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EXAMINING CURRENT AND FUTURE CHALLENGES OF SEA LEVEL RISE ON COASTAL NATIONAL PARKS

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Abstract: Over the past decade, the increase in extreme weather events requires each sector to reflect on vulnerabilities to develop strategies for ramping up climate action. Owing to the shortage of climate data, significant knowledge gaps exist in some sectors of society and the economy, particularly in developing countries such as Africa. This has caused challenges for adaptation and resilience building as governments and other stakeholders cannot leverage knowledge for policy and practice and to seek funding for climate change action. This study responds to this knowledge by examining sea level challenges and their implications on coastal national parks in South Africa. The key question for this study is the most at-risk areas regarding sea level in coastal national parks and the implications of sea level on coastal national parks. The study utilises primary, secondary and archival data to arrive at conclusions. The study also uses climate change modelling data from SSP2-4.5 and SSP3-7.0. The study found that the most vulnerable coastal park in South Africa is the Garden Route National Park, which has the highest sea level rise, which will result in the Knysna section followed by the Cape Point section of Table Mountain, which will see the areas witnessing a 1m rise in sea level around 2100. Sea level rise is a threat to infrastructure, heritage, beaches, tourism employees and tourist safety, to mention but a few. The study recommends scaling up climate change action to assist the parks in adapting and building climate change resilience.

Keywords: coastal tourism, loss and damage, climate vulnerability, heritage, nature tourism, sea level rise

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INTRODUCTION

Coastal areas are critical in human development amongst nation-states. The coastlines form part of the earth's most populated (Agoubi, 2021) and economically active parts (Toimil et al., 2020). For decades, coastal areas have been celebrated for their contributions towards improving the quality of life through the various recreational and tourism opportunities they offer (Dube et al., 2020). Activities along the coastline vary from one coastal area to the other. Of note are the significant economic spinoffs from coastal tourism activities such as beach tourism and a plethora of other adventure activities such as windsurfing, cruise tours, shark cage diving, and other water sports and recreational activities.

These activities ensure that coastal areas are attractive to many coastal habitats and inland populations, which take annual breaks from these people for leisure and business. Regardless of the central role played by coastal areas, there is growing concern over the adverse impacts of extreme weather attributed to climate change that has increased in various coastal areas worldwide. Coastal areas such as Spain (Losada et al., 2019), Bangladesh (Uddin et al., 2019), China (Zhang et al., 2019), Hong Kong (Zhou et al., 2023) and elsewhere across the African coastline, there are fears that climate change will prove catastrophic to coastal areas disrupting socio and economic activities. This raises the need for proper coastal management and mapping of some of the most vulnerable areas (Toimil et al., 2020).

As carbon emissions rise and temperatures rise due to anthropogenic activities, there are fears that this will trigger further extreme weather events (Dube et al., 2023). Sea level rise and coastal erosion pose a significant challenge for coastal areas globally, regionally and locally. Evidence shows that an increase in temperature will trigger an increase in sea level rise and even more pronounced coastal erosion (Wang et al., 2022). Sea level rise is one of the biggest threats to coastal communities, threatening to inundate and submerge some coastal properties and beaches worldwide.

Vousdoukas et al. (2022) argue that a rise in sea levels is a threat to heritage sites on the African coastline. Apart from heritage, there is concern that sea level rise and coastal erosion threaten beaches and, by proxy, beach tourism in several geographic areas (Mgadle et al., 2022). The beach areas also witnessed the destruction of mangroves (Xie et al., 2022; Singh et al., 2022), which act as a buffer and protect the coastline from severe sea surges and erosion, further threatening people and property along coastal areas. Such surges are becoming more pronounced due to the increased intensity of coastal storms (Calafat et al., 2022). Khojasteh et al. (2022) noted that this change in tidal activity would adversely affect estuaries. Rising sea levels also pose an additional challenge of raising the risk of coastal flooding in many coastal

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communities (Gaisie and Cobbinah, 2023). The increased intensity of tropical cyclones with climate change is also causing havoc in areas prone to cyclone storm tracks which compound climate change impacts (Dube et al., 2021). There are suggestions that earlier projections have understated the extent and impact of sea level rise in many areas (Mendelsohn et al., 2022). Evidence reveals variations in understanding the extent of sea level rise in different parts of the world (Walker et al., 2022). Khojasteh et al. (2022) argue that there are vast knowledge gaps regarding how sea level rise and tidal energy will affect estuaries. In South Africa, national parks have several estuaries with vast knowledge gaps.

