B of Schedule 5 of the Constitution of South Africa (i.e. to control refuse removal, refuse dumps and solid waste disposal). As such, in certain cases, the specialised nature of equipment required may require outsourcing of removal services by local municipalities. The summary data for number of *Kogia* strandings per municipality is presented against the backdrop of additional strain to municipalities' fiscus due to strandings.

Total number of strandings per municipalities are presented in Table 1. The City of Cape Town and Mossel Bay municipalities recorded the highest number of strandings, 22 and 11, respectively. Strandings distribution maps suggests that *Kogia* are more likely to strand in areas south of 34°S (Figure 8). There were eight *K. sima* records containing location coordinates for the area between 18°E and 19°E coinciding with the City of Cape Town and Overstrand municipalities (Figure 9). Six of these occurred between the months of February and March with exception of May and September where one stranding was recorded, respectively. The rest of *K. sima* strandings (six) occurred in the Hessequa and Mossel Bay municipalities. These occurred in the months of June and July except on one occasion when a stranding occurred in May. *K. breviceps* strandings were more widely distributed. At least one stranding was recorded per municipality except for Bergriver (Figure 10). Strandings occurred in almost all months of the year with notable absence of strandings in November. The peak in strandings was in winter months, distributed between the City of Cape Town and Mossel Bay.

Distribution patterns are consistent with published records. Records of *K. breviceps* extend from Namibia to the KwaZulu-Natal coastline, however, their stranding records are concentrated off the south coast of South Africa (Ross, 1984). *K. sima* distribution was, however, limited to the south coast, also consistent with previous records e.g. Plön (2004). These data thus provide further evidence of importance of the south coast for genus *Kogia* in South Africa. It is therefore imperative that commercial ocean users and policy makers take cognisance of these stranding patterns that are indicative of the seasonal distribution of *Kogia* whales in South Africa.

Table 1. Total number of strandings per Municipality

Municipality	Number of strandings
Cape Agulhas	2
Cederberg	1
City of Cape Town	22
Hessequa	7
Mossel Bay	11
Overstrand	7
Saldanha Bay	2
Swartland	1

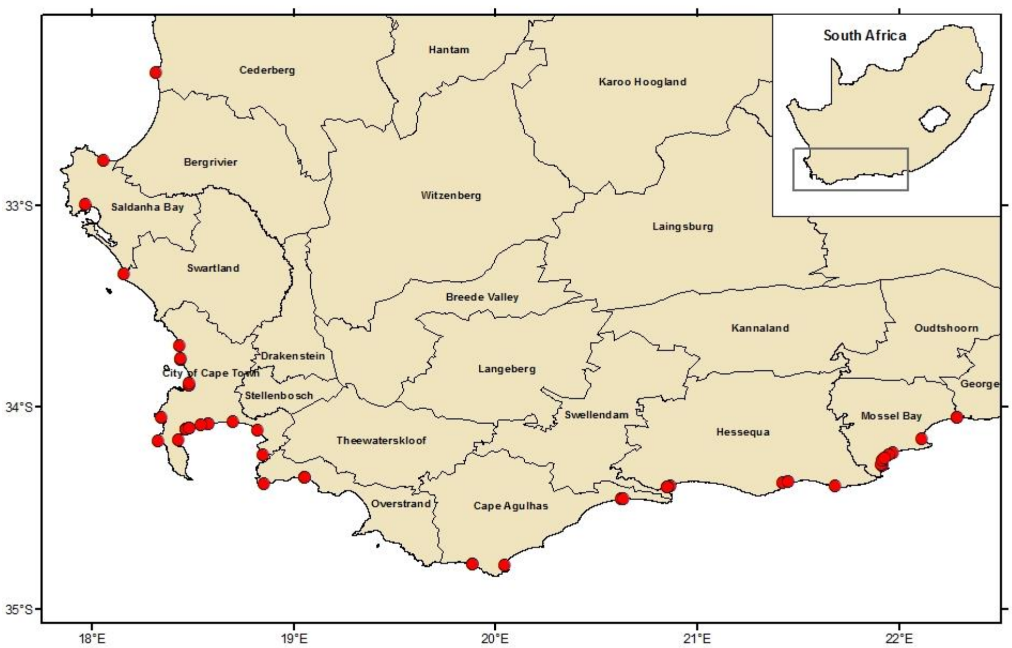

Figure 8. Distribution map of *Kogia* strandings relative to coastal municipalities during 2010-2020.

