Table Mountain National Park
Marine Protected Area

State of Knowledge Report
March 2022

Alison Kock, Debbie Stanbridge, Rene Brink, Stephen Holness, Linda Harris, Kathryn Gardner, Nicola van Wilgen-Bredenkamp, Sisanda Mayekiso and Georgina Jones

Internal Report 01 / 2022

Scientific Services
South African National Parks

Please cite this report as

Kock, A.A., Stanbridge, D., Brink, R., Holness, S., Harris, L., Gardner, K., van Wilgen-Bredenkamp, N., Mayekiso, S. and Jones, G. (2022). Table Mountain National Park Marine Protected Area – State of Knowledge. *Internal Report 01/2022*, South African National Parks, Scientific Services, Pretoria.

Design and layout

Yolanda Chirango

Photo credits

Alison Kock, Jean Tresfon, Mark van Coller, Lisa Beasley, Georgina Jones, Morne Hardenberg, Mick Haupt, Claire Lindeque, Tobias Reich, Steve Benjamin, Two Oceans Aquarium

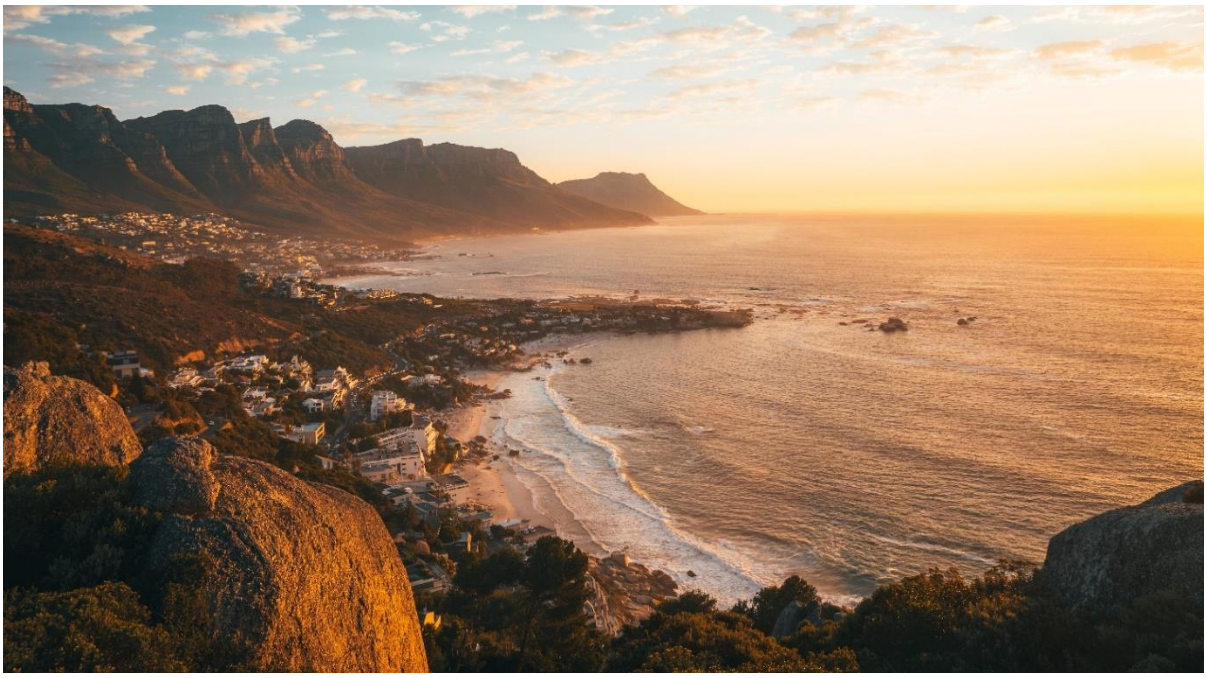
Enquiries

Alison Kock email: alison.kock@sanparks.org or cape.researchcentre@sanparks.org

Acknowledgements

SANParks sincerely thanks the Table Mountain Fund for funding a project in 2019 to re-assess the state of biodiversity of the Table Mountain National Park Marine Protected Area (TMNP MPA) since it was declared in 2004. This State of Knowledge report and associated species lists are deliverables of that project (TM 5850 - *Re-assessing the biodiversity and status of marine resource use in the Table Mountain National Park Marine Protected Area*). We also gratefully acknowledge comments on earlier versions of this report from Dr Ane Oosthuizen (Park Planning, SANParks), Wendy Johnson (Socio-Economic Transformation, SANParks), Ezekiel Kosa (Table Mountain National Park, SANParks) and Deborah Winterton (Cape Research Centre, SANParks). Sarah Waries and Mandy Giorgio of Shark Spotters NPO are thanked for administering the project funds.

CONTENTS



The Cape's indigenous people called Table Mountain, "Hoerikwaggo" which means "Mountain in the sea".

1. INTRODUCTION

The Cape's indigenous people, the Cape KhoeKhoe, knew Table Mountain as Hoerikwaggo, meaning "Mountain in the sea". This iconic mountain and its surrounding coastal zone have long been connected, each playing an indispensable role in today's Table Mountain National Park.

The Table Mountain National Park Marine Protected Area (TMNP MPA) is adjacent to the national park and the City of Cape Town and boasts exceptional marine and coastal biodiversity. It stretches from Muizenberg in False Bay, around Cape Point, to Mouille Point on the Atlantic seaboard. Beachgoers, surfers, kayakers, SCUBA divers, free divers, anglers, fishers, rock pool hoppers, and other ocean enthusiasts enjoy the 127 km stretch of coastline year-round.

The TMNP MPA is a designated coastal and ocean space that is legally protected. It is managed to conserve valuable and sensitive ecosystems and species for the benefit of people and nature.

The MPA is managed by South African National Parks (SANParks) and protects several threatened species, such as African penguins, bank cormorants, and several endemic sharks, fish and invertebrate species. The MPA provides a refuge for important commercial species like abalone and West Coast rock lobster, is a hub for recreational activities such as diving, swimming, surfing, kayaking, and protects culturally significant fish traps, shell middens, and historical wrecks.

Several pressures and threats exist for this MPA adjacent to a major city, including over-exploitation and illegal harvesting of marine species, invasive alien species, shipping noise and ship strikes, human-wildlife conflict, pollution (oil, heavy metals, plastics, and sewerage), habitat modification and destruction and climate change.

Large-scale industrial activities like bottom trawling, longlining, mining and aquaculture are excluded from all areas of the MPA to protect vulnerable habitats. Traditional and small-scale fishing communities depend on the MPA to ensure they can continue to catch fish for their livelihoods and conserve their traditions and cultural heritage. The MPA also provides tranquil nature-based experiences that improve visitors' well-being. It provides experiential learning, education and scientific opportunities for school learners, students and professionals.

Table Mountain National Park
Marine Protected Area conserves:

> 24 ecosystem types 2 stromatolite sites 4 shell middens
37 ship wrecks 129 algae species 687 marine invertebrates
46 sharks and rays 149 fish 39 shorebirds and seabirds
16 marine mammals 3 marine reptiles

This report focuses on the coastal, inshore and offshore marine area that forms the TMNP MPA. The primary objective of this report is to provide an overview of the state of knowledge of the MPA, including:

- History and cultural heritage
- Biotic and abiotic characteristics
- Pressures and threats
- Management and conservation
- Research and monitoring activities
- Provides an inventory of species and habitats in the MPA

It is never possible to include all activities and groups contributing to our understanding in a report like this. Still, with a broad target audience, including SANParks staff, academic researchers, practitioners and the public, we hope this synthesis is interesting and informative while providing a foundation to promote and guide future collaborations, research and management.

2. ACCOUNT OF AREA

2.1 Location

Table Mountain National Park Marine Protected Area (TMNP MPA) is a large marine protected area situated on the urban edge of the City of Cape Town, Western Cape Province, South Africa (Fig 1). This MPA includes 956 km^2 of marine estate and a coastline that stretches 127 km around the Cape Peninsula, from Mouille Point in Cape Town to Bailey's Cottage in Muizenberg. TMNP MPA is located in a transition zone between two biogeographical regions, namely the South-western Cape Bioregion and the Agulhas Bioregion (Turpie *et al.,* 2000, Tunley, 2009). The cold Benguela Current, characterized by nutrient-rich upwelling, and the warm Agulhas Current of the Indian Ocean (Griffiths *et al.* 2010), influences the TMNP MPA. Thus, due to its unique location at the junction of two major oceanic systems, the TMNP MPA supports a rich diversity of marine fauna and flora comprising several endemic species (Griffiths *et al.* 2010).

Colourful sea fans, soft corals, sea urchins and sponges decorate the reefs of the MPA
© Mark van Coller

2.2 Declaration and legislation

Before the TMNP MPA's declaration, the marine component of the TMNP was fragmented, comprising several smaller marine reserves (Brill and Raemaekers 2013, Centre for Marine Studies*,* 2001). Several anthropogenic factors affected these marine reserves, including overexploitation of fish stocks and marine invertebrates, pollution, and poaching (Brill 2012). Fisheries management approaches, such as daily bag limits and minimum size limits, were ineffective in stopping the decline of several species due to low compliance and weak enforcement (Hauck and Kroese 2006; Brill 2012). To resolve this situation and ensure effective management of resources, the smaller marine reserves were combined into the TMNP MPA, which was declared in 2004 under section 43 of the Marine Living Resources Act (MRLA 1998). In 2014, all MPAs, including TMNP MPA, were repealed from the MLRA and moved to the National Environmental Management Protected Areas Act (NEMPAA), section 48A, which provided stronger legislation for the management of MPAs.

The TMNP MPA was declared to maintain the natural patterns and processes of TMNP's coastal zones while safeguarding the sustainable use of marine resources (SANParks, 2016). The three gazetted objectives are (Government gazette 2004: No. 26431):

1. Protect the marine environment and the marine biodiversity
2. Allow over-exploited and commercially collapsed species of fish a sanctuary in which to recover and breed
3. Promote and regulate eco-tourism activities and scientific research in a way that does not adversely affect the marine environment and to prescribe penalties for contraventions

Management of the MPA must comply with several national policies, legislation and international conventions. Key relevant legislation includes:

Coast and sea

- Marine Living Recourses Act, 1998 (Act No. 18 of 1998)
- Integrated Coastal Management Act, No 24 of 2008
- Sea Shore Act 21 of 1935
- Wreck and Salvage Act 94 of 1996
- National Environmental Management Act, 1998 National Environmental Management: Integrated Coastal Management Act 24 of 2008

Biodiversity

- National Environmental Management: Biodiversity Act, No. 10 of 2004
- Marine Living Resources Act, No. 18 of 1998
- Sea Birds and Seals Protection Act, 1973 (Act No. 46 of 1973)
- National Environmental Management Act, No. 107 of 1998
- Animals Protection Act, 1962
- Conservation of Agricultural Resources Act, 1983
- National Heritage Resources Act 25 of 1999
- World Heritage Convention Act, No. 49 of 1999

Protected areas

- National Environmental Management: Protected Areas Act 57 of 2003

International conventions and treaties

- Convention on Biological Diversity, 1992
- Convention on International Trade in Endangered species of Wild Fauna and Flora, 1973
- Convention of Migratory Species of Wild Animals, 1991
- Convention on Wetlands of International Importance, especially as Waterfowl Habitat, 1971

Figure 1*. A map of TMNP MPA showing the large controlled zone and six smaller restricted (no-take) zones of the marine protected area.*

2.3 Boundaries

The TMNP MPA includes the seabed, the water, and the airspace above it to an altitude of 1000 metres above sea level (DEFF 2004: 695). The area boundaries extend from:

- the high-water mark between Green Point at position 33°54.075'S; 018°24.037'E and Bailey's Cottage,
- Muizenberg at position 34°06.590'S; 018°28.125'E;
- a line drawn east (090°) from the beacon at Bailey's Cottage to position 34°06.590'S; 018°33.413E;
- a line drawn south (180°) in False Bay from position 34°06.590S; 018°33.413E to position 34° 24' .444S; 018°33.413E;
- a line drawn west (270°) from position 34°24.444S; 018°33.413E to position 34° 24' .444S; 018°15'.000E;
- a line drawn north (000°) from position 34°24.444S; 018°15.000E to
- position 34° 54' .075S; 018° 15' .000E; and
- a line drawn east (090°) from position 34° 54' .075S; 018°33.000E to Green Point (Fig 1; Government Gazette No. 26431)

2.4 Controlled and restricted zones of the MPA

The concept of MPAs in South Africa is not new (Attwood *et al.,* 1997). Historically, marine and coastal reserves gave little consideration to their public nature, economic value, or socio-economic and cultural aspects (Sowman and Malan 2018, Mann-Lang *et al.,* 2021). Communities that rely on the rich marine biodiversity for food security, income and livelihoods (Brill 2012; Hauck 2008) surround TMNP MPA. However, increased fishing pressure from growing coastal communities, increased use of motorized vessels and ineffective regulations have resulted in the collapse of many species, especially those vulnerable due to slow growth and late maturation (Griffiths 2000; Sanguinetti 2013).

Recently, the MPA concept has been promoted as an effective fisheries management and marine conservation tool and has been endorsed by international conventions such as the World Summit on Sustainable Development, the Convention on Biological Diversity and the FAO Code of Conduct for Responsible Fisheries (Brill 2012). In line with international trends in marine resource management, South Africa invested in establishing multiple-use MPA networks with different zones offering different levels of protection. These different zones include controlled areas and restricted (no-take) zones (zonation). A controlled area is where resources are extracted by adhering to minimum size limits, daily bag limits and selective fishing gears (Brill 2012). Restricted zones are where the collection of resources is prohibited, and only low impact and non-invasive activities are allowed (Brill, 2012; SANParks 2016). The TMNP MPA was zoned into one controlled and six restricted zones (Clark 2001; Brill 2012; Brill and Raemaekers 2013; SANParks 2016) (Fig. 2). The restricted zones include Karbonkelberg; Cape of Good Hope; Paulsberg; Boulders; St James and Castle Rock (Clark 2001; Brill 2012; SANParks 2016).

Fishing is allowed in the controlled zones of the TMNP MPA with a valid permit © Jean Tresfon

The restricted areas consist of five no-take zones where no fishing or extractive activities are permitted. In the sixth restricted area around the Karbonkelberg in Hout Bay, only snoek can be caught at depths greater than 35 metres. These no-take zones protect essential breeding and nursery areas for marine life, e.g., West Coast rock lobster, abalone and resident fish. The remaining area of the MPA is designated as a controlled area, where harvesting of living resources is allowed, provided valid permits have been obtained.

2.5 Management authority

Table Mountain National Park marine rangers at work in the MPA © Alison Kock

South African National Parks (SANParks) is the designated management authority of the TMNP MPA. However, the Department of Forestry, Fisheries and the Environment (DFFE) Marine Resources Management, is responsible for issuing fishing permits, allocating fishing quotas and law enforcement, while SANParks (TMNP) undertakes the administrative and coastal law enforcement, monitoring and educational activities. Scientific services from SANParks and DFFE conduct research and monitoring. In addition, the South African Police Service, City of Cape Town law enforcement, environmental officers, and fisheries authorities (DFFE) either collaborate with SANParks or independently operate along the coast to ensure law enforcement and compliance (Brill and Raemaekers 2013).

2.6 Access and facilities

Due to its proximity to Cape Town, TMNP MPA experiences high tourism, recreational, research and educational activities. Cape Point and Boulders African penguin colony are two internationally renowned tourist attractions within the TMNP that, in 2019, attracted over 1.1 million and 800,000 visitors, respectively (Wesgro Annual Report 2019). There are three harbours within the TMNP MPA's boundaries: Simons Town, Kalk Bay and Hout Bay. These harbours facilitate and support a wide range of activities, including commercial fishing (e.g., purse-seiners, longlining vessels and rock lobster fisheries) and tourist and recreational use (e.g., charter fishing, boat-based whale and shark watching, yachting, snorkelling with Cape fur seals, SCUBA diving and sea kayaking).