This study, therefore, seeks to examine the impact of sea level and other extreme weather events on coastal national parks. Secondly, the study will examine future potential trends and what can be done to ameliorate the adverse effects of climate change on coastal national parks in South Africa that South African National Parks manage.

MATERIALS AND METHODS

The study will explore all the coastal national parks managed by South African National Parks. The national parks with a coastline include Addo Elephant National Park, various Garden Route National Park sections, Agulhas, Table Mountain, West Coast and Namaqua National Parks. The park lies on the Indian Ocean and the Atlantic Ocean.

The study uses primary, secondary and archival data from authoritative sources, with both qualitative and quantitative research being adopted to fulfil the study's aims and objectives. Primary data comprised mainly of field observations and interviews that were conducted by the research team between 2020 and 2022. During the fieldwork, interviews were conducted with 45 national park employees who fall within various categories and ranks. Among others, interviews were conducted with climate change scientists from SANParks, conservationists, section and senior section rangers, park managers, tourism managers and other key informants who constitute SANParks park management at the selected national parks. Among other things, interviews aimed to understand current historical patterns of ocean behaviour concerning observed tidal activity and the impact of oceanic activities such as sea surges during their working life in the park. Specific questions were asked to park scientists to understand the impact of sea level rise on coastal parks and their impacts on tourism and tourism infrastructure and the envisaged future under a changing climate. Interviews were conducted at the selected national park; participation was through snowballing and voluntary through informed consent.

During field observations, the researchers sought to make meaning of the availed data by visiting identified sea level rise and coastal erosion hotspots to ascertain the conditions and understand the possible causes of vulnerability and current remedial action being undertaken to deal with the challenge of sea level rise during field observations high-resolution images of the hotspots were taken. Notes were made on what was observed.

The study also uses archival data and modelled data from various sources. Permanent sea level markers were used to obtain current sea level rates for areas closest to the selected national parks. The NASA Seal Level Projection Tool was developed for the IPCC 6th Assessment Report (AR6). The tools allow the decision-makers to visualise what could happen under various carbon emissions scenarios to Sea Level Rise worldwide. In this study, the emissions pathways used are SSP2-4.5 and SSP3-7.0. Under the SSP3-7.0, carbon emissions are anticipated to continue to increase and roughly double by the end of the century, i.e. in 2100. Most scientists believe that this is the most plausible high-emissions pathway. The study also uses SSP2-4.5 scenarios with intermediate emissions, with carbon emissions expected to remain at current levels until the middle of the century. These are more accurate scenarios of what will likely happen.

The Climate Central Mapping tool was used to identify areas that are at risk areas of coastal flooding. CoastalDEM® v2.1 was used. The data is relatively reliable and can be used to denote areas at risk of flooding as the data is based on sea level rise and annual floods. Data analysis followed the qualitative and quantitative data analysis protocols. Interview data were transcribed using Amberscript, which saved time spent on transcription. Post transcription, the data was read and screened for accuracy and cleaning. The second reading was done to develop themes later used in the content and thematic analysis. Major themes developed from this exercise include sea level rise, tourism infrastructure, climate change impacts, coastal erosion, coastal flooding and extreme weather events.