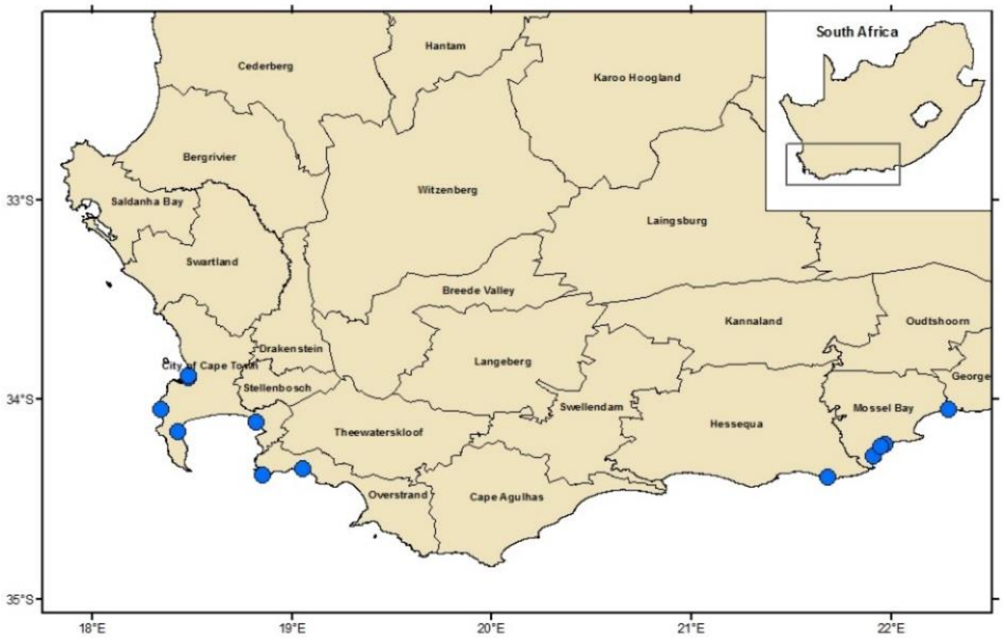

Figure 9. Distribution map of *K. sima* strandings relative to coastal municipalities during 2010-2020.

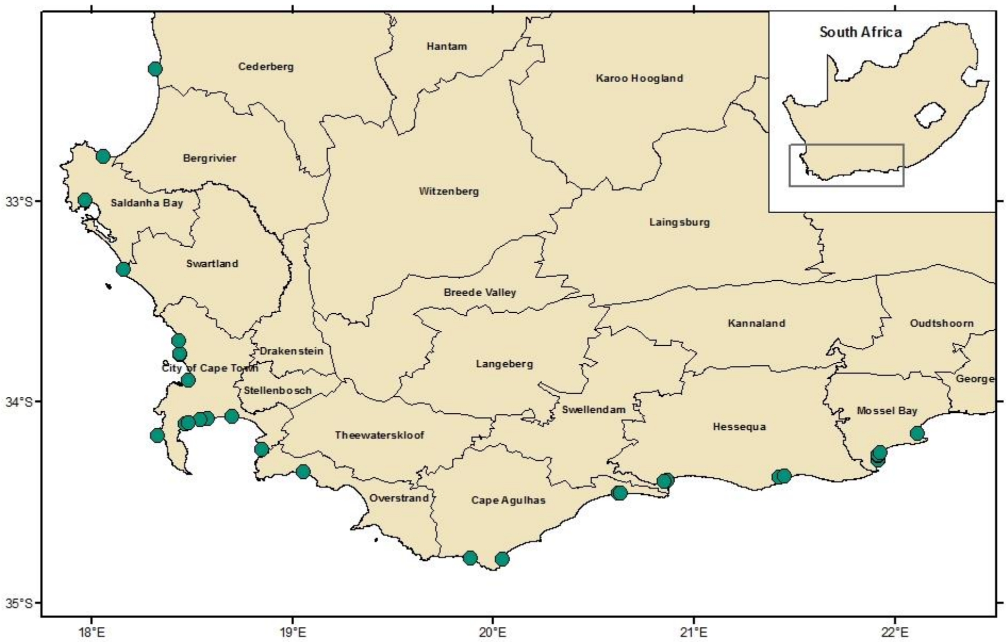

Figure 10. Distribution map of *K. breviceps* strandings relative to coastal municipalities during 2010-2020.

Concluding remarks

The authors do not make an attempt to discuss the cause of death of these *Kogia* strandings. This report is meant to alert Managers of a developing situation regarding an uncommon species.

Acknowledgements

The authors would like to acknowledge members of the South African Stranding Network and the experts therein for their contribution to strandings response. Statutory bodies (i.e. Management Agencies), Municipalities and their structures within the DEFF response area are acknowledged for their continued assistance and collaboration with scientists in ensuring that biological sampling is conducted prior to disposal of carcasses. Volunteer organisations and non-governmental organisations such as S.M.A.R.T (Mossel Bay), are acknowledged for their continued involvement in stranding response despite little monetary incentive. Members of the public are thanked for their efforts in reporting strandings and safeguarding of animals while we initiate a response. The South African Police Service is acknowledged for their assistance with euthanasia. Independent veterinarians are also thanked for their efforts when called upon. Lastly, Managers of the CD: Oceans and Coasts Research, (including Specialist Scientist in Top Predators) are thanked for their continued support and funding of stranding response by the Marine Mammal Research Group within the Department. Thanks also to Dr. Stephanie Plön for her input into the report. The response efforts are highly integrated, and the authors would like to be pardoned for any omissions.

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