Hout Bay harbour is one of three harbours located inside the MPA © Mick Haupt

There are six small vessel launching sites within the MPA, i.e., Witsands, Kommetjie, Millers Point, Simon's Town, Buffels Bay and Granger Bay. The Oceana Power Boat Club is adjacent to the MPA at the Mouille Point boundary. There are also three access pay points, namely, at Oudekraal, Boulders and the Cape of Good Hope.

Cape Point's first lighthouse, completed in 1859, stands 238 m above sea level © Jean Tresfon

3. HISTORY AND MARINE CULTURAL HERITAGE

3.1 Geological history and paleontology

The three main rock formations of the Cape Peninsula include the late-Precambrian Malmesbury Group, the Cambrian Peninsula Granite, and the Cambrian-Carboniferous Table Mountain Supergroup. The Malmesbury group, the oldest rock formation in the area (560 – 540 million years ago (MYA)), forms the base of Table Mountain and was deposited on the ancient continental slope in the Adamastor Ocean (an earlier version of the South Atlantic) by submarine slumping and turbidity currents (Hartnady *et al.,* 1974; Theron *et al.,* 1991). Around 600 – 530 MYA, the cratonic plates of South America and Africa collided and merged, forming part of Gondwana (Meert and Van der Voo 1997). Consequently, intense heat and pressure metamorphosed these rocks, folding them tightly in a north-west direction so that the rock layers are now almost vertical (Theron *et al.,* 1992). These metamorphosed rocks, consisting of alternating layers of dark grey mudstone and lighter sandstone, can be seen along Sea Point's coast.

During the early Cambrian (around 545 - 540 MYA), magma intruded into the Malmesbury Group. This intrusion of hot igneous rock locally metamorphosed the host shales before cooling into hard and coarse-grained crystalline granite, forming the Peninsula Granite. This coarse-grained granite rock consists of large white or pink feldspar crystals, flakes of black mica and glass brown quartz and inclusions of dark Malmesbury hornfels (fine-grained metamorphic rock) (Theron *et al.,* 1992). Subsequently, prolonged uplift and erosion have exposed the once deeply buried Peninsula Granite (Meadows and Compton 2015). Most exposed granite is extensively weathered, resulting in the characteristic round granite boulders commonly seen around the Llandudno and Simon's Town coastline. The contact zone between the Malmesbury Group and the intruded molten granite is visible at Sea Point, famously noted by Charles Darwin on his voyage aboard the HMS Beagle in 1836 (Darwin (1809-1882) 1959). Together, the remaining eroded Malmesbury group and the Peninsula Granite formed a platform upon which the younger sedimentary sandstone of the Table Mountain Group was deposited in stream channels and tidal flats around 500 – 440 MYA (Compton 2004). Along the Peninsula, the Table Mountain Group (which forms the basal section of the Cape Supergroup sequence) is approximately 2 km thick and is divided into the basal Graafwater Formation (80-100 m thick), the overlying Peninsula Formation (800 - 1500 m thick), and the newer rock type of the Pakhuis Formation found on the highest points of Table Mountain (Compton 2004).

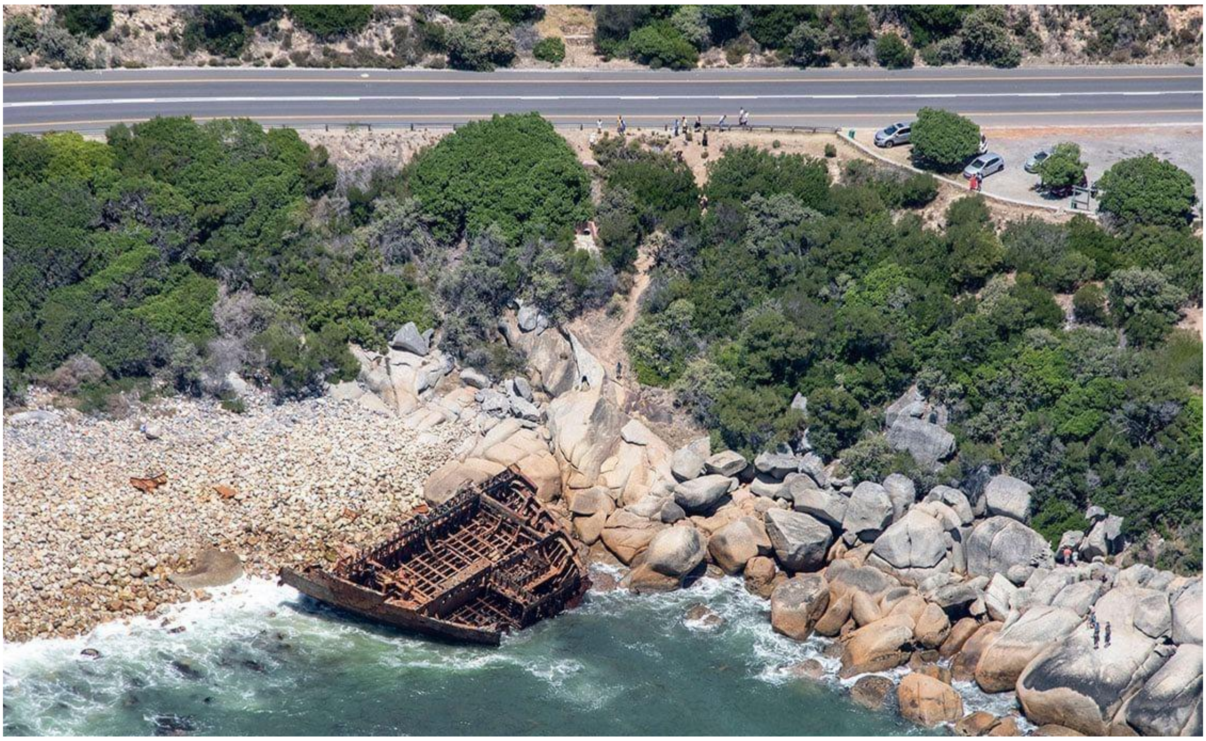
Trace fossils, in the form of tracks left by aquatic invertebrates crawling and burrowing in a mud surface some 500 MYA, are found in the Graafwater deposits of Table Mountain (Hunter 1987). The earliest preserved remains of plants (primarily pollens) have been discovered in Noordhoek on the Cape Peninsula, with Winteraceae pollen fossils dating back to the late Miocene (13 – 6 MYA) (Coetzee and Praglowski 1988). However, most marine fossil deposits are mainly found further inland in previously underwater areas, such as in Langebaanweg (100 km north of Cape Town), one of the region's most significant fossil sites. Fossils dating back 5 million years, discovered at Langebaanweg, have provided insight into the prehistory of the Cape coast, showing rich and diverse cetacean and seal fauna during the Mio-Pliocene (Govender *et al.,* 2012; Govender and Chinsamy-Turan 2013). There were also at least four species of penguins (*Dege hendeyi*, *Inguza predemersus*, *Nucleornis insolitus*, and *Palaeospheniscus huxleyorum*) during the early Pliocene (Simpson 1971, 1973, 1979a, 1979b), compared to just one extant species, the African penguin (*Spheniscus demersus*) found today.

Studies investigating the paleo-oceanographic climate in the region indicate that although the Benguela upwelling system had its origins during the late Miocene (around 12 MYA), the system as we currently understand it emerged during the late Pliocene (2 - 3 MYA) (Shannon and Pillar 1986). The nutrient-rich waters resulting from this upwelling, contributed to the evolution of distinct seaweed flora within this relatively short evolutionary period (Bolton and Levitt 1987). During the Pliocene and subsequent Pleistocene ice-age (between 2.6 million and 18,000 years ago), average sea levels have ranged between 120 m lower and 30 m higher than today's average sea level due to interglacial global warming cycles and dynamic polar ice sheets containing variable amounts of water (Compton 2004). Periodically, due to global warming and melting ice caps, the Cape Peninsula has been an island. As sea levels retreated, beach sands with shell fragments and estuarine muds were deposited and later overlain by calcrete-cemented dune sands. Evidence of higher sea levels (between +4 and +8 m) can be seen with wave-cut caves between Cape Point and Muizenberg at various locations, including Rooikrans, Batsata Cove, Blaasbalkgrot and Hell's Gate (Theron *et al.,* 1992).

3.2 Archaeology

Archaeological evidence indicates that "Strandlopers" (coastal dwellers) were the first humans to inhabit the caves and rock shelters of the Cape Peninsula since the Later Stone Age (Werz 2003). For example, excavations of a large granite cave and shell midden overlooking Logie's Bay (Llandudno) found several artefacts, including stone and bone implements, ornaments (e.g., ostrich eggshell beads) and pottery (Rudner and Rudner 1956). Additionally, excavations of a shell midden within Smitswinkel Bay Cave (34° 16' S; 18° 28' E) near Simon's Town reveal layers of deposits dating to around)

.



The Antipolis was a Greek tanker built in 1959, which sank in July 1977. Since then, it has been a favourite dive spot for locals. However, in January 2022, large swells washed it ashore 44 years later, where it now lies on the rocky shore © Jean Tresfon

1,400 years ago (Poggenpoel and Robertshaw 1981). These deposits include fish and shellfish remains from various species and non-lithic artefacts such as bone beads, ostrich eggshell beads and abalone shell pendants. Similarly, excavations of a nearby Strandloper midden-cave at Bonteberg Shelter (34° 12' S, 18° 23' E) revealed that inhabitants from the Later Stone Age ate various marine seafood, including marine molluscs, crustaceans, seals and several fish species (Maggs and Speed 1967). Grindley (1967) examined the first evidence of crayfish in Strandloper remains found at the Bonteberg Shelter and found that these early inhabitants had been exploiting West Coast rock lobster *Jasus lalandii*. These crayfish were also the earliest recorded occurrence of *J. lalandii*. Together, these findings indicate that people in this area have depended on its marine resources since its first inhabitants.

One of the large shell middens located along the coast of the MPA © Claire Lindeque

Another interesting, yet often forgotten Stone Age archaeological site is Peer's Cave (also known as Skildergat Kop), located on a south-facing mountain ridge above Fish Hoek (34°7.14' S; 18°24.49' E). Initially causing much furore, the cave was reported to contain cave paintings (the most southerly in Africa), beads, ochre and human skeletal remains (Peers 1927, 1928, 1929; Goodwin 1929; Jager *et al.,* 1941, 1942).

It was initially thought that the human skeleton originated in the upper Pleistocene (Middle to Later Stone Age) (Keith 1931; Rightmire 1974, 1978; Stynder 2006). However, a later study using updated radiocarbon dating methodology has shown this skeleton from the more recent mid-Holocene (Later Stone Age) (Stynder *et al.,* 2009). There has also been debate whether cave paintings initially reported ever existed (Goodwin 1929; Andreassen 2010). However, there are several possible explanations for the disappearance of these paintings, from destructive excavation methods to damage by smoke from being used as a campsite in modern times to being covered by graffiti in 1980 (Andreassen 2010). Nevertheless, Peer's Cave remains an important archaeological site for its rich and plentiful Stone Age deposits. It also represents how easily important knowledge and archaeological history can be lost through poor extraction methodology and negligence. Coastal sites, especially in Western Cape, are important as some of the earliest contacts between European explorers and indigenous peoples would have occurred in this area.

3.3 Maritime history

The first Europeans to reach the Cape were the Portuguese, led by Bartholomeu Dias, to find a sea route to the East that rounded the Cape in 1488. Originally named the Cape of Storms by Dias, it was renamed by King John II of Portugal the Cape of Good Hope as it represented the hope of opening a trade route to the East. A decade later, compatriot Vasco da Gama followed Dias' route, making it to India, marking the beginning of the European "Age of Discovery" (Athiros and Athiros 2007). An English admiral, Francis Drake, rounded the Cape in 1580, followed by the Dutch in the 1600s, with Jan van Riebeck establishing a permanent trading post in Cape Town in 1652.

The Dutch ruled the Cape between 1652 and 1795 and from 1803 to 1806 (Heese 1972). The British occupied the Cape in 1975, but relinquished the colony back to the Dutch in the Treaty of Amiens (1802). The British reannexed the Cape in 1806 after the beginning of the Napoleonic Wars.

The Cape's rich and diverse maritime history, and treacherous coastline, have caused numerous shipwrecks off its coast. Today, several of these shipwrecks are found within the TMNP MPA, and many are popular SCUBA diving sites such as the "SS Maori", "M.V. Aster", "M.V. Katsu Maru", the five Smitswinkel Bay wrecks and "SAS Pietermaritzburg" (Appendix II, Table 1). Indiscriminate treasure hunters, salvagers and divers have removed or destroyed valuable historical information from much of the underwater heritage. Today, salvaging historic shipwrecks is coordinated by the South African Heritage Resources Agency (SAHRA) through permits governed by the National Heritage Resources Act. This is the most significant domestic legislation protecting shipwrecks older than 60 years. Relevant permits are also needed from SANParks.

The Dutch East India Company used Simon's Bay (Simon's Town) in 1743 to provide a safe winter anchorage for the Dutch East India Company's ships. After the second British occupation, Simon's Town became a naval base in 1814, and a harbour was constructed. At this time, the Cape formally became part of the British Empire under British administration. With no fishing restrictions, the early 1800s saw hunting whales for their meat and blubber gaining momentum in South Africa (Bruton 1998). In 1806, the first whaling station operated from Seaforth in Simon's Town. Due to the smell, it was relocated to the less populated Kalk Bay and later again to the beaches of Muizenberg (Toerien 2000). The southern right whale (*Eubalaena australis*) received international protection from commercial whaling in 1935. By that time, excessive whaling had severely depleted their numbers. However, it was not until 1986 that South Africa supported an international moratorium on all commercial whaling. Today, all whales in South Africa are protected under the Threatened or Protected Species Act (TOPS), and Southern Right and Humpback whales are seasonal visitors of the TMNP MPA.

4. ABIOTIC CHARACTERISTICS

4.1 Climate

Cape Town, and consequently, the TMNP MPA, experiences a Mediterranean-style climate: warm, dry summers and cool, wet winters. As the TMNP MPA is situated at approximately 33-34° S, the climate is influenced by a semi-permanent high-pressure cell over the South Atlantic Ocean in summer. This results in an offshore south-easterly wind that blows along the coast of South Africa. The subsiding air generally results in clear skies and dry air. However, a ridging high-pressure cell may cause post-frontal conditions to advect moist air from the south and southeast, resulting in summer rain (Cowling *et al.,* 1996). In winter, the high-pressure cell is displaced northwards, allowing cold fronts to reach Cape Town. The bulk of the rain falling in this region is due to these cold fronts budding (breaking) off the circumpolar westerly belt (Cowling *et al.,* 1996).

The Cape Peninsula (and thus TMNP MPA) has a wide variation in local climatic conditions, e.g., Maclear's Beacon (the Peninsula's highest point) receives 2270 mm per year compared to 402 mm annual rainfall received at Cape Point. This steep rainfall gradient is due to variation in altitude, aspect and topographic features that trap rain-bearing winds (Cowling *et al.,* 1996). The winter months receive a monthly range of 69-93 mm rainfall, while the dry summer months receive 15-17 mm (van Doorn *et al.,* 2010).

Due to its maritime climate, air temperature variations on the Cape Peninsula are less pronounced spatially and temporally. Winters are cool (7-20 °C), while summers are warm (15-27 °C). Mean annual temperatures on the Cape Peninsula vary between 18 – 20 °C, with a difference in mean maximum and mean minimum temperature ranging slightly from 6 °C at Cape Point to 10 °C on Table Mountain (Cowling *et al.,* 1996).

The climate on the Cape Peninsula is generally dominated by a bi-modal wind regime (Schulze 1965) that demarcates the area's annual seasons. In summer, particularly during January and February, steep pressure gradients along the coast result in the infamous "South Easter" blowing at mean gale-force speeds of 20-40 km/h (Pfaff *et al.,* 2019). However, Clifton Beach, sheltered by Table Mountain, may remain relatively calm in these windy conditions. In winter, north-westerly winds often exceed gale-force speeds of 30 km/h (Cowling *et al.,* 1996). The south-easterly winds result in crystal clean, but very cold upwelled water on the western arm of the Cape Peninsula, while the north-westerly winds provide ideal diving conditions on the eastern (False Bay) arm of the peninsula.