RESULTS AND DISCUSSIONS

The study found that national parks along the coastline, such as Addo Elephant and Garden Route, suffer the harsh realities of climate change. One of the biggest threats to these parks is rising sea levels, posing a considerable risk to tourism infrastructure, beaches, heritage and activities. The study found that various national parks had different challenges regarding climate change, with the future also looking different for different national parks related to rising sea levels. One of the parks witnessing the harsh realities of climate change is the various sections of the Garden Route National Park on the Indian Ocean side of South Africa. A combination of rising sea levels and surges is threatening various properties in Tsitsikama National Park, which are in perpetual danger from rising sea levels and surges. Evidence from interviews indicated that on several occasions, the Cattle Baron Restaurant, located near the Storms River, has been swept away by the Ocean at least twice between 2010 and 2020. The restaurant is the sole supplier of food services to park visitors. Its disturbance and closure upset tourists who visit the area. The storm surge was also blamed several times for destroying braai and picnic facilities near the camp (Figure 1). Consequently, the campsite has been flooded by gushing water from the ocean during high tide episodes. The storm surges are reportedly also threatening the chalets near the ocean. The destruction of chalets at the rest camp and the threat of sea level also undermine camping activities, threatening safety and revenue income from accommodation in the park. It was revealed that in as much as there is awareness of the risks associated with accommodation. Apart from the infrastructure, the rising sea poses a danger to the beach, a favourite for many who visit this national park.

Regardless of the risk, the park manager indicated that it was difficult to relocate the campsite given that it is one of the favourite spots that come to the park. The indications were that the park would want to upgrade that part of its accommodation facilities as they were most profitable. Sea level rise was feared to pose a risk to other heritage infrastructure and walk trails close to the ocean. Tsitsikama's walking trails are quite popular with tourists that visit the park. Concerns were also raised over the impact of flooding on Nature's Valley section of the Park. This threatens road infrastructure, the walking trails and the beach, which is being eroded. Field observations revealed that beaches were being eroded, and the ocean was chiselled into the mountains, destroying vegetation (Figure 2).

Figure 1. Some of the most vulnerable areas (Source: Google Earth Pro)

Figure 2. Evidence of coastal erosion near Nature's Valley: Tsitsikama National Park (Source: Author taken during fieldwork)

Although this might happen slowly, evidence is that the coastline is being redrawn due to increased high tides affecting the national park. One of the managers indicated that the park is maintaining and upgrading the accommodation at the Storms River Camp. They are simply responding to the clientele's needs. Another challenge that was noted from the study of the Garden Route National Park was that given the rising sea level and climate changes, estuaries' geomorphology was significantly altered, which could impact beaches on river mouths and affect aquatic life upriver streams. It emerged from interviews that river mouths were not closing and opening as expected and as regularly as they would without climate change. The increase in sea level also resulted in sand accumulating on the river mouth, blocking sea and land freshwater from the river interaction. This has caused challenges, particularly in the Wilderness section of the park. The failure of the river mouth to open naturally has created headaches for host communities and park management, often resulting in upstream flooding destroying properties.

Figure 3. Vulnerability Map of Knysna: Map from CoastalDEM v2.1 9 (areas in red denotes areas that are below annual flood level)

This phenomenon is often made worse when an extreme rainfall event coincides with high seas and an extreme rainfall event. This development often causes a tussle between the park and residents who have homes on the estuaries. The Park management is often forced to embark on a risk exercise to artificially open the river mouth, which poses a risk for park employees tasked with opening the mouth artificially using a tractor. Where this has not been done, residents with properties on the river and or coastline have often threatened the park with legal action for damages. Such weather events, therefore, create conflict between the park and its residents. The blockage of the river mouth is also believed to disturb the natural interchange between sea and freshwater, which is feared to alter the water salinity in the lakes area, an important Ramsar Site. There are fears that recent fish deaths and diseases could result from disrupting this important interaction between the ocean and the river system. This situation is not localised to the Wilderness section only. The Garden Route National Park has many flushing points that Sea Level Rise causes.

In the Knysna section of the park, on several occasions, the high tide is reported to have caused damages to the SANParks offices at Thesen Island in Knysna owing to several areas that lie below the annual flood line (Figure 3). The increased tidal activity was also to blame for the destruction of the coastal defence system at the two Islands, which was at the centre of a legal wrangle in 2021, wherein residents were demanding that the municipality and SANParks take responsibility for repairing the damaged tidal activity which was damaging sea walls in the area. Most holiday homes on Leisure Island are also threatened by rising sea levels, with visible evidence of coastal erosion (Figure 3). Consequently, many homes on the coastline have adopted some form of coastline defence system to ameliorate the rise of sea levels and coastal erosion.