4.2 Geology

The Cape Peninsula forms part of the Cape Folded Belt, which underwent extensive erosion, producing the landscape seen today. The region is composed predominantly of quarzitic Sandstone Mountains, alternating with plains and valleys underlain by softer shales and mantled at the coastal margin with young siliceous and calcareous sediments (Cowling *et al.,* 1996). The Peninsula has an irregular, rocky coastline, which juts into the Atlantic Ocean on its western side and False Bay on its eastern shores. The shape of the coastline is primarily defined by sets of joints and faults in the bedrock, where wave action, pounding on zones of weaknesses, has contributed to its irregular shape and mixture of rocky shorelines, sandy shores and pocket beaches (Theron *et al.,* 1992). Of all the rocks in the area, Table Mountain Sandstone is the most resistant to erosion. In the northern section of the Peninsula, the base of this quarzitic sandstone lies mainly above sea level, while the older rocks form the gentler lower slopes. In the south, these sandstone rocks lie primarily below sea level, forming the mountains of the Cape Peninsula and the steep coastal cliffs seen around Hout Bay and Cape Point (Rust 1991).

Off the Cape Peninsula's West Coast, the bottom sediment is mostly fine white quarzitic sand interspersed with areas of coarser shelly sand. However, off the east coast, the bottom sediments are more varied. Glass (1980) showed that there are areas of sand from course to very fine sand at sheltered Simon's Bay. In contrast, the sediments surrounding granite outcrops are coarser, calcareous material, mostly from mollusc shell fragments with patches of coralline algae fragments (Terhorst 1988).

Dolerite dykes, primarily fine to medium-grained, dark-grey, melanocratic rocks found around the Cape Peninsula, form part of the dolerite dyke swarm, which intruded 130-132 MYA into the Malmesbury Group, the Cape Granite Suite and the lower formations of the Table Mountain Group. These dykes follow an NW-SE trend and are mostly 1-2 m wide. An exception is at Logie's Bay, where the dyke is more than 40 m in places (Reid *et al.,* 1991).

4.3 Physiography

4.3.1 General topography

The Cape Peninsula is renowned for its spectacular scenic beauty, primarily attributed to its topographic heterogeneity. Just over 100 km long and at most 30 km wide, this narrow mountainous strip of land is the most topographically diverse area of similar size in southern Africa (Cowling *et al.,* 1996). A range of mountains stretching from the north to south form the backbone of the Peninsula, with the highest point at Maclear's Beacon (1085 m) on Table Mountain. The cold waters of the Atlantic Ocean lie along its western coastline, which is dominated by a rocky coastline with steep plunging cliffs. Together with high-energy wave action, these cliffs make sediment deposition relatively minor along this coast (Brown 1971). Noordhoek Beach is an exception with its 3.6 km stretch of sandy beach. The western coastline has several small bays, with a single large one at Hout Bay. The Peninsula narrows towards the south, ending in Cape Point. The comparatively warmer waters of False Bay lie on its eastern coastline with bays including Smitswinkel Bay, Simon's Bay and Fish Hoek. At Muizenberg, the coastline becomes relatively low and sandy as it extends east along False Bay.

4.3.2 Drainage

Rivers draining Table Mountain across the Cape Peninsula are estimated to remove around 30 tons of sediment per square kilometre annually (Linol and De Wit 2016). This sediment ultimately ends up in the ocean. The Peninsula has a rectangular drainage pattern, with a mostly parallel NW-SE or NE-SW stream alignment due to its underlying geology (King 1983). In the Peninsula's southern half, mature streams such as the Klaasjagers river, Klawesvlei river (west of Simon's Town), and Schuster's river drain the plateau. In contrast, young streams drain the escarpment. The valleys in these areas are narrow, with steep sides and gradients, following direct courses to the sea. These streams have the greatest energy and erosive powers, resulting in rocky gorges cutting into the Table Mountain sandstone (King 1983). The Disa River, one of the oldest draining Table Mountain, originates on top of the mountain, flowing south through Orangekloof, on the southern slops of the mountain. It converges with its tributaries as the Hout Bay river leading into the Disa (or Hout Bay) estuary, with the entire catchment area covering 33.8 km^2 (Hutchings *et al.,* 2016).

4.3.3 Bathymetry

The coastal area of the Cape Peninsula falls on the western edge of the Agulhas Bank, which has a depth of less than 200 m (Boyd *et al.,* 1985). The bathymetry of the Cape Peninsula changes dramatically between its western Atlantic side and the eastern False Bay side (Pfaff *et al.,* 2019). The West Coast's seabed has a sharper gradient than the False Bay side, with the 100 m contour lying mostly in a south-south-easterly orientation within 10 km of the coastline. The steep continental slope is about 20 km west of the coastline. In contrast, the entire False Bay is relatively shallow, with a depth of less than 80 m, with the 100 m isobath moving across the mouth of False Bay (Boyd *et al.,* 1985). The bottom morphology of False Bay is generally smooth with a few granite outcrops, e.g., Roman Rock (34° 10.52' S 18° 27.36' E) is a major protrusion in False Bay, protruding just above the sea-surface and upon which a lighthouse was built in 1861 (Williams 1993). Castor Rock (34° 10.74' S 18° 27.61' E), a rocky reef located north of the lighthouse, is 3.3 m deep at its shallowest point, and Rambler Rock (34° 10.92' S 18° 27.90 E), a reef southeast of the lighthouse is 8.2 m at its shallowest point (Terhorst 1988). The waters around these granite outcrops are popular diving sites for Cape Town's resident SCUBA divers.

4.4 Oceanography and hydrography

Although the TMNP MPA is not located at the most southerly tip of Africa, it has a unique oceanographic setting being the most south-westerly tip. It serves as a boundary between the Benguela and Agulhas Marine Provinces, with significant variation in marine life on either side of the peninsula (Smit *et al.,* 2013). While both sides of the Peninsula are bound by the cold waters of the Atlantic Ocean, the eastern False Bay coastline experiences warmer temperatures than the West Coastline, which is cooled by summer upwelling (McQuaid and Branch 1984; Smit *et al.,* 2013; Coppin *et al.,* 2020). The physical oceanography of the waters surrounding the TMNP MPA is influenced by the bi-directional wind regime, dominated by anticyclonic (southerly) winds in summer and cyclonic (northerly) winds in winter (Terhorst 1988). During summer, the anticyclonic high-pressure zone generates strong south-easterly winds. These strong winds blow offshore on the Peninsula's western side, driving the surface water north-west, away from the coast. Combined with Coriolis forces, these winds facilitate upwelling, as the displaced surface water is replaced with cold, nutrient-rich water from the depths (Shannon 1985). In winter (May-August), these conditions change radically as the anticyclonic highs are replaced with successive, east-moving, cyclonic lows (cold fronts) that bring north-westerly winds and rain. These winds blow offshore on the eastern side of the Peninsula, preventing swell from entering False Bay, resulting in calm waters.

The waves reaching the shores of the Cape Peninsula are due to the combination of local wind waves and distant swell sources. The Cape Peninsula's general prevailing swell direction is from the southwest, typified by long-period swells (12 – 15 seconds) and an average wave height of 3 m (Pfaff *et al.,* 2019). The western side of the Peninsula experiences significantly higher waves than the eastern side (Coppin *et al.,* 2020), as much of the Peninsula's eastern coast is sheltered from the prevailing swell direction and wind waves. However, seasonal southerly swells created by low-pressure systems from the Southern Ocean create large ocean waves and storm surges, often causing shoreline structural damage visible at the seafront of Kalk Bay. The Cape Peninsula has relatively weak local tides and no strong tidal currents, with a low tidal range varying between 1.8 m and 1.9 m on both sides (Van Zyl 2018).

On the Atlantic coastline, the mean monthly sea surface temperatures in summer ranges between 10° and 13°C (Smit *et al.,* 2013). Bottom temperatures can be a few degrees colder. During winter, both inshore bottom and surface temperatures are 2°- 3°C warmer, ranging between 13°-15°C (Smit *et al.,* 2013). The average winter surface sea temperature on the False Bay coastline is approximately 13.2 °C, with similar bottom temperatures (Dufois and Rouault 2012). During summer, mean sea surface temperatures are considerably warmer, at approximately 21.5 °C. In comparison, bottom temperatures are 1° - 3 °C lower than in winter (Dufois and Rouault, 2012; Smit *et al.,* 2013). Between December and May, a distinct thermocline usually develops (Gründlingh *et al.,* 1989). Mean annual coastal water temperatures recorded by Coppin *et al.* (2020) show Olifantsbos, on the western side of the Peninsula, to be 14.6°C (± 0.3°C SD), while Buffelsbaai, on the eastern side, was warmer at 15.5 °C (± 0.9 SD).

In addition to these factors affecting the marine environment, occasionally, eddies of the warm (21-25 °C) Agulhas current can move into False Bay and past the Peninsula. These eddies may produce a light- to medium-strength current. Under these conditions, open ocean marine species such as warm water jellyfish and even whale sharks may enter the Cape Peninsula's waters (Jones 2008).

Evidence of higher sea levels (between +4 and +8 m) can be seen with wave-cut caves found between Cape Point and Muizenberg at various locations, including Rooikrans near Cape Point © Alison Kock

The most south-western point of the African continent inside the Cape of Good Hope section of the Table Mountain National Park © Zandrie van der Mescht

5. BIOTIC CHARACTERISTICS

The TMNP MPA has exceptional marine and coastal biodiversity (Griffiths *et al.,* 2010; De Vos *et al.,* 2015) because it lies at the junction of two major oceanic systems. It supports highly diverse fauna and flora comprising numerous endemic species, several migrant species, and the occasional warm water visitor brought in by eddies of the Agulhas Current (Jones 2008). Furthermore, due to the varied environmental conditions, there is a notable difference in marine life on either side of the Peninsula. The cold waters of the western coastline contain giant kelp forests, home to a vast array of reasonably resilient invertebrate life that can withstand being pummelled by the north-west winter storms. The West Coast has greater biomass and productivity than the relatively warmer, calmer eastern coastline, while the east coast typically provides ideal habitats for a broader range of species (Jones 2008; Griffiths *et al.,* 2010).

5.1 Microbes

Microbes, a heterogeneous group of organisms including viruses, prokaryotes (i.e., bacteria and archaea) and small eukaryotes, constitute more than 90% of the ocean's biomass (Díez *et al.,* 2001; Suttle, 2005; Fuhrman 2009; Solonenko *et al.,* 2013). They are key role players in the marine environment: they form the base of marine food webs (Azam *et al.,* 1983; Cho and Azam, 1990), influence oxygen production (Pfennig 1967) and the carbon and nutrient cycles (Longhurst and Glen Harrison 1989; Buchan *et al.,* 2014), regulate mortality (Proctor and Fuhrman 1990; Suttle *et al.,* 1990), and can serve as climate regulators (Holligan 1992). Yet, despite their importance, there is a lack of literature on their diversity and functional role in South African waters, with a few exceptions relating to microbes on sandy beaches (e.g., Koop and Griffiths, 1982, Koop *et al.*, 1982). However, developing sequencing technologies facilitating high-throughput analyses and an inter-disciplinary approach will make future studies more affordable and accessible (Pfaff *et al.,* 2015b). For example, using a metagenomics approach, Flaviani *et al.* (2017) characterized the full microbial diversity within the Southern Ocean and the southwest Indian Ocean from relatively small (<250 mL) quantities of seawater. What is evident from the current literature is that marine microbial composition is exceptionally variable and depends on numerous factors such as nutrient and light availability controlled by the spatial and seasonal variability in the physical environment (Hutchings *et al.,* 2009).

5.1.1 Viruses

Viral numbers range from 10^7 to 10^9 per millilitre of seawater, making them the most abundant biological entities on earth (Williamson *et al.,* 2008, 2012; Martínez *et al.,* 2014). Little is known about their marine diversity (Breitbart *et al.,* 2002; Roux *et al.,* 2011), but it is thought that major virus taxa are pervasive across all marine ecosystems (Breitbart and Rohwer, 2005), comprising 94% of all microbes yet only 5% of all microbial biomass (Suttle 2007). Based on this overwhelming majority, viruses play a pivotal role in driving the dynamics in marine systems by regulating population numbers of dominant species and thereby allowing weaker competitors to co-exist (Brussaard *et al.,* 2008). Studies pertaining specifically to TMNP MPA are lacking.

5.1.2 Bacteria and marine microbial eukaryotes

Eukaryotes play an essential role in upwelling regions such as the southern Benguela ecosystem (extending from Orange River in the north to Cape Agulhas in the south), with research showing significant links between bacterial production and primary production in the ocean (Painting *et al.,* 1993; Prieto *et al.,* 2016). The nutrient-rich upwelled water stimulates high primary production, primarily by diatoms, followed by high bacterial abundance (Lamont *et al.,* 2014) and potentially harmful algal blooms (Pitcher and Calder, 2000; Kudela *et al.,* 2005). As grazing pressure increases, light and nutrients become limited, this primary production and bacterial abundance decline (Rocke *et al.,* 2020). Studies in the southern Benguela region have mainly focused on measuring bacterial biomass during upwelling events, where bacteria and picoeukaryotes (0.2-3 µm in diameter) peak post upwelling due to high dissolved nitrogen and carbon concentrations caused by decaying phytoplankton blooms (Brown *et al.,* 1991; Painting *et al.,* 1993). Rocke *et al.* (2020) described the marine microbial communities of the southern Benguela from samples taken near St Helena. However, studies on the marine microbial composition explicitly related to the TMNP MPA are limited.

5.2 Plankton

5.2.1 Phytoplankton

Autotrophic phytoplankton forms the base of the marine food web. Phytoplankton responds quickly to upwelling, as sunlight and nutrients influence its abundance. A proxy for phytoplankton biomass is the concentration of chlorophyll-a in the water (Brown *et al.,* 1991). Surface chlorophyll-a concentration (obtained from satellite imagery and oceanographic cruise collections) indicate that phytoplankton biomass off the Cape Peninsula coast is moderate (2.77 mg.m-3), but lower than those found off Namibia (15-29° S; 5-6 mg.m-3) (northern Benguela ecosystem) and are highest near the coast, while decreasing offshore (Brown *et al.,* 1991; Verheye *et al.,* 2015). Brown *et al.,* 1991 estimated that the Cape coast of southern Benguela (29 - 34°30' S, an area of 104 000 km^2 including TMNP MPA) supports ~671420 tons of phytoplankton biomass, which is considerably lower than the northern Benguela ecosystem of ~2558300 tons (covering an area of 179 000 km^2). However, the Peninsula has distinct seasonal variations, with chlorophyll levels reaching a maximum during summer and a minimum during winter (Verheye *et al.,* 2015). This seasonal fluctuation in chlorophyll-a concentrations, characteristic of this sector of the Benguela current, is in contrast to the northern sector of the Benguela ecosystem, which experiences a uniform distribution (Brown *et al.,* 1991). The surf zone at Muizenberg supports major accumulations of surf diatoms, *Annaulus australis* that drive high productivity on the adjacent beaches (Campbell, 1996). These accumulations are relatively rare globally (Odebrecht *et al.*, 2013) and are not harmful.

Dense, orange-red coloured algal blooms are common in coastal areas and tidal pools in coastal regions around Cape Town. Dinoflagellates, characterized by having a eukaryotic endosymbiotic algae, are responsible for the coloured waters. Horstman *et al.* (1981) identified *Noctiluca scintillans* as the dinoflagellate most often responsible for red tides in False Bay. These blooms are seldom harmful. To the delight of Cape Town residents, this species creates a sea of bioluminescence at night time, attracting flocks of people to the beachfront to witness the natural spectacle. Novel species of dinoflagellates found in TMNP MPA include *Durinskia capensis* sp. nov. (Peridiniales, Dinophyceae) sampled from a tidal pool at Kommetjie, Cape Peninsula (Pienaar *et al.,* 2007), and *Bysmatrum austrafrum* sp. *nov.* (Dinophyceae) collected from a tidal pool at Bordjiesrif, Cape Peninsula (Dawut *et al.,* 2018).

5.2.2 Zooplankton

Zooplankton, dominated by copepods and euphausiids, plays a pivotal role in the Benguela ecosystem: they control phytoplankton abundance through grazing and are food sources for higher tropic levels (Verheye *et al.,* 2015). The waters of the Cape Peninsula display distinct seasonality in zooplankton biomass, with summer peaks and winter troughs linked to the seasonal variations in wind intensity and primary production (Pillar 1986). Andrews and Hutchings (1980) observed a twofold increase in zooplankton biomass during summer (3g dry weight m^{-2} in January) compared to winter (1.5g dry weight m^{-2} in August), taken from water columns along a line of stations of the Cape Peninsula. Biannual zooplankton sampling has been conducted off the west and south-West Coasts of South Africa since 1988 (Huggett *et al.,* 2009). Huggett et al. (2009) investigated inter-annual variability between 1988 and 2003 in copepod (a proxy for zooplankton) biomass, size composition and production over the continental shelf of the southern Benguela system. They found an uneven distribution of copepod biomass and production across the system. The southern sector (from Cape Agulhas to Cape Columbine, including TMNP MPA) was considerably lower than the northern sector (extending north from Cape Columbine to the Orange River). However, there was no clear evidence of consistent trends in inter-annual variability within the southern sector. This is in contrast to the coast of St Helena Bay, which has shown an initial two-fold increase in abundance and change in species composition between the 1950s and mid-1990s, followed by a decline since the mid-2000s suggesting the occurrence of significant changes in the ecosystem (Verheye *et al.,* 2015). Closer to shore, mysids such as *Gastrosaccus psammodytes* can be found in the surf (Harris *et al.*, 2014).

5.3 Algae

Leliaert *et al.* (2000) investigated the composition of the subtidal algal communities surrounding the Cape Peninsula. This study recorded 142 seaweed taxa (Appendix II, Table 1) across their sampling sites comprising 21 Cholophyta (green algae), 14 Phaeophyta (brown algae) and 107 Rhodophyta (red algae). On the Peninsula's Atlantic West Coast side, prominent species included foliose red algae such as *Botryocarpa prolifera*, *Botryoglossum platycarpum*, *Epymenia capensis*, *E. obtusa*, *Gigartina bracteata*, *Neuroglossum binderianum*, *Pachymenia carnosa*, *Plocamium corallorhiza*, *Thamnophyllis discigera*, *T. pocockiae*; and filamentous red algae such as *Ceramium obsoletum*, *Polysiphonia virgata*, and *Polyopes constrictus*. While, on the False Bay coastline, Leliaert *et al.,* (2000) mainly recorded encrusting and articulated coralline rhodophytes such as *Bifurcariopsis capensis*, *Caulerpa filiformis*, *C. holmesiana*, *Codium stephensiae*, and *Champia compressa*, as well as green algae, *Bifurcariopsis capensis* (Phaeophyta). Species on both sides of the Peninsula included *Acrosorium acrospermum*, *Ceramium planum*, *Ecklonia maxima*, *Griffithsia confervoides*, *Plocamium rigidum*, *Pterosiphonia cloiophylla*, *Rhodymenia natalensis*, and *Trematocarpus flabellatus*.

Over 140 species of algae are found inside the TMNP MPA © Alison Kock

The kelp forests, characteristic of the West Coast, include the fast-growing sea bamboo (*Ecklonia maxima*) (the largest species growing up to 17 m in length) and split fan kelp (*Laminaria pollida*) (Branch *et al.,* 2005). Epiphytes attached to the kelp include *Carpoblepharis flaccida*, *Suhria vittata*, and *Polysiphonia virgate* (Branch *et al.,* 2005). West Coast kelp forests have been commercially utilized for several decades, mainly for alginate production (Anderson *et al.,* 2003), fertilizer supplement (~50 tons per year is harvested from Kommetjie for this purpose) and as feedstock in the abalone aquaculture industry. Kelp harvesting is only permitted in the controlled zone of the TMNP MPA on the western side of the MPA.

While Rhodophyta contributed towards the majority of the West Coast's biomass, on the False Bay (eastern) coastline, the average biomass of Rhodophyta is comparatively low, with the three groups (Rhodophyta, Phaeophyta and Chlorophyta) having similar biomass (Leliaert *et al.,* 2000). Here *Caulerpa* spp., *Codium stephensiae* (Chlorophyta) and *Bifurcariopsis capensis* (Phaeophyta) form a substantial proportion of the biomass, much higher than on the West Coast. Additionally, small, colourful seaweeds, such as *Dictyota* and *Hypnea*, are common in the tidal pools, and tough jelly-weeds (e.g., Gelidium) are found in the gullies on the east coast (Branch *et al.,* 1994). Leliaert *et al.* (2000) found that the steep seawater temperature gradient between the west and east coastline was a major factor controlling the variation in the composition of these communities on either side of the Peninsula. Additionally, the West Coast has a higher degree of wave exposure. This may result in a higher occurrence of grazers on the east coast and, consequently, the greater proportion of encrusting corallines observed due to increased grazing pressure (Leliaert *et al.,* 2000).

5.4 Marine Invertebrates

To date, 687 marine invertebrate species have been identified in the TMNP MPA (Appendix II, Table 2).

5.4.1 Sponges

Sponge species composition and distribution along South African coastlines are understudied despite their diversity and abundance (Samaai et al., 2018). Two major classes of marine sponges include Calcarea (characterised by calcium carbonate spicules) and Demospongiae (which contain spongin and may or may not have spicules). Sponges within TMNP MPA belonging to Class Calcarea include the hairy tube sponge (*Sycon* spp.), branching ball sponge (*Leucoslenia* spp.) and tube sponge (*Leucoslenia* spp.) (Branch *et al.,* 2005). Samaai and Gibbons (2005) described the taxonomy and biodiversity of Demospongiae found within the intertidal and shallow-water on South Africa's West Coast. Two of their study sites were within TMNP MPA: Hout Bay (location 34° 03' S, 18° 18' E) and Oudekraal (location 33° 59' S, 18° 22' E). Species identified at these sites that are endemic to the West Coast include *Polymastia littoralis*, *Clathria (Clathria) conica*, *Clathria (Clathria) dayi*, *Lissodendoryx (Lissodendoryx) stephensoni*, *Ectyonopsis flabellate*, *Esperiopsis informis* and *Callyspongia (Callyspongia) tubulosa.*

*The beautiful blue and yellow hunchback amphipod (*Iphimedia gibba) *is a resident of the MPA © Georgina Jones*

This study also described several new species from these two sites, including *Craniella australis*, *Polymastia atlanticus*, *Halichondria (Halichondria) capensis*, *Lissodendoryx (Anomodoryx) coralgardeniensis*, *Aaptos alphiensis*, *Tethya rubra*, *Hymeniacidon sublittoralis*, *Clathria (Thalysias) hooperi*, *C. (Axosuberites) benguelaensis*, *C. (Isociella) oudekraalensis*, *Antho (Acarnia) kellyae*, *Mycale (Oxymycale) stephensae* and *Petrosia (Strongylophora) vulcaniensis* (Samaai and Gibbons 2005).

5.4.2 Cnidarians

Cnidarians are a massive, diverse group comprising anemones, corals, sea fans, jellies and hydroids. Kruger and Griffiths (1998) examined species composition, abundance and distribution patterns of intertidal sea anemones on the Cape Peninsula (one site was within TMNP MPA: Woolley's Tidal Pool, Kalk Bay) (Supplementary data, Table 4). This study also investigated the diet, consumption rate, and density of anemones found at the study site. Anemones are carnivorous, and their high densities recorded (660 m^{-1}) together with their high consumption rates of prey (including isopods, amphipods, cirripedes, pelecypods and gastropods) illustrate their importance as major invertebrate predators (Kruger and Griffiths 1998).

Species identified at Woolley's Tidal Pool include *Actinia equina* and *Anthothoe stimpsoni* (located mostly in the upper intertidal, *Anthopleura michaelseni*, *Bunodosoma capensis* and *Bunodactis reynaudi* (located in the mid to low intertidal) and *Pseudactinia varia*, Carlgren and *P. flagellifera* (located in sheltered pools) (Kruger and Griffiths 1998). Acuña and Griffiths (2004) examined South African sea anemones' species richness, distribution patterns, and endemicity (orders Actinaria and Corallimorpharia). This was later reviewed and updated by Laird and Griffiths (2016). Endemic sea anemones within TMNP MPA, belonging to order Actinaria, include *Halcurias capensis* (distribution includes Cape Town, Agulhas Bank and Kommetjie), *Edwardsia capensis* (distribution: False Bay), *Halcampa capensis* (distribution: False Bay), *Haloclava capensis* (distribution: Simon's Bay), *Phelliactis capensis* (distribution: Cape Point), *Anthosactis capensis* (distribution: Cape Point) (Acuña and Griffiths 2004).

Large areas of strawberry anemones (*Corynactis annulata*), order Corallimorpharia, are also found in the inshore rocky reef near Oudekraal on the Atlantic seaboard of the Peninsula (Laird and Griffiths 2016). Sea anemone species richness is relatively low in South Africa; however, Cape Town and False Bay have comparatively high richness, with False Bay having a high proportion (37%) of endemicity (Acuña and Griffiths 2004). Likely, many more species are yet to be discovered, given that Laird and Griffiths (2016) were able to describe 14 new South African species in a relatively short study.

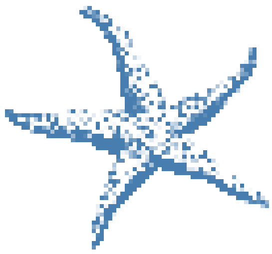
Large patches of strawberry anemones (Corynactis annulata) *inside the TMNP MPA are protected from reef damaging activities © Alison Kock*

There are few studies on hard and soft corals within TMNP MPA. *Malacacanthus capensis*, the only soft coral (Order Alcyonacea) species in its genus, is a common inhabitant and is endemic to South Africa. Its distribution extends from Cape Peninsula to southern KwaZulu-Natal (Williams 1987; Jones 2008). Species of hard corals (Order Scleractinia) include *Balanophyllia (Balanophyllia) bonaespei,* and *Caryophyllia* spp. (Branch *et al.,* 2005).

Pagès *et al.* (1992) described 64 species of medusae (including Hydrozoa, Scyphozoa and Cubozoa) collected from oceanic expeditions between 1977 and 1986 identified in the Benguela Current. Examples in the TMNP MPA include compass sea jelly (*Chrysaora hysoscella*), which has the largest biomass in the Benguela system, and the pelagic root-mouthed sea jelly (*Eupilema inexpecta*) (Pagès *et al.,* 1992). *Candelabrum tentaculatum* (also known as *Myriothela capensis*), a sessile marine hydroid, is endemic to South Africa and only described from Cape Peninsula and Port Elizabeth.

5.4.3 Echinoderms

Literature dealing with the Echinoderm fauna in South Africa, especially TMNP MPA, is sparse and outdated despite their vital role in the community structure and ecology of marine habitats. For example, the predatory behaviour of asteroids, and the consequent escape behaviour of prey, can influence the distribution patterns of the prey (e.g., mussels; Griffiths and Hockey 1987). Large sea stars, such as spiny starfish *Marthasterias africana* and granular starfish *Fromia schultzei*, are found around both sides of the Peninsula (Jones 2008). The Cape urchin *Parechinus angulosus* is the most common echinoid found in dense communities around the Cape Peninsula (Fricke 1979, 1980). These grazers are essential in regulating the density of *Ecklonia maxima* kelp forests (Fricke 1979). The Cape urchin plays a vital role in the survival of juvenile abalone, *Haliotis midae*, as the urchin provides the abalone with protection from predation and access to additional food sources (Day 1998). Sea cucumber species (class: Holothuroidea), *Thyone aurea*, and *Pentacta doliolum* are commonly found together in dense clusters around the Cape Peninsula. This commensalism interaction is thought to be a means to resist water drag in turbulent areas, where they can feed efficiently as filter feeders (Barkai 1991).



The intricate cobbled starfish (Calliaster baccatus) *thrives inside the TMNP MPA © Georgina Jones*

The red-breasted sea cucumber *Hemiocnus insolens* is also commonly found within the TMNP MPA (Barkai 1991; Jones 2008). Other echinoderms found in the TMNP MPA include brittle stars (Class: Ophiuroidea) such as *Astrocladus euryale*, *Ophiothrix fragilis*, *Amphiura capensis* and *Ophiarachnella capensis*, and feather stars (Class: Crinoidea) such as *Comanthus wahlbergi* and *Tropiometra carinata* (Jones 2008).

5.4.4 Molluscs

Molluscs form the largest marine phylum, comprising diverse groups such as gastropods, bivalves, cephalopods and chitons. The ecology of the limpets, Cymbula (formerly of the genus *Patella*) (Class: Gastropoda) from the Cape Peninsula has been studied in detail, including zonation, feeding, and movements, reproductive cycles, growth rates, desiccation, and commensalism (Branch 1971, 1974a, 1974b, 1975a, 1975b). Branch (1975b) recorded 46 species associated with *Cymbula* spp. from the Cape Peninsula. Mostly, these were species seeking temporary shelter, while some were commensal, such as an amphipod species, *Calliopiella michaelseni*, which was observed to change colour relative to its host species.

The giant periwinkle (known locally as alikreukel), *Turbo sarmaticus*, is an abundant herbivorous gastropod found primarily on the rocky reefs in the lower intertidal and subtidal zones of False Bay (Field *et al.,* 1980). Alikreukel are harvested as a food source and as bait for recreational fishers, making them vulnerable to over-exploitation. Another commonly harvested gastropod is abalone (also known as perlemoen), *Haliotis midae*. This species has one of the highest commercial values of any of South Africa's marine resources per kilogram. Therefore, reefs around the Cape Peninsula face severe pressure from illegal harvesting (Mayfield *et al.,* 2001; de Greef, 2013).

Bullia rhodostoma and *B. digitalis* are whelks found in the beach swash and low shore. *B. pura*, *B. laevissima* and *B. tenuis* are found subtidally. White mussels *D. serra* are a recreationally harvested species, and *Scissodesma splengeri* are common in False Bay.

Abalone (Haliotis midae) *are provided protection inside the MPA © Alison Kock*

Bivalves of the order Mytilida, such as the black mussel (*Choromytilus meridionalis*), the ribbed mussel (*Aulacomya ater)* and the brown mussel (*Perna perna)*, frequently co-exist on the Cape Peninsula's rocky shores (Bayne *et al.,* 1984). The Mediterranean mussel (*Mytilus galloprivincialis)*, an invasive European species, is a common inhabitant competing with the indigenous bivalve species (Grant and Cherry 1985).

Cephalopods (cuttlefish, squids and octopuses) are arguably the most cognitively advanced invertebrates, with large, complex brains and high behavioural flexibility (Packard 1972; Young 1991; Hochner *et al.,* 2006; Mather and Dickel 2017). Thus, many early studies focused on their nervous system, learning and behaviour, particularly on the common octopus, *Octopus vulgaris* (Mangold 1983).

The common octopus inside the TMNP MPA was the star of the award-winning Netflix documentary My Octopus Teacher © *Alison Kock*

The biology, ecology and population dynamics of octopus species have since been extensively studied, revealing their wide depth and geographic distributions, short lifespans ranging from six months to three years (Mangold 1987), and opportunistic predatory behaviour (Nixon 1987). However, relatively few studies on octopuses from the south-western Cape exist. An exception is Smith (1999) that investigated the biology, ecology and diet of three common species. These were the brush-tip octopus *Eledone schultzei*, the giant octopus magnificus *Octopus magnificus*, and the common octopus *O. vulgaris* from several sites on the Peninsula's False Bay coastline. *A. schultzei* is a small (<350 g) shallow-water species (intertidal zone – 18 m) mainly found west of Cape Point. On the other hand, the larger *O. vulgaris* (average of 4625 g) is common throughout South African waters, with a more extensive depth range (intertidal zone – 290 m), and even larger *O. magnificus* (average of 8625 g) common in deeper (110-560 m) temperate waters. *O. vulgaris* is short-lived, fast-growing and has firm textured meat. This, together with its accessibility in shallow water, makes it the most suitable species for exploitation by small-scale fisheries (traditionally for bait) (Smith 1999). However, since 2014, *O. vulgaris* has been exploited inside the controlled zones of the TMNP MPA in an exploratory fishery (DEFF, 2020a). Up to 51 tonnes of *O. vulgaris* were caught in 2018, with most of the catch caught in False Bay (DEFF 2020a). There is currently no data available on the population status of *O. vulgaris* in the TMNP MPA or how much is harvested.