Given the extent of the rise in sea level, it is unclear if the current measures are of any comfort. The high tides and extreme rainfall are blamed for causing coastal flooding in the Knysna estuary. The flooding is blamed for causing damage to the railway line that is near N2, which was a major tourist link. The flooding of Knysna is also a challenge as it threatens the sewage treatment works, which can trigger water pollution. Under the SSP3-7.0 (Table 1), Knysna is expected to witness a sea level rise of about 1 meter around 2100. This will cause significant losses to the infrastructure in Knysna, a tourist town. The Western Cape National Park is another park battling the impact of rising sea levels. This national park's soft coastline makes it vulnerable to changes in oceanic trends. The study found several beaches disappearing due to rising sea levels and increased tidal activity. Large portions of beach areas around the estuary risk being wiped off. Field observations revealed that in some areas, due to tidal activity, the beach appears during the low tide and disappears during the low tide during the day. As this happens, tourists and residents sit on the coastline gazing at the sea as the beaches disappear. Figure 4 shows the areas that are most at risk from rising sea levels at the West Coast National Park.

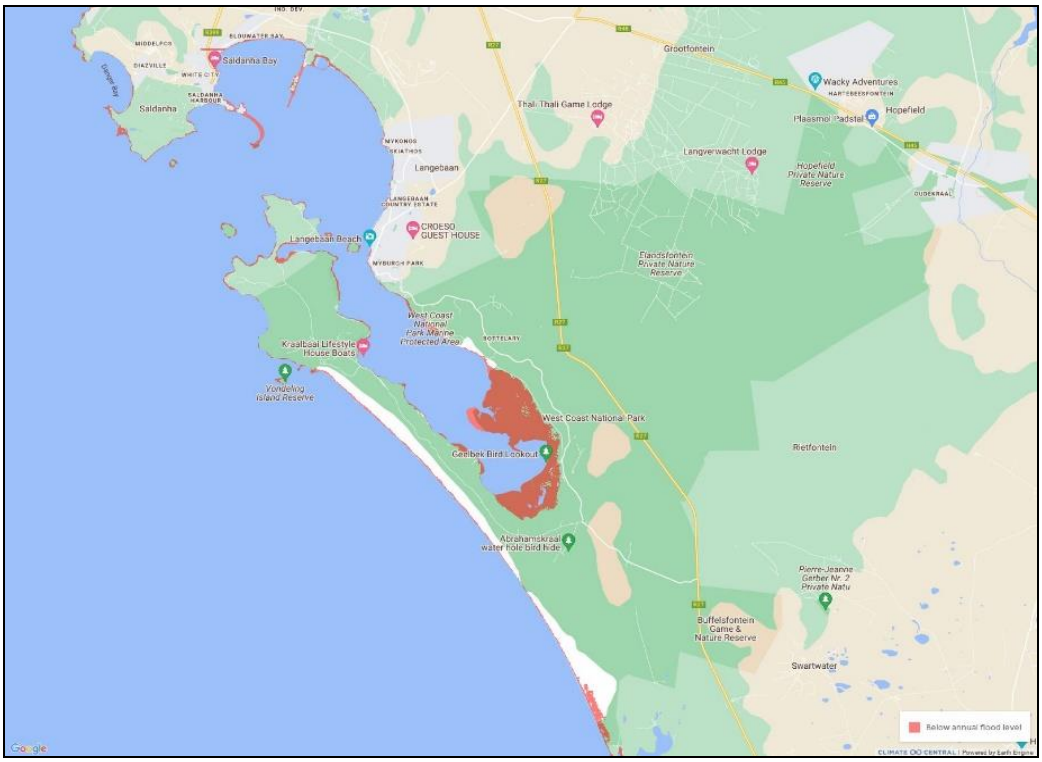

Figure 4. Most vulnerable areas to sea level rise and coastal flooding at West Coast National Park (areas in red denote areas that are below annual flood level)