TMNP MPA has a wide variety of Heterobranchia (sea slugs and nudibranchs), including orders Cephalasipidea, Anaspidea, Sacoglassa, Notaspidea and Nudibranchia. With over 80 species, this area attracts recreational divers to view these small, colourful and varied animals. Most of the Opisthobranch species of the Cape Peninsula are recorded in Zsilavecz (2007)


The TMNP MPA is home to over 80 species of nudibranchs (sea slugs) with some species still undescribed to science. The nudibranchs' variety of sizes, shapes and colours attract numerous divers and underwater photographers © Lisa Beasley

5.4.5 Arthropods

Marine arthropods are a highly successful phylum, having evolved into various forms, with major groups including sea spiders and crustaceans. Sea spiders (Class: Pycnogonida) common to TMNP MPA waters include *Tanystylum brevipes*, *Queubus jamesanus* and *Nymphon signatum* (Jones 2008). Subphylum Crustacea includes marine lobsters, crabs, shrimps, prawns, isopods, amphipods and barnacles. There is a rich diversity of these animals on the sandy and rocky shores. Isopods such as *Ligia* are abundant on rocky shores, and amphipods such *Capeorchestia capensis* and *Africorchestia quadrispinosa* are found by the thousand on beach-cast kelp wrack. A notable beach isopod that is relatively rare but present in TMNP MPA is *Tylos spp*, with *T. granulatus* being a potentially Endangered species (Brown 2000).

The West Coast rock lobster, *Jasus lalandii*, is a keystone predator (mainly of mussels) in shallow coastal waters, playing a vital role in prey density and population structure (Newman and Pollock 1974; Pollock 1979; Griffiths and Seiderer 1980). Over-exploitation, together with a reduction in growth rates (Pollock *et al.,* 1997), has severely depleted *J. lalandii* stocks (the current harvestable biomass is estimated to be 2-3 % of their pre-exploitation levels (Johnston and Butterworth 2017). To prevent overfishing, fishing quotas are allocated to commercial fisheries (regulated by total allowable catch) and recreational fisheries (regulated by daily bag limits and closed seasons, generally between mid-April and November).

Hermit crabs (family: Paguroidea) of South Africa are a largely understudied group of crustaceans. *Areopaguristes engyops* is the most common hermit crab in the TMNP MPA, found in large groups under boulders in the mid-intertidal zone (Landschoff 2018).

The restricted zones of the MPA protect the breeding stock of the West Coast rock lobster (Jasus lalandii) *© Mark van Coller*

5.5 Marine vertebrates

5.5.1 Fish

5.5.1.1 Chondrichthyans

Chondrichthyans (sharks, rays and chimaeras) are globally harvested (Best *et al.,* 2013; Dulvy *et al.*, 2014). In combination with late sexual maturity and slow growth, overexploitation has caused a significant decline in chondrichthyan populations, with many species considered Vulnerable, Endangered, or Critically Endangered (Dulvy et al., 2014). Removing top predator sharks can trigger cascading effects on marine ecosystems (Heithaus *et al.*, 2008). Ecosystem changes can have significant socioeconomic and ecological repercussions.

Recent research on the diversity and abundance of chondrichthyans includes catch data from beach-seine, recreational shore angling and the commercial linefishery, as well as Baited Remote Underwater Video systems (BRUVs) in False Bay, including the eastern arm of the TMNP MPA (Best *et al.,* 2013; De Vos *et al.,* 2015). Best *et al.* (2013) found a high diversity with 37 chondrichthyan species from 18 families within False Bay. To date, nineteen chondrichthyan species were recorded from 11 families between four and 49 m depth across the TMNP MPA using BRUVs (De Vos *et al.,* 2015). In total, >40 species are known to occur in the MPA (Appendix II, Table 3). Puffadder shy sharks *Haploblepharus edwardsii* (listed as Endangered by the IUCN Red List of Threatened Species) were the dominant species in summer and winter (De Vos *et al.,* 2015).

Endangered and endemic puffadder shy sharks (Haploblepharus edwardsii) *are caught as bycatch in commercial trawl fisheries, but they thrive inside the TMNP MPA © Mark van Coller*

The greatest diversity of chondrichthyans on the reefs and shallow water occurs during summer (De Vos *et al.,* 2015). Large aggregations of the endemic spotted gully sharks (*Triakis megalopterus*) regularly occur inside the MPA (unpublished data). The six restricted zones of the TMNP MPA provide refuge for several endemic, resident shark species.

The TMNP MPA provides healthy reefs for threatened and endemic shy sharks to lay their eggs (also called mermaid's purses) ©Alison Kock

In terms of top predators, white sharks throughout the year (Kock *et al.,* 2013). During winter, white sharks aggregate around Seal Island in False Bay due to its population of ~70,000 Cape fur seals (*Arctocephalus pusillus pusillus*) and, in particular, the abundance of young, inexperienced seals (De Vos *et al.,* 2015). During spring, these seal pups have gained sufficient experience in evading sharks; consequently, the white sharks move inshore to northern areas of False Bay (Kock 2014). Reported sightings of white sharks along the coastline, such as at Muizenberg and Fish Hoek, increase during the summer months, likely due to the seasonal increase in prey abundance (Kock *et al.,* 2013; De Vos *et al.,* 2015). Most recently, white sharks have disappeared from False Bay, most likely due to an increase in the presence of shark-hunting killer whales, *Orcinus orca* (DEFF, 2020b). However, further research is needed to better understand the disappearance.

Sevengill sharks (Notorynchus cepedianus) *are abundant top predators inside the TMNP MPA © Morne Hardenberg*

Miller's Point, in False Bay, has one of the largest global aggregations of broadnose sevengill sharks (*Notorynchus cepedianus*) (Engelbrecht *et al.,* 2019). These sharks likely seek refuge from white shark attacks amongst the sheltered kelp forests at Miller's Point (Kock *et al.,* 2013). Two unprecedented reports of killer whale (*Orcinus orca*) attacks on sevengill sharks occurred at Miller's Point between November 2015 and April 2016 (Engelbrecht *et al.,* 2019). Previously co-existing with sharks, it is thought that these attacks were by two killer whales, displaying a novel shark-specialist behaviour, that were newly arrived in the False Bay area (Engelbrecht *et al.,* 2019). A decline in killer whales' prey (pelagic fish and shark species) may have caused a shift in the killer whales' distribution to more coastal areas (Engelbrecht *et al.,* 2019). However, further research is needed to understand the drivers of change in killer whale distribution and its impacts on sevengill and white shark movement patterns and behaviour (Engelbrecht *et al.,* 2019).

5.5.1.2 Teleosts

One hundred and forty-nine teleost species occur inside the TMNP MPA (Appendix II, Table 4). Although most fishes of the Cape Peninsula's temperate waters are comparatively dull in colour, with less variety than those of tropical waters, they have high diversity within species. For example, at least 24 species of klipfish (genus *Clinus)* can be found in the rock pools around the Peninsula, displaying great variation in colour and patterns amongst them (Zsilavecz 2005). Bennett and Griffiths (1984) investigated factors affecting the distribution, abundance and diversity of intertidal fish on the Cape Peninsula. They found that across the 84 rock pools investigated, population densities (in terms of biomass and numbers) on both sides of the Peninsula were similar, whereas species distribution and abundance varied considerably. False Bay exhibited more species, with bluntnose klipfish (*Clinus cottoides*), an endemic fish to South African coasts, and the most abundant intertidal species on the False Bay coast. On the Peninsula's West Coast, the Super klipfish (*Clinus superciliosus)* was the most abundant species. Together, *C. superciliosus*, *C. cottoides* and *Chorisochismus dentex* (rocksucker) comprised 75% of the total biomass and 60% of all fish caught across all sites (Bennett and Griffiths, 1984).

MPAs are vital to the conservation of white steenbras (Lithognathus lithognathus) © *Two Oceans Aquarium*

Variations in species distribution and abundance correlated with the physical characteristics of the rock pools, with the amount of rock cover being the most important factor. Rock cover protects fish from predators; thus, pools with more cover allow for a greater abundance of intertidal fish. Additionally, greater rock cover provides several microhabitats, promoting greater diversity amongst the rock-dwelling species (Bennett and Griffiths 1984). Lechanteur (1999) used underwater visual census (UVC) to evaluate the species composition, abundance and seasonal variation of reef fish assemblage in Castle Rocks Marine Protected Area (MPA) on the West Coast of False Bay. There were 28 species and 11 families of fish recorded during 795 point-counts (Lechanteur 1999). Higher species abundance of Hottentot seabream *Pachymetopon blochii* (30.6%), Strepie *Sarpa salpa* (17.7%), fransmadam *Boopsoidea inornata* (16.1 %), roman *Chrysoblephus laticeps* (10.4%) and steentjie *Spondyliosoma emarginatum* (9.2%) was observed in the no-take zone of Castle Rocks (Lechanteur 1999). Sanguinetti (2013), using BRUVs, recorded 27 species and 14 families of fish at the TMNP MPA.

The TMNP MPA provides refuge for over-exploited reef fish like the beautiful roman (Chrysoblephus laticeps) *© Alison Kock*

The restricted areas of the TMNP MPA provide refuge for over-exploited reef fish. The no-take zones of Castle Rocks and Paulsberg supported the highest species diversity. Boulders had the highest abundance of reef fish, whilst St. James was the only site with estuarine-dependent species (Sanguinetti 2013).

An example of an estuarine-dependent species found in the coastal waters of TMNP MPA is the white steenbras (*Lithognathus lithognathus*). Endemic to South Africa, this slow-growing, long-lived, late-maturing species have been extensively fished, and consequently, the stock is currently considered to be collapsed (Bennett 1993). The population has declined by more than 55% extrapolated over three generations (i.e., 36 years), with further declines predicted given current trajectories of exploitation and habitat degradation. It is currently listed as Endangered by the IUCN Red List (Mann *et al.,* 2014). While measures such as "no-take" MPAs have been implemented throughout their range to aid in the recovery of the stock, this species continues to face severe threats, including habitat loss and degradation of critical nursery habitats (i.e., estuaries) and illegal fishing.

Genetic studies that include False Bay and Cape Point sites have provided evidence that the gene flow of Silver kob *Argyrosomus inodorus* and Goby *Caffrogobius caffer* is not impeded by the oceanographic barriers of Agulhas and Benguela current systems (Mirimin *et al.,* 2016; Neethling *et al.,* 2008). The lack of genetic differentiation within the South African waters is attributed to life-history characteristics of species, particularly the long pelagic larval stage (Neethling *et al.,* 2008).

At least 24 species of klipfish (genus Clinus*) are found in the rock pools of the TMNP MPA, displaying great variation in colour and patterns amongst them © Jean Tresfon*

Seabirds like the Cape gannet (Morus capensis) *are declining at increasing rates over recent decades due to over-fishing of prey, habitat loss, oil pollution and incidental bycatch in fisheries © Jean Tresfon*

5.5.2 Seabirds and shorebirds

Globally, seabirds are amongst the most threatened group of birds, with their status declining at increasing rates over recent decades (Croxall *et al.,* 2012). Most of this decline is due to anthropogenic disturbances, such as over-fishing of prey, habitat loss, oil pollution and incidental bycatch in fisheries. Almost half (43%) of 346 species investigated by Croxall *et al.* (2012) were either Near Threatened (10%), globally threatened (28%), or Critically Endangered (5%). There are 15 breeding seabird species in continental South Africa, 12 of which nest at localities in or around False Bay (Pfaff *et al.,* 2015). Six of these species are endemic to the region, including four Endangered species (African penguin, (*Spheniscus demersus*), Cape gannet (*Morus capensis*), Cape cormorant (*Phalacrocorax capensis*), bank cormorant (*P. neglectus*)), one Near Threatened species (crowned cormorant (*Microcarbo coronatus*)) and one Least Concern species (Hartlaub's gull (*Larus hartlaubii*)).

Other species visiting TMNP MPA include the kelp gull (*Larus dominicanus vetula*), greater crested (swift) tern (*Thalasseus bergii bergii*), great white pelican (*Pelecanus onocrotalus*), white-breasted cormorant (*P. lucidus*), grey-headed gull (*L. cirrocephalus*) and Caspian tern (*Sterna caspia*). To date, 39 species of seabirds and shorebirds have been identified using the TMNP MPA (Appendix II, Table 5).

The Boulders Beach African penguin colony, colonized by African penguins in 1982 (Crawford *et al.,* 2000), is an important breeding colony, currently home to approximately 5% of South Africa's breeding African penguins (BirdLife International 2020). Since its establishment, the Boulders colony has become a significant tourist attraction in the Western Cape (Lewis *et al.,* 2012). The primary food source for African Penguins (i.e., sardine (*Sardinops sagax*) and anchovy (*Engraulis encrasicolus*)) shifted its distribution to the south-east in the 1990 and early 2000 (Blamey *et al.,* 2015), causing the collapse of breeding populations west of Cape Point (Hockey *et al.,* 2005; Roy *et al.,* 2007; Coetzee *et al.,* 2008). Resource competition between penguins and the purse-seine fishery is another threat (Sydeman *et al.,* 2021). While Boulder's colony did experience a decline in nest numbers after peaking in 2005, the decline was not as severe as those of colonies up the

West Coast. Anchovy and sardine are also prey for Cape cormorants, Cape gannets and greater crested terns (Hockey *et al.,* 2005). Further research into understanding the drivers of the change in the distribution of these fish species is critical for seabird conservation.

Black-backed kelp gulls are a resilient species common inside the TMNP MPA © Alison Kock

South African seabirds are protected in the Sea Birds and Seals Protection Act 1973 (Act No. 46 of 1973). This Act prescribes that seabirds may not be harassed or unnecessarily disturbed and prohibits the killing, capture or wilful disturbance of seabirds. The South African Policy on the Management of Seals, Seabirds and Shorebirds (2007) commits the government to adopt "plans of action to reduce the incidental mortality of seabirds, seals and shorebirds caused by fishing operations". In 2013, a Biodiversity Management Plan for the African Penguin was gazetted to ensure the long-term survival of this charismatic species. No guano harvesting is allowed inside the TMNP MPA.

5.5.3 Mammals

5.5.3.1 Cetaceans

Several cetacean species occur along the coast of the Cape Peninsula. Delphinids encountered include dusky dolphins (*Lagenorhynchus obscurus*) and heaviside's dolphins (*Cephalorhynchus heavisidii*). These species are associated with the cold waters of the Benguela ecosystem. They are frequently and predominantly encountered west of Cape Point, with Hout Bay being the southern range limit of heaviside's dolphins (Laubscher 2018). The Endangered Indian Ocean humpback dolphins (*Sousa plumbea*) and bottlenose dolphins (*Tursiops aduncus*) range eastwards from False Bay, and common dolphins (*Delphinus delphis*) are the most abundant species in False Bay (Best and Folkens 2007). Killer whales (*Orcinus orca*) also occur in False Bay, with increasing evidence of their preying on broadnose sevengill sharks *Notorynchus cepedianus* at Miller's Point in False Bay (Engelbrecht *et al.,* 2019).

Whale species encountered in False Bay include three species of baleen whales: the migratory southern right (*Eubalaena australis*) and humpback whales (*Megaptera novaeangliae*); and the non-migratory Bryde's whale (*Balaenoptera brydei*), which is the only baleen whale species known to regularly feed in the bay (Best 2001). Whales, particularly southern right whales, have been heavily exploited in the area since the late 18th Century, with the advent of whaling stations operating in False Bay (Best and Ross 1989). The end of commercial whaling in 1979 has allowed for the recovery of the humpback whale. While the recovery of the southern right whale also initially showed signs of recovery, reduced numbers and changes in population structure have more recently been reported along the southern Cape coast, including False Bay, possibly as a result of climate change and decreased krill densities in their feeding grounds (Leaper *et al.,* 2006; Seyboth *et al.,* 2015).

5.5.3.2 Pinnipeds

The Cape fur seal (*Arctocephalus pusillus pusillus*) is the only pinniped endemic to Africa. Its breeding range extends from southern Angola to the southeast coast of South Africa (Kirkman *et al.,* 2013). Historically, Cape fur seals occurred on most coastal islands of South Africa and Namibia. However, during the 19th Century, uncontrolled seal harvesting and habitat modification caused the extirpation of many island colonies (Kirkman *et al.,* 2007). Improved management and protective legislation have resulted in the recovery of the species, with breeding colonies increasing substantially from 23 to 40 since the 1970s (Kirkman et al., 2013).

Surface-feeding humpback whales (Megaptera novaeangliae) *regularly feed on krill inside the TMNP MPA © Jean Tresfon*

Cape fur seals are important top predators in the marine ecosystems they inhabit, feeding primarily on teleost fish (including horse mackerel (*Trachurus capensis*), hake (*Merluccius* spp.), sardine, anchovy, cephalopods or crustaceans (David 1987). In turn, Cape fur seals constitute prey of killer whales *Orcinus orca* (Pitman and Ensor 2003) and large sharks such as the great white shark *Carcharodon carcharias* (Martin *et al.,* 2005). Consuming around two million tons of marine organisms annually, considerable resource competition exists between Cape fur seals and commercial fisheries (Kirkman *et al.,* 2019). In False Bay, seals and line fisheries compete primarily for snoek *Thyrsites atun* and Hottentot *Pachymetopon blochii* (Pfaff *et al.,* 2019). Furthermore, competition with seabirds for breeding space and predation threatens seabird conservation, resulting in increased pressure to cull seal numbers (Kirkman 2009). However, modelled outcomes of removing this top predator are inconclusive, and seal culling has not been implemented in South Africa. In Cape Town, commercial marine wildlife encounters, such as "snorkelling-with-seals" have become popular tourist attractions at the seal colony located at Duikerklip (34° 03' 31" S 18° 19' 37" E) near Hout Bay, and Partridge Point, within TMNP MPA. Other pinniped species occasionally visiting the Cape Peninsula include elephant seals (*Mirounga leonine*), Subantarctic fur seals (*Arctocephalus tropicalis*), and leopard seals (*Hydrurga leptonyx*).

5.5.4 Sea turtles and sea snakes

Sea turtles are not commonly seen in the TMNP MPA, but leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) sea turtles sometimes occur in the area. Now and then, small hatchlings wash up along the shore of False Bay and are collected for rehabilitation. Yellow-bellied *(Hydrophis platurus)* sea snakes occasionally strand along the shores of the Peninsula, but are very rare.

Turtle hatchlings found inside the TMNP MPA are rescued and rehabilitated by the Two Oceans Aquarium © Alison Kock

5.6 Ecosystem types and ecological processes

TMNP MPA has a large diversity of habitats, including rocky shores and reefs, wave-cut platforms, sandy beaches and soft shelves, kelp forests, estuaries, and pelagic habitats. This habitat diversity, particularly on the False Bay coastline, is instrumental to the high biological diversity observed along the Cape Peninsula.

The MPA protects twenty-four benthic and coastal ecosystem types (Fig 2, Table 1.). Of these types, three are classified as Endangered (Cape Island, Cape Sheltered Rocky Shore and Southern Benguela Reflective Sandy Shore), ten are Vulnerable, five are Near Threatened, and six are of Least Concern (Fig. 2, Table 1). The MPA fully meets national biodiversity targets for seven ecosystem types (Harris *et al.*, 2021, Sink *et al.*, 2019; Skowno *et al.*, 2019). The MPA is particularly important for threatened ecosystem types, especially for the Cape Boulder Shore, Cape Kelp Forests and the Cape Very Exposed Rocky Shore, and False and Walker Bay, Agulhas Kelp Forest, Cape Rocky Mid Shelf Mosaic, Agulhas Reflective Sandy Shore and Cape Mixed Shore (Harris *et al.*, 2021, Sink *et al.*, 2019; Skowno *et al.*, 2019) (Fig. 2). The MPA plays an important role in protecting the Seas of Good Hope Ecologically or Biologically Significant Marine Area (EBSA) (Harris *et al.* 2022).

Dense clusters of colourful sea urchins occur on the reefs of the TMNP MPA. Sea urchins provide shelter to juvenile abalone and are prey for West Coast rock lobsters © Alison Kock

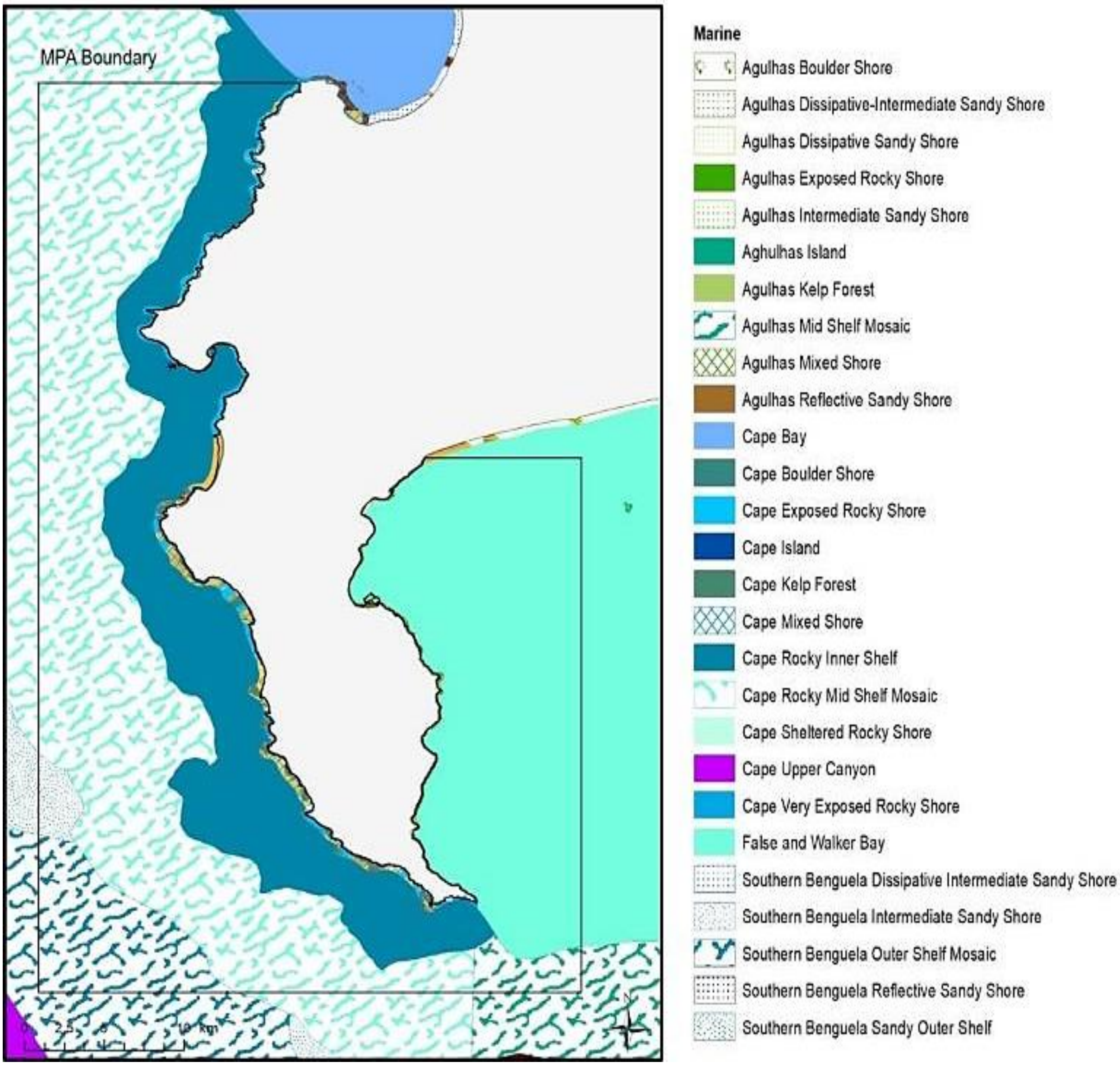


Figure 2. *The TMNP MPA protects twenty-four benthic and coastal ecosystem types. Three ecosystem types are classified as Endangered (Cape Island, Cape Sheltered Rocky Shore and Southern Benguela Reflective Sandy Shore), ten are Vulnerable, five are Near Threatened, and six are Least Concern. The MPA fully meets national biodiversity targets for seven ecosystem types (Harris et al., 2021, Sink et al., 2019; Skowno et al., 2019).*

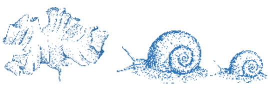
Table 1. *Coastal and marine ecosystem types found in Table Mountain National Park MPA. Classification and ecosystem threat status from the National Biodiversity Assessment 2018*

Ecoregion	Broad	Ecosystem Type	Threat Status
Agulhas	Coast	Agulhas Boulder Shore	Near Threatened
		Agulhas Dissipative Intermediate Sandy Shore	Least Concern
		Agulhas Exposed Rocky Shore	Vulnerable
		Agulhas Intermediate Sandy Shore	Least Concern
		Agulhas Kelp Forest	Vulnerable
		Agulhas Mixed Shore	Near Threatened
		Agulhas Reflective Sandy Shore	Vulnerable
		False and Walker Bay	Vulnerable
	Marine	Agulhas Mid Shelf Mosaic	Near Threatened
Southern Benguela	Coast	Cape Boulder Shore	Vulnerable
		Cape Exposed Rocky Shore	Vulnerable
		Cape Island	Endangered
		Cape Kelp Forest	Vulnerable
		Cape Mixed Shore	Vulnerable
		Cape Rocky Inner Shelf	Vulnerable
		Cape Sheltered Rocky Shore	Endangered
		Cape Very Exposed Rocky Shore	Near Threatened
		Southern Benguela Dissipative Intermediate Sandy Shore	Least Concern
		Southern Benguela Dissipative Sandy Shore	Least Concern
		Southern Benguela Intermediate Sandy Shore	Near Threatened
		Southern Benguela Reflective Sandy Shore	Endangered
	Marine	Cape Rocky Mid Shelf Mosaic	Vulnerable
		Southern Benguela Outer Shelf Mosaic	Least Concern
		Southern Benguela Sandy Outer Shelf	Least Concern

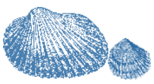
5.6.1 Rocky shores and reefs

The variety of marine life living on rocky shores occupy several niche habitats. Some marine life is submerged in pools and gullies, while others are found on open rocks exposed to wave action and the rise and fall of tides (Branch 2018). Three types of factors shape rocky shores communities (Branch 2018), including: (1) shore zonation, which is associated with the increase of physical stress from the high to low shore, (2) community composition influenced by the intensity of the wave action, and (3) water temperature increase and a decrease in productivity from west to east (Branch 2018). Whether or not an area is harvested, e.g., harvesting limpets also shapes the abundance, diversity and community composition (Baliwe 2021).

Intertidal zones are transition areas between the land and sea, which are submerged underwater during high tide while exposed to the air and heat by the sun during low tide (Branch 2018). They are divided into different zones listed below:



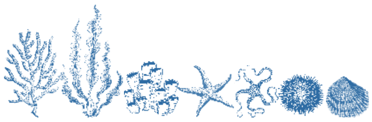
Littorina Zone
(Periwinkles)
This area is dominated by abundant tiny snails *Afrolittorina knynaensis* and the purple laver *Porphyra capensis*.



Upper Balanoid Zone
(Barnacles)
Limpets and barnacles characterise this shore region. The alien (acorn) barnacle *Balanus glandula* dominates and crowds out the granular limpets.

Lower Balanoid Zone
(Barnacles and seaweeds)
Limpets, algae and mussels dominate further down. Algae in this zone include slippery orbits *Pachymenia orbitosa*, spotted *Mazzaella capensis*, dead man's fingers *Splachnidium rugosum*, tongue weeds *Gigartina polycarpa* and tongue weeds *Sarcothalia stiriata*. In this zone, the alien Mediterranean mussel *Mytilus galloprovincialis*, indigenous ribbed mussel *Aulacomya atra* and sandy anemone *Bunodactis reynaudi*.

Cochlear or Argenvillei Zone
(Pear and Argenville Limpets)
This area is sandwiched between the lower balanoid and intertidal zones. The gardening limpets, *Scutellastra cochlear* and *Argenville limpet*, *Scutellastra argenvillei*, dominate this zone. Granite limpet *Cymbula granatina*, tongue weeds and sandy anemone also occur here.



Infratidal or Intertidal Zone
(Diverse Community)
This region, the lowest region on the shore, is usually submerged by water. Typical fauna includes red bait *Pyura stolonifera* (sea squirts), anemones, sea urchins and starfish. There are two dominant kelp species: sea bamboo *Ecklonia maxima* and split fan kelp *Laminaria pallida*.

5.6.2 Kelp forests

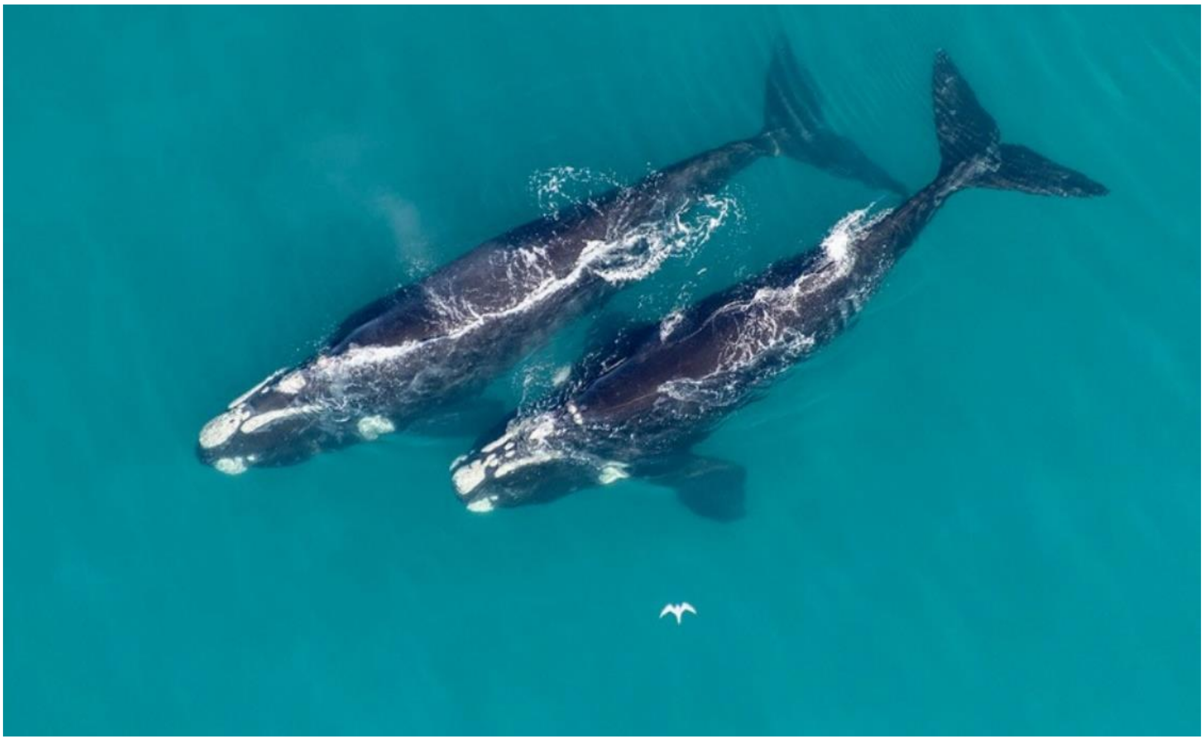
Kelp forests provide sheltered habitats for several species (Branch 1994). Kelp survival depends on a relatively strong, stable substrate to anchor to, to withstand winter storms and high-energy environments. Turbulent waters support kelp growth by supplying nutrients, dispersing propagules, and removing fouling organisms (Hurd 2000; Gaylord *et al.,* 2002). The nutrient-rich waters of the cold Benguela current and the rocky coastline and high-energy environment make the Cape Peninsula's West Coast ideal habitat for kelp (Velimirov *et al.,* 1977). Although initially, kelp did not occur in False Bay (Field *et al.,* 1977; Velimirov *et al.,* 1977), kelp forests now extend around Cape Point to St. James. However, there is a marked difference in kelp forest communities on the east compared to the West Coast. Red algae, mussels, and West Coast rock lobster are characteristic of West Coast kelp forests (Branch 1994; Leliaert *et al.,* 2000), while encrusting corallines and benthic herbivores typify the forests on the east coast (Anderson *et al.,* 1997). Typical east coast herbivores include sea urchins (*Parechinus angulosus*), sea snails (*Turbo cidaris*, *T. sarmaticus* and *Oxystele sinensis*), and abalone (*Haliotis midae*) (Field *et al.,* 1980; Anderson *et al.,* 1997).