Field observations revealed that given the soft coastline, which is largely composed of sandy soils, segments of the lagoon suffered due to wave action and water action, resulting in large chunks of the earth being eroded as the water advanced into the park. Due to rising sea levels, some of the infrastructure installed to cater for beachgoers now lies inside the estuary (ocean flow). Some of the infrastructure to take people to the beach is collapsing as the foundation erodes and falls into the estuary (Figure 5). This causes the park to incur losses in the form of repair costs. Nevertheless, some areas' ecosystem services and recreational value are lost as they become unusable for their original purposes. This can result in

some areas being over-subscribed by the number of recreational makers and other visitors. Given that the other main beach is experiencing the same challenges, it will frustrate many tourists. The park also has a long history and heritage, given the level and extent of erosion. Some of the archaeological artefacts are at high risk of being eroded.

Figure 5. Inundated beach, collapsing walkways and large chunks of eroded earth at the West Coast National Park

Part of the park is a marine protected area. Some fear that rising sea levels could have an adverse impact on bird habitats on that island, which is an important bird site. A combination of rising sea levels and pollution from Saldana Bay, which is used as a harbour by mining and manufacturing companies, threatens many recreational activities in the estuary, including fishing. Changes in seawater temperature were also blamed for changes in the size and quantity of fish in the estuaries by some employees, which can adversely affect recreational fishing activities in the park.

The Future of Sea Level Rise in Coastal National Parks in South Africa

The study found that many national parks will suffer the adverse effects of the ever-increasing sea level rise. The study showed that the park that will experience the highest sea level rise is the Garden Route if one considers the projected sea level rise at Knysna. Under the SSP3-7.0, Knysna is expected to rise about 1 m sea level by 2100. This will likely compound the challenge of sea level rise experienced in the three sections of the park, particularly those areas with a soft coastline. According to projections, the other area of concern is the Sea Point section (Cape Point) of Table Mountain National Park. The rate of increase will result in the area also witnessing a 1m sea level rise around 2100.

Field observations and interviews revealed that some beaches quickly disappeared in and around the Cape Peninsula. A small beach, Dias Beach, is one of the most Southern beaches near the Cape of Good Hope. A time series of Google Earth Images between July 2005 and July 2020 shows that the beach has lost 60m of its width to the advancing ocean. Most areas that had sand are now covered in water due to the rise of the sea level. The advancing ocean has also submerged another beach that is in that area. The Platboom Beach in the Cape Peninsula had a width size of 240m in July 2004. In July 2018, according to Google Images, the beach was only left with a 30m width beach size due to the sea level. This development is a huge upset to tourism and recreation in the area. The evidence of the rise of sea level is equally evident at the Slangkop Light House. The Southerly side of the Light House exhibits evidence of significant levels of coastal erosion, with part of the fence footing eroded significantly. During the fieldwork, Southwestern parts of the fence were hanging in the air, and there were efforts to put concrete and other rocks from the ocean to defend the coastline from further damage. The footing of the light, which is touted as one of the strongest in the country, is under threat from erosion (Figure 6).