The giant kelp forests of the MPA attract divers from around the world © Mark van Coller

5.6.3 Sandy beaches and bottoms

Brown (1964, 1971) has described the general ecology of Cape Peninsula's sandy beaches. The interplay between different types of sand, waves and tides result in a continuum of morphodynamic types (McLachlan and Defeo, 2018). TMNP MPA supports beaches across a range of beach morphodynamic types, from steep reflective beaches with coarse sand and narrow surf zones to broad and flat ultra-dissipative beaches with fine sand and wide surf zones (Harris *et al.*, 2019a). Because beach biodiversity is strongly related to the morphodynamic type (McLachlan and Defeo, 2018), TMNP MPA spans two of the beach bioregions in South Africa. It supports an exceptionally diverse suite of sandy beach species (Harris *et al.*, 2014). These animals provide important links between terrestrial and marine food webs, with macrofauna consumed by fish in the surf zone and shorebirds on the beach. It is imperative to keep the littoral active zone intact to maintain healthy beaches that can provide important ecosystem services, including coastal protection, sites for tourism and recreation, and water filtration and nutrient cycling. This means maintaining an unconstrained link between the dunes, beach, and surf zone. TMNP MPA is one of 17 places in South Africa where contiguous terrestrial and marine protected areas offer opportunities for land-sea protection for these important ecotonal systems (Harris *et al.*, 2019b).

Although not as biodiverse as rocky reefs, sandy bottoms provide shelter and feeding opportunities for several unique species, especially burrowing animals, such as various gastropod scavengers *Bullia* spp. (Brown 1971), and filter-feeding surf clams *Donax serra* and *Scissodesma spengleri*. These animals are also an important food source for gulls and are harvested for bait. The MPA also plays a small, but important role in protecting productive areas associated with *Anaulus* spp. (surf diatom) accumulations and beaches with kelp wrack (Harris *et al.*, 2019, Sink *et al.*, 2019).



There are excellent whale watching opportunities from land and sea inside the Table Mountain National Park and MPA © Jean Tresfon

5.6.4 Estuaries

Estuaries serve as important nursery areas for several marine species, such as white Steenbras *Lithognathus lithognathus*. The MPA plays a small but important role in securing estuary mouths of non-flagship free-flowing rivers (Sink *et al.*, 2019). Although no major estuaries occur within TMNP MPA, some small estuaries include Hout Bay (Disa) River Estuary and Silvermine River Estuary (Hutchings *et al.*, 2016), both of which have been severely affected by housing development. See section 4.3.2 on Drainage for details of all the estuaries in the TMNP feed on MPA.

Cape clawless otters (*Aonyx capensis*) feed primarily in aquatic habitats while breeding and resting on land. However, they rely on freshwater for their survival. They feed various species, from freshwater crabs and fish to marine West Coast rock lobster and shy sharks. The TMNP MPA provides otters with a valuable, stable feeding environment which may counterbalance the negative impact of urbanization on freshwater ecosystems (Okes and O'Riain 2017).

The Schusters estuary at Scarborough has a unique biodiversity connecting land and sea © Alison Kock

5.6.5 Bay and pelagic habitats

The MPA plays a significant role in securing key bay habitats for whales, African penguins, bank cormorants, Cape fur seals and various shark species (Kock *et al.*, 2022). The pelagic habitats also support large seasonal aggregations of whales, snoek, yellowtail and squid.

6. PRESSURES AND THREATS

Our oceans are perceived as having an infinite capacity to withstand anthropogenic disturbances. However, the "common resource" nature of the oceans has caused many marine ecosystems to become susceptible to Hardin's "Tragedy of the Commons" (1968), leading to overexploitation and, consequently, depleted fish stocks. Furthermore, habitat destruction, pollution, coastal development, invasive species and climate change are threats faced by many marine ecosystems. While not necessarily unique to the TMNP MPA, as the human population grows and urbanisation increases, these threats will likely intensify in this urban MPA adjacent to a major city.

Poaching abalone is a major threat to the biodiversity of the MPA and the natural heritage of all South Africans © Alison Kock

6.1 Exploitation and overfishing

By the mid-1800s, commercial boat-based linefishing had become a thriving industry in the Cape Colony (Thompson 1913). Over-exploitation of several marine stocks in Cape Town has become increasingly apparent over the past century (Griffiths *et al.,* 2010). Overfishing, including widespread illegal fishing, has led to the decimation of several species found within the TMNP MPA (Griffiths 2000; Brill and Raemaekers 2013). This exploitation of marine resources around the Peninsula dates back to when the earliest human inhabitants collected marine resources for their subsistence (e.g., *Jasus lalandii* (Grindley 1967)) and decorative purposes (e.g., shell pendants made from *Haliotis* shells (Poggenpoel and Robertshaw 1981)).

Commercial exploitation also has a long history extending to the late 1600s. The first European inhabitants partook in unabated whaling, hunting Cape fur seals, penguin egg harvesting, and guano scraping.

Illegal harvesting of West Coast rock lobster and reef fish is increasing inside the MPA © SANParks

By the time these activities ended in the late 1900s, their target populations had already been dangerously depleted (Pfaff *et al.,* 2019).

The Cape commercial linefishery targets a variety of species around the Cape Peninsula. Traditionally, these included snoek *Thyrsites atun* (~30% of the catch), Hottentot seabream *Pachymetopon blochii*, kob *Argyrosomus* spp. and white stumpnose *Rhabdosargus globiceps*, and to a lesser extent geelbek *Atractoscion aequidens*, yellowtail *Seriola lalandi* and roman *Chrysoblephus laticeps* (Penney 1991). Despite technological improvements in fishing, declining catch rates for many linefish species were reported during the 20th Century, indicating severe overexploitation (i.e., 75-99%) (Griffiths 2000). This overexploitation has caused a marked change in the catch composition of linefish, now dominated by snoek (~90% of the catch), due to the collapse of several species once popular with anglers (Clark 2001; Pfaff *et al.,* 2019). To curb this overexploitation, line fisheries are restricted by fishing effort to a total allowable effort of 316 boats within a management zone extending from Port Nolloth on the West Coast to Cape Infanta on the south coast of South Africa (Pfaff *et al.,* 2019).

Recreational fishing, including shore and boat-based angling, comprises the largest (in terms of numbers) fishery in False Bay (Pfaff *et al.,* 2019). Traditionally targeting rocky shores and species such as red stumpnose and roman, a shift towards sandy habitats have seen a change in catch composition, with catch dominated by kob, white steenbras and slender bellman *Umbrina robinsoni.* Despite catch limitations imposed since 1985, a shift in target species, and "catch-and-release" by sport anglers, overfishing has caused further depletion of stocks of the most popular target species, silver kob *A. inodorus*, dusky kob *A. japonicas* (Hutchings and Griffiths 2010; Mirimin *et al.,* 2016; Winker *et al.,* 2017), white steenbras, slender bellman and galjoen *Dichistius capensis* (Attwood 2003; Hutchings and Griffiths 2010; Winker *et al.,* 2012; Bennett and Lamberth 2013).

Beach-seine netting has been practised off several recreational beaches, including Smitswinkel Bay, Simon's Town, Fish Hoek and Muizenberg Corner, for over three centuries (Pfaff *et al.,* 2019). Therefore, it plays an important role in our coastal heritage and provides a source of income and employment. However, there has been continued lobbying from commercial and recreational fishers to remove this fishery due to the perception that it has detrimental impacts on species such as white steenbras and yellowtail and damages habitats by dragging nets over seabeds. However, studies have shown that beach-seine netting has negligible impacts on the ecosystems of False Bay (Lamberth *et al.,* 1995a, 1995b, 1995c). Due to subsequent management interventions, e.g., removing white steenbras and bellman from the market and further effort restrictions, only five beach-seine operators remain today, catching mostly Harder *Chelon richardsonii* (70%), yellowtail (20%), and smaller amounts of silver kob, elf and other linefish species (Pfaff *et al.,* 2019).

Although chondrichthyans were previously caught mostly as bycatch, declines in other target species, together with an emerging market for rays and sharks, have increased their catch and keep frequency, placing these top predators at risk of overexploitation (Pfaff *et al.,* 2019). Thus, using a baseline described by De Vos *et al.* (2015), continued monitoring of their abundance, diversity, and seasonal distribution is critical for their future conservation (De Vos *et al.,* 2015; Pfaff *et al.,* 2019).

Today, all fishers require a license or permit (commercial, recreational or small-scale) in terms of the Marine Living Resources Act (Act 18 of 1998). However, unsustainable levels of resource allocation by authorities (Johnston and Butterworth 2017), together with illegal fishing activities, mainly West Coast rock lobster and abalone poaching (Brill and Raemaekers 2013), have intensified in recent years, threatening the survival of these species. Abalone is one of the highest commercial value marine species; therefore, reefs around the Cape Peninsula face severe pressure from illegal harvesting (poaching) (Mayfield *et al.,* 2001; de Greef, 2013). Commercial rock lobster fishing operations were initially focused on the Peninsula's West Coast. However, declining numbers on the West Coast and an eastward shift in rock lobster distribution have resulted in a decline in the value of the lobster fishery of the Cape Peninsula since its peak in the 1950s (Johnston and Butterworth 2005). This decline in the lobster fishery has had devastating consequences for low-income communities dependent on this resource for its nutritional and economic value (Agasi 2008; Eggers 2021). Increasingly, law enforcement is reporting illegal harvesting of West Coast rock lobster and reef fish inside the TMNP MPA, requiring urgent attention.

6.2 Invasive alien species

Invasive marine species are one of the greatest threats to marine and coastal ecosystems. These introduced species cause complex environmental changes that can substantially alter the structure and composition of native communities, posing a severe threat to marine biodiversity (Peters *et al.,* 2014; Grosholz, 2002). At least 58 recorded alien species are found in the TMNP MPA (Appendix III, Table 1). However, as more surveys and additional taxa are investigated, the number of identified invasive species will probably increase.

Invasive species may have knock-on social and economic effects on fisheries, aquaculture and tourism (Thomsen *et al.,* 2016). Identifying and monitoring species of concern is critical to reduce their negative impacts and assist in their management (McGeoch *et al.,* 2012). However, challenges, such as lack of taxonomic expertise, mean that introduced species are often misidentified as local species or re-described as new 'indigenous' species. Additionally, most likely introduction sites (e.g., harbours or aquaculture facilities) are seldom surveyed (Griffiths *et al.,* 2009).

South African waters have a high volume of shipping traffic, including recreational boating (sports and leisure), freight shipping (economy) and aquaculture (food security). Although ballast water has since been phased out, historically discharging ballast water, along with biofouling, aquaculture and the aquarium trade, are the primary vectors responsible for introducing several alien species into South African waters (Robinson *et al.*, 2020). Within TMNP MPA, Simon's Town and Hout Bay harbour support many alien species, probably due to the high frequency of local and international vessel movement (Floerl and Inglis, 2003). These alien species can quickly spread among harbours and establish in neighbouring MPAs, making these conservation areas vulnerable to marine invasions (Branch *et al.,* 2008; Minchin *et al.,* 2009).

The Mediterranean mussel, *Mytilus galloprovincialis*, first invaded South African waters in the late 1970s (Griffiths *et al.,* 1992) and is now the dominant mussel species (in terms of biomass and space occupied) on rocky shores along the entire West Coast of South Africa (Branch and Steffani 2004) Robinson *et al.,* 2005)), occurring as far as East London in the Eastern Cape. This aggressive invader outcompetes indigenous limpets (e.g., *Scutellastra argenvillei*) and mussels (e.g., *Choromytilus meridionalis* and *Aulacomya ater* (Hockey and Van Erkom Schurink 1992; Robison *et al.,* 2007)) and can radically change the structure and composition of their marine environment (Bax *et al.,* 2003). On the other hand, *M. galloprovincialis* also increases the density of *S. granularis* by providing a settlement and recruitment substratum for juveniles (Robison *et al.,* 2007). A further positive effect is that the Near Threatened African Oystercatcher, *Haematopus moquini*, has benefitted from an increased food supply due to this alien invader's rapid establishment and spread, resulting in widespread local increases in oystercatcher numbers (Loewenthal *et al.,* 2015).

Considered one of the world's top 100 worst invaders (Global Invasive Species Database 2020), the European shore-crab *Carcinus maenas* was first reported in 1983 at Table Bay Harbour in South Africa (Robison *et al.,* 2005). While surveys assessing its distribution have found *C. maenas* to occur both intertidally and subtidally, thriving on sheltered bays and harbours, the only two populations recorded in South Africa are in Table Bay and Hout Bay harbours (Hampton and Griffiths 2007), with further low numbers found in the intertidal zone in Sea Point (Mabin *et al.,* 2017). High-wave exposure may limit these crabs to more sheltered areas. However, routine monitoring within TMNP MPA, particularly Oudekraal and Seaforth, is essential to manage its potential for further spread (Mabin *et al.,* 2017).

Kalk Bay harbour was first established around 1742 and has significant cultural and socio-economic heritage value on the Cape Peninsula © Alison Kock

Japanese skeleton shrimp *Caprella mutica* has been detected in marinas such as Simon's Town and Hout Bay (Peters *et al.,* 2014). This species outcompetes native amphipods (Peters *et al.,* 2014; 2017). *C. mutica* is assumed to affect mariculture operations, but this socio-economic impact is poorly understood (Peters *et al.,* 2014). Thus, this species' impact needs to be evaluated and monitored to avoid being transferred to other sites within TMNP MPA (Peters *et al.,* 2014).

The acorn barnacle, *Balanus glandula*, likely introduced by ship fouling, is a common mid-intertidal barnacle. Although first reported by Simon-Blech *et al.* (2008), photographic evidence indicates that populations were already well established on the Cape Peninsula in the early 1990s (Laird and Griffiths 2008). Today, it is the most abundant barnacle within its invaded range extending from Cape Point to Eland's Bay on the West Coast (Laird and Griffiths 2008), severely impacting native species distribution and abundance.

6.3 Human-wildlife conflict

Human-wildlife conflict can significantly threaten wildlife conservation. It can threaten both the populations of species conservationists are trying to protect and the people interacting with these species (Kock *et al.,* 2012).

Although relatively rare, fatal shark attacks pose a threat in TMNP MPA (e.g., False Bay), having negative economic impacts, particularly on coastal tourism and local businesses (Kock *et al.,* 2012). To reduce the negative impacts and risks of shark bites and find a balance between recreational water user safety and white shark conservation, the shark safety programme, "Shark Spotters", was established in 2004 (Kock *et al.,* 2012). The Shark Spotters use informational flags and a shark siren to warn bathers or beach users of nearby sharks to exit the ocean when a shark enters a bathing area. This pioneering program is successful as an early warning system and mitigating shark bites, as shown by the high number of shark sightings (619 sharks were sighted between November 2004 and December 2009 (Kock *et al.,* 2012)). While effective, the Shark Spotters program cannot 100% guarantee the safety of water users. To add additional protection, Shark Spotters, in conjunction with the City of Cape Town, have operated a unique shark exclusion net at Fish Hoek beach since 2013 (Spotters 2020). In contrast to traditional shark barriers, this barrier is deployed and retrieved daily, forming a complete barrier from the sea surface to the seafloor. Designed to have a minimal environmental impact, this non-lethal and cost-effective mitigation measure has received strong public support (Pardoe *et al.,* 2014).