Figure 6. Sections of Slangkop Lighthouse being eroded by ocean wave action

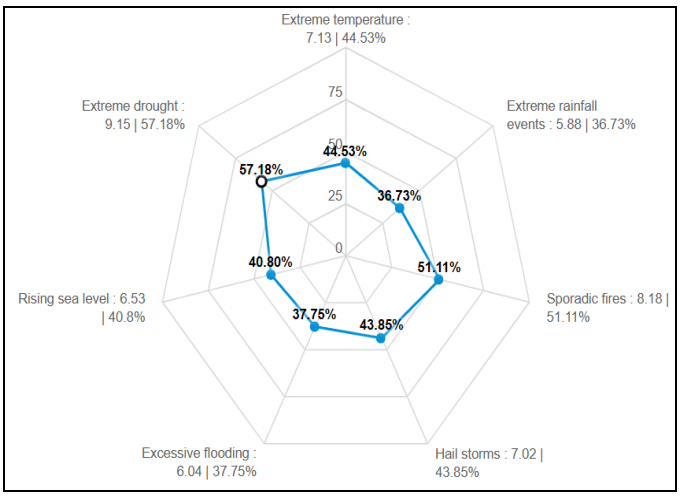

Figure 7. Most significant extreme weather event in South African National Parks

With regard to Table Mountain National Park, there are fears that the combined effects of storms, storm surges, and coastal erosion will worsen the loss of heritage in that park. Table Mountain has much heritage that can be easily lost to erosion. Other tourism operations have been disrupted on the Sofia Cape Town railway line has been in the past buried in the sand from the advancing ocean as it runs along the coastline, which has disrupted tourists' movement. This is a testament to the challenges that are to be experienced due to sea level rise.

Most national parks will witness a 1m sea level rise post-2150 (Table 1), which could also affect even those parks with a lot of infrastructure on the coast, such as Namaqua National Park in Northern Cape. Data from Port Norloth shows that the area will experience a 0.5m sea level rise around 2090 before shooting to 1m around 2150. It is unimaginable that the Namaqua Coastal area, which has 8 camp areas and braai facilities, will be affected by such rising sea levels. Some camps that could be affected by such an increase are Delwerskamp Campsite, Skilpad Rest Camp, Bamboes Camp, Namaqua Flowers Beach Camp, Groen River, Kwass, Skuinsklip, Boulder Baai, Skuinsbaai Noord, Koringkorrel Baai, among others.

Table 1. Projected Sea level along the Southern and western coastline of South Africa

	Sea Level Scenario for Kysna		**Sea Level Scenario for Port Elizabeth**		**Sea Level Scenario for Cape Town Granger Bay**		**Sea Level Scenario for Simon's Bay**		**Sea level Scenario for Port Norloth**	
	SSP2-4.5	**SSP3-7.0**	**SSP2-4.5**	**SSP3-7.0**	**SSP2-4.5**	**SSP3-7.0**	**SSP2-4.5**	**SSP3-7.0**	**SSP2-4.5**	**SSP3-7.0**
Total 2030	0.12 (0.09–0.15)	0.11 (0.09–0.14)	0.10 (0.07–0.14)	0.10 (0.07–0.13)	0.09 (0.06–0.13)	0.09 (0.06–0.12)	0.11 (0.08–0.14)	0.11 (0.08–0.14)	0.10 (0.07–0.14)	0.10 (0.08–0.13)
Total 2050	0.24 (0.20–0.31)	0.26 (0.21–0.32)	0.22 (0.17–0.29)	0.23 (0.18–0.30)	0.20 (0.15–0.27)	0.21 (0.16–0.28)	0.23 (0.18–0.30)	0.25 (0.20–0.32)	0.23 (0.17–0.30)	0.24 (0.19–0.31)
Total 2090	0.55 (0.43–0.74)	0.64 (0.52–0.84)	0.50 (0.37–0.70)	0.59 (0.46–0.79)	0.48 (0.35–0.67)	0.56 (0.43–0.76)	0.54 (0.41–0.73)	0.63 (0.50–0.82)	0.52 (0.39–0.71)	0.61 (0.48–0.81)
Total 2100	0.64 (0.49–0.87)	0.77 (0.62–1.01)	0.58 (0.42–0.82)	0.72 (0.55–0.97)	0.55 (0.40–0.78)	0.68 (0.52–0.92)	0.63 (0.47–0.85)	0.75 (0.59–1.00)	0.60 (0.45–0.83)	0.73 (0.57–0.97)
Total 2150	1.07 (0.77–1.50)	1.35 (1.01–1.81)	0.99 (0.67–1.42)	1.27 (0.91–1.75)	0.94 (0.63–1.37)	1.21 (0.86–1.68)	1.05 (0.74–1.48)	1.32 (0.97–1.79)	1.01 (0.70–1.44)	1.28 (0.94–1.75)
Rate 2040-2060	6.7 (5.0–9.0)	7.5 (5.9–9.8)	6.1 (4.3–8.4)	7.0 (5.3–9.2)	5.8 (4.1–8.1)	6.6 (4.9–8.8)	6.5 (4.9–8.8)	7.3 (5.7–9.6)	6.4 (4.8–8.8)	7.1 (5.4–9.4)
Rate 2080-2100	8.8 (5.9–12.7)	11.7 (8.4–16.2)	8.2 (5.2–12.2)	11.2 (7.6–16.0)	7.8 (4.9–11.8)	10.6 (7.3–15.1)	8.6 (5.8–12.6)	11.4 (8.0–15.8)	8.2 (5.4–12.2)	11.0 (7.8–15.4)