An ecologically responsible shark exclusion net is deployed daily by the Shark Spotters to reduce conflict between people and sharks © Alison Kock

6.4 Pollution and water quality

6.4.1 Oil pollution

Oil spills have catastrophic consequences on marine life and their habitats. The impact of oil spills on community diversity is twofold: firstly, it causes massive immediate mortalities (Suchanek 1993), both to oiled individuals and abandoned young. Secondly, it can have long-term impacts on mortality, growth and recruitment (Conan *et al.,* 1982). Given the TMNP MPA's position along a busy crude-oil shipping route, encompassing several harbours and with its exposed coastline and treacherous seas, the threat of oil pollution is relatively high. A notable example is the vessel "Apollo Sea" which sank off the West Coast of South Africa in 1994, resulting in ~2500 tons of heavy fuel oil spilt on the Cape Peninsula's Atlantic coastline (Glassom *et al.,* 1997). Although invertebrate communities on the rocky shores were relatively unscathed from this disaster (Glassom *et al.,* 1997), birds (particularly African penguins) were severely impacted, with ~7500 penguins requiring treatment at the South African National Foundation for the Conservation of Coastal Birds (SANCCOB). Of these treated birds, ~63% survived until release (Moldan 1994), with low mortality post-release (Underhill *et al.,* 1999). While this penguin rescue is considered a conservation success, research conducted a decade later has shown secondary effects of having significantly reduced subsequent survival and breeding success of the de-oiled birds (Wolfaardt *et al.,* 2008).

6.4.2 Plastic pollution

South Africa is the world's 11th worst culprit for land-based plastic waste entering the ocean (Jambeck *et al.,* 2015), with high densities concentrated around urban centres (Ryan, 2020). Microplastics (larger plastic pieces that degrade into smaller pieces (<5mm in diameter)) have become a significant component of marine plastic litter (Law and Thompson 2014). They have been found in most marine ecosystems, including open oceans (Law and Thompson 2014), deep seas (Jamieson *et al.,* 2019), coastal habitats (Setälä *et al.,* 2016) and estuaries (Naidoo *et al.,* 2015). This pervasive distribution poses a severe environmental threat, as they are ingested by most marine organisms (Cole *et al.,* 2011). Microplastics often contain harmful contaminants (Digka *et al.,* 2018), and their ingestion by lower trophic organisms, such as mussels, means that these contaminants may bioconcentrate up the food chain, ultimately affecting human health (Wright *et al.,* 2013). Sparks (2020) found that 98% of mussels (*Mytilus galloprovincialis*, *Choromytilus meridionalis* and *Aulacomya ater*) sampled from various locations in Cape Town (including several sites within the TMNP MPA) contained microplastics. An average of 2.33 microplastic particles per gram and 4.27 particles per individual was recorded across all sites (Sparks 2020), providing a baseline for future studies.

6.4.3 Heavy metals

Heavy metals, such as copper, cobalt, zinc, iron and manganese, naturally occur at low concentrations in seawater and are vital for the normal function of living organisms (Singh *et al.,* 2011). However, anthropogenic pollutants from industrial, residential and agricultural areas that are discharged into the ocean significantly increase their concentrations along with other heavy metals, such as cadmium, mercury, and lead, which are toxic even at low concentrations (Yi and Zhang 2012; Copat *et al.,* 2013; Looi *et al.,* 2013). Heavy metals are persistent in the environment, contaminate food chains at sufficiently high concentrations, are toxic to living organisms, and have been recognised as a severe environmental concern for coastal ecosystems. Sparks *et al.* (2017) compared metal concentrations in the intertidal water and surface sediments along the Cape Peninsula's West Coast to those recorded 30 years previously by Hennig (1985). They found that concentrations had not increased across the sampled sites. Furthermore, metal concentrations were lower than those of comparable industrialised coastal cities (Acton 2013). However, continued monitoring of heavy metal levels, either measured directly from surface sediments or indirectly from bioaccumulation in organisms such as mussels (e.g., *Mytilus galloprovincialis* (Fatoki *et al.,* 2011)) or echinoderms (e.g., *Parvalustra exigua* (Reinecke and Reinecke 2014)), is essential for TMNP MPA, given its proximity to areas with high human habitation (e.g., Muizenberg, Hout Bay and Cape Town Harbour).

6.4.4 Sewage

Sewage effluent and stormwater discharged into the sea is another large contributor to marine pollution in TMNP MPA (City of Cape Town, 2020; Petrik *et al.,* 2017; Ojemaye *et al.,* 2020). Numerous stormwater outlets and four sewage outfalls discharge into the MPA. The sewage outfalls are located at Hout Bay, Llundudno, Camps Bay and Green Point (City of Cape Town 2020). These outfalls existed before the establishment of the TMNP MPA. Sewage outfalls, operated by the City of Cape Town, pump mostly untreated (only larger solid objects such as plastic or solid items are removed) sewage into the marine environment. Storm water outfalls are another source of inorganic and organic pollutants entering the MPA. Petrik *et al.* (2017) examined seawater quality and marine organisms at Granger Bay on the Atlantic coast, which receives ~30 million litres of sewage daily from the Green Point outfall. Their results showed worrying chemical and pharmacological organic pollutants (e.g., antibiotics, natural and synthetic hormones, soaps, detergents, disinfectants) and intermittent bacterial contamination (*Escherichia coli* and *Enterococcus bacteria*) in seawater beach sediment and marine organisms. A further study by Ojemaye *et al.* (2020) found several herbicides in seawater, beach sediment, and marine organisms collected in Camps Bay, posing an ecotoxicological risk for marine organisms and a carcinogenic risk to human's regularly consuming seafood sourced from this area. In response to these concerns, the City of Cape Town has committed to improving its water strategy through continued monitoring of water quality, research on understanding the impact of sewage on biodiversity, improved disclosure of information, education, awareness and enforcement (City of Cape Town 2020). Ongoing monitoring and research on the impacts of stormwater and sewage pollution on the ecosystems and marine life of the TMNP MPA are essential.

6.5 Marine and coastal habitat destruction

Development in the coastal zone has become a major driving force for environmental changes in coastal marine ecosystems. Estuaries are attractive areas for development due to their sheltered locations. However, ecologically they serve as important nursery areas for several marine species. Although no major estuaries occur within TMNP MPA, some small estuaries include Hout Bay (Disa) River Estuary and Silvermine River Estuary (Hutchings *et al.,* 2016), both of which have been severely affected by housing development.

Coastal development inappropriately located too close to the shore and replacing the fore dunes is a significant pressure, especially for sandy beaches. With sea-level rise, stabilized shorelines cause coastal squeeze, where beaches are trapped and gradually narrowed until they are inundated and lost. This causes the destruction of habitat for species like the pillbug, *Tylos* spp., which lives in the dunes and forages on the beach high shore (e.g., Hubbard *et al.*, 2014). It also reduces the beaches' capacity for delivering ecosystem services, like coastal protection, recreation, tourism, and nesting sites for shorebirds. Most of the beaches in TMNP MPA are unconstrained, and it is important to maintain the intact cordons of dunes adjacent to these beaches. The climbing-falling dune system that connected Hout Bay and Sandy Bay was stabilized and developed so sand is no longer mobile between them (Harris *et al.*, 2019c). This contributes to erosion downstream (i.e., at Sandy Bay) because the supply of sand has been cut off. Although the dune system is outside of TMNP MPA, it does influence the available habitat and ecological condition of the beaches in the MPA.

Since the early 1900s, African penguins, *Spheniscus demersus*, have decreased dramatically, mainly due to a loss and modification of their breeding habitats (Frost *et al.,* 1976). Guano collection, a major cause of disturbance at many of these colonies, destroyed penguin nest-burrowing sites, forcing these birds to nest on open ground, exposing them to direct solar radiation and heat stress. These penguins spent additional time in the colder water to cool down, leaving their exposed nests vulnerable to increased predation (Frost *et al.,* 1976; Shannon and Crawford, 1999; Kemper, 2015). At the same time, many populations suffered huge decreases in breeding numbers (e.g., Dassen Island and Dyer Island (Crawford *et al.,* 1995), three new colonies were established near Cape Town in the 1980s (i.e., Stony Point, Robben Island and Boulders). Artificial next boxes, implemented at these colonies, are a successful conservation intervention to replace lost habitat for these birds, providing shelter from weather and protection from predators (Sherley *et al.,* 2012).

6.6 Climate change

Anthropogenic climate change is one of our planet's most significant environmental challenges, and its impact could devastate vulnerable coastal and marine areas and the function and structure of these ecosystems. Globally, a well-accepted consequence of this climate change is that sea levels are predicted to rise (Church and White 2006) (mainly due to ocean thermal expansion and ice-sheet melting (Kopp *et al.,* 2017)), as well as an increase in extreme sea levels (due to storm surges) (Kirezci *et al.,* 2020).

Notwithstanding the increased frequency of storm surges, rising sea levels will increase the severity of these storm surge events due to a higher sea base level and stronger wind regimes (Church and White 2006). Another consequence of rising sea levels and storm surges is that shorelines retreat due to accelerating coastal erosion and dune migration (FitzGerald *et al.,* 2008). Sandy beaches are particularly vulnerable to coastal erosion, and rising sea levels will exacerbate the erosion in these areas (Mather 2008).

While predictions of mean sea-level changes are not uniform in all regions of the world, changes around the City of Cape Town) are similar to the mean global rate (i.e.,1.58 ± 0.22 SD cm per decade) (Mather *et al.,* 2009). This translates to a predicted increase in sea level of 15 cm by 2030, seemingly a modest amount, but can have significant implications. Although the Cape Peninsula is no stranger to violent sea-storms, an increased coastal development adjacent to the coast will likely experience severe damage as climate change progresses. A risk assessment conducted in 2008 estimated damages to Cape Town due to sea-level rises were in the range of R4.9 to R11 billion over the next 25 years (Colenbrander *et al.*, 2011). "Hotspots" identified within the TMNP MPA vulnerable to these risks include Green Point, Sea Point, Bakoven Cottages, Camps Bay, Kommetjie, Witsands, Glencairn, Fish Hoek, Kalk Bay and Muizenberg Corner (Brundrit and Cartwright 2012).

While the Peninsula's West Coast will be more at risk of big wave events from the southwest, the beaches of the False Bay coastline are likely to face heavy erosion. However, harbours like Hout Bay and

Simon's Town are more likely to be sheltered from the southwest waves. Wetland coasts may also be at risk of flooding from rivers, especially since higher sea levels may block floodwaters from leaving rivers. Areas such as Hout Bay (from the Disa River), Fish Hoek (from Silvermine River), and Muizenberg (from Sandvlei River) may become vulnerable (Brundrit and Cartwright 2012).

In 2017 the Simon's Town penguin colony had a value of ~R6.87 billion in terms of future expenditure flows and will support 885 jobs over the next 30 years © Alison Kock

Climate change is also likely to significantly affect marine ecology and biodiversity, as changing ocean temperatures and acidity will alter marine populations, favouring some species and proving catastrophic for others. Predicting the impacts and how species respond is difficult due to uncertainties in the severity of changes, complexities within and amongst species, and impacts of other stressors. Extreme events such as sudden oceanic heat waves and cold snaps can, in themselves, have significant effects on populations exposed to these events (Schlegel *et al.,* 2017). Such events have been recorded in the past in the MPA, and further research into the impacts of these events locally is required.

Permanent changes in conditions can also occur. Migratory fish will likely shift their distributions, while resident species may see changes in growth rate and reproductive scope in response to temperature changes (Potts *et al.,* 2015). Ocean acidification, because of increased ocean CO_2 concentration, may cause damage to organisms with calcium-based structures and reduce the survival of eggs and larvae of coastal fishes (Potts *et al.,* 2015). The impacts of ocean acidification on commercial species, such as West Coast rock lobster and abalone, are of particular concern. Knapp *et al.* (2016) showed that West Coast rock lobsters are well adapted to withstanding hypercapnic (i.e., abnormally elevated levels of CO_2) and high-temperature conditions. However, further research is needed to assess the impact of long-term exposure. Chondrichthyans, such as the endemic puffadder shyshark, *Haploblepharus edwardsii*, may also be vulnerable to higher acidity by corroding their denticles (and their ability to swim) and possibly their teeth (and so their food intake) (Dziergwa *et al.,* 2019). However, research on ocean acidification is limited, particularly on the population- and ecosystem-level effects (Le Quesne and Pinnegar 2012).

The discussion above highlights some of the major threats the TMNP MPA faces. However, it is important to note that these are not mutually exclusive, and multiple interacting threats usually cause changes in biodiversity. Furthermore, understanding how these threats impact species' genetic diversity and connectivity is an important area where research is lacking in TMNP MPA. Populations that have become small and isolated are at increased risk of extinction due to genetic diversity being reduced by genetic drift and inbreeding processes (Keller and Waller 2002). Genetic diversity affects the capacity of each species to adapt genetically to change and maintain gene flow. It is essential to shield populations against stochastic events such as extreme weather and disease outbreaks.

7. MANAGEMENT

MPAs have become widely regarded as beneficial for biodiversity conservation and fisheries management (Ballantine 2014). While the primary focus of MPAs is biodiversity and heritage conservation, its objectives are not necessarily incompatible with fishing and other resource use activities, provided these activities are sustainable and have a low ecological impact. Following the International Union for Conservation of Nature's (IUCN) guidelines, MPAs should demonstrate sound planning, design, and good governance (Day *et al.,* 2019). Thus, a vital determinant of a MPAs success is effective management. MPA management in South Africa has been periodically assessed (Lemm and Attwood, 2003; Tunley, 2009; Chadwick *et al.,* 2014). Limited human resources (especially skilled staff such as skippers), non-compliance and lack of monitoring and education are significant ongoing challenges (Chadwick *et al.,* 2014). Further priority actions identified in the TMNP MPA include budget reviews, development and implementation of a dedicated MPA management plan and operational plan, improved stakeholder engagement, upgraded infrastructure (including repair of degraded signage), and development of research and monitoring programmes (Chadwick *et al.,* 2014).

7.1 Protected area design and effectiveness

Zoning is the primary tool to accommodate functions beyond biodiversity conservation, such as ensuring visitor access and allowing adjoining communities and local economies to continue benefiting from the area. Appropriate zoning can reduce conflict between users with variable interests while ensuring that their activities do not negatively affect the park's key objectives. It can also protect sensitive areas of the MPA from over-utilisation (Songelwa *et al.,* 2015). As described previously, TMNP MPA comprises 956 km^2 and is zoned into one controlled zone, where certain fisheries are allowed under permit, and six restricted zones (collectively comprising 5.9% of the total area of the MPA), where no exploitation is allowed (apart from snoek in Karbonkelberg in Hout Bay).

Rocky shore surveys to monitor changes in diversity and abundance of invertebrates, like limpets, are conducted inside the TMNP MPA © Alison Kock

The zoning for TMNP MPA is comprehensively detailed in its declaration (Government Gazette 26431). While primarily an open-access MPA, there are three established entry pay points – Oudekraal, Boulders and Cape of Good Hope. Although Chadwick *et al.* (2014) found the size and shape of the MPA to be suitable, the assessment suggests that the restricted areas are likely too small and should be expanded. This is supported by a recent re-assessment of the TMNP MPA (Gardner, 2021; Kock *et al.*, 2022). A further recommendation is to include Seal Island in False Bay within the TMNP MPA's boundaries (Chadwick *et al.,* 2014).

A recent study assessed the effectiveness of no-take ('restricted') zones of the TMNP MPA relative to controlled zones (Baliwe 2021). Rocky shore surveys showed greater numbers and sizes of exploited grazers (limpets) and less macroalgal cover in no-take zones of the MPA, demonstrating that no-take zones conserve these exploited species. Macroalgae was greater inside the controlled zones where harvesting occurs, showing that exploitation significantly impacts the rocky shore's community structure.

Another recent study funded by the Table Mountain Fund assessed the effectiveness of spatial regulations of the TMNP MPA on West Coast rock lobster, abalone and giant periwinkle abundances, historically the region's three most important invertebrate resources (Gardner 2021, Kock et al., 2022). Using data from three comprehensive peninsula-wide SCUBA surveys conducted in 2000, 2003 and 2019, the effects of the TMNP MPA and its multiple no-take zones were quantified. Overall, the rock lobster abundance around the Cape Peninsula decreased since implementing the TMNP MPA. This decrease is possibly