An Employee Perspective of sea level rise

The staff survey conducted amongst 244 employees across the 19 national parks showed that sea level rise remains a relatively underrated risk within South African National Parks (Figure 7). The study found that rising sea levels are ranked after extreme drought, fire, temperature and hailstorms but ahead of flooding, which is significant in that in as much as the number of parks that are on the coastline is relatively low, there is recognition of the threat posed by sea level rise. Sea level rise is also a slow-onset event that requires careful attention to master its impact in many ways.

That recognition of the threat posed by rising sea levels is a significant indicator of the need for action to deal with rising sea levels on South Africa's coastline. On another question, employees were requested to articulate the impact of sea level rise on national parks in South African national parks. Figure 8 shows that one of the biggest threats from a tourism perspective of sea level rise is that it instils fear in tourists and park employees alike. This is particularly tru e when considering the impacts of high tides along the coast with vast amounts of water moving onshore.

This can be an intimidating and catastrophic event. The study also finds that there is an acknowledgement of the adverse effect of rising sea levels on infrastructure such as roads, accommodation-fencing, and other critical infrastructure in the park, as already seen from interview data, field observations, and other sources in this study.

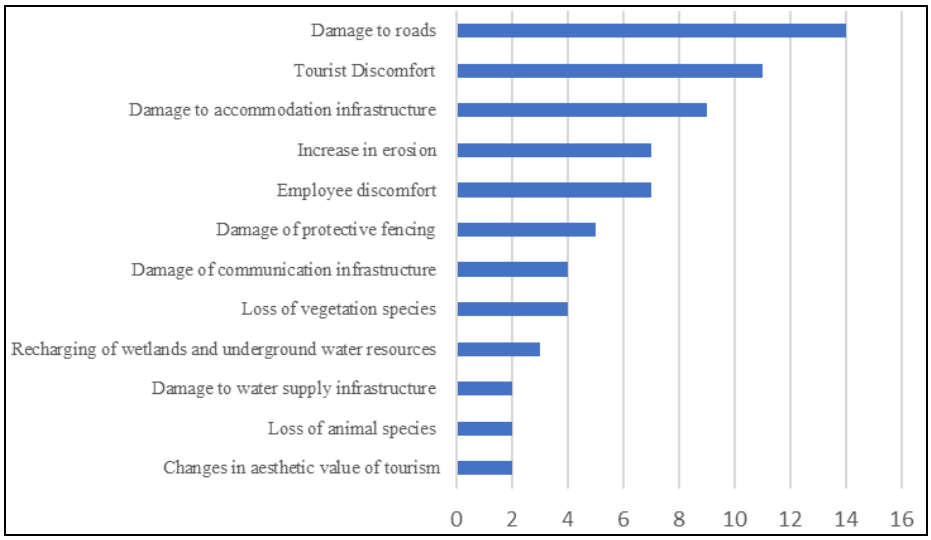

Figure 8. An employee perspective on the impacts of sea level rise on national parks

Mean 6.529, Confidence Interval @ 95% [5.541 - 7.517] n = 70.0, Standard Deviation 4.218, Standard Error 0.504. The employees also raise a critical issue of vegetation species loss; this could be a consequence of salt seawater intrusion and other challenges noted in the study, such as the disruption of fresh and seawater interaction, which could change the chemical composition of water and other habitats which resides in estuaries with adverse impacts on such ecosystems.

DISCUSSION

The study confirmed earlier findings that the coastline faces coastal squeeze due to climate change (Lithgow et al., 2019; Wen and Hughes, 2022) caused by increased anthropogenic activities that release carbon emissions into the atmosphere. The studies show a strong link between observed and anticipated carbon emissions and increased sea levels, as earlier observed by previous scholars (Lu et al., 2022). The resultant warm poses an existential threat to various economic activities, including tourism. Rising sea levels and other extreme coastal weather events, such as coastal storms, amplify the rising sea levels and often manifest in increased damage and costs from erosion and coastal flooding (Mgadle et al., 2022; Dube et al., 2021). The evidence seems to suggest that in as much as sea level rise poses a threat to tourism infrastructure and activities (Gbedemah, 2023; Dube et al., 2023), there is very little evidence to suggest that SANParks actively seeks the adoption of adaptation measures to deal with sea level rise. There doesn't seem to be urgency in dealing with this challenge, which can lead to maladaptation on the part of South African National Parks. This poses an even bigger threat to the parks' sustainability in high-risk coastal areas.

If left unchecked, there is a real risk that could result in casualties from future climate change and sea level-related events. The lack of coastal defence in some of the most vulnerable areas is a cause of concern. Two issues emerge: either SANParks does not have the technical and or financial capacity to deal with the climate change challenge from the sea level rising perspective, or it has chosen to turn a blind eye to this challenge or decided to adopt a wait-and-see attitude, which could prove disastrous as the challenge grows. Threats of legal liability are worrying, and SANParks has to take concrete steps to address this matter holistically. There is a need to closely ensure that all the coastal parks have adequate and reliable insurance to deal with the often sudden and high-impact extreme weather events that are increasing in coastal areas.

Given that sea level rise is likely to become a growing disaster concern, SANParks needs to train its personnel in dealing with risks associated with sea level rise and put in place disaster management mechanisms that will arise from sea level rise. This will call for understanding and installation of early disaster warning technology to equip parks and their employees on eventualities that may emerge from the anticipated rapid increase in sea level rise post-2021. There is always a need to assist the employees in managing the psychological trauma often ushered by extreme weather events from rising sea levels, given the fear factor raised in the study by many employees, which is equally a concern for tourists.

The SANParks organisation has to work and mobilise resources to put proper coastal management defence mechanisms in place as we advance as part of the adaptation building and climate change resilience strategy. This will assist SANParks in the medium to long term. Such efforts must be scientifically sound and evidence-based. There is a chance of utilising ecosystem adaptation-based strategies where this is feasible, which can assist in saving the ultimate cost of adaptation.

CONCLUSION

The study found that several coastal national parks are at risk of climate change-imposed rising sea levels. The park of the highest concern with regard to rising sea levels is the Garden Route National Park, where various sections are experiencing challenges due to rising sea levels. The challenges range from the destruction of key infrastructure such as roads, accommodation, and office space to the erosion of beaches and the disruption of natural estuary opening and closing cycles, which have implications for estuary ecosystems in the affected areas.

Sea levels also complicated the situation and increased the chances and occurrence of coastal flooding in several areas. Coastal flooding often causes havoc, resulting in a blame game, and some players are taking South African National for legal action due to climate backlash and coastal squeeze caused by sea level rise. Climate change has raised conflict in some coastal national parks due to loss and damage that results from the same in national parks and host communities that reside near or around national parks, which is a matter of concern. The study also found that coastal areas with a soft coastline are most at risk as they seem to be experiencing severe erosion above the global coastal erosion rates.

Future climate change scenarios indicate that rising sea levels will compound current sea level challenges, trigger unimaginable situations and property damage and loss, and adversely alter beach and coastal tourism. There is, therefore, a need to ramp up efforts to build resilience for coastal tourism in coastal national parks. This requires a substantial financial investment on the part of the government. A de-risked approach might be appropriate for other parks in the future.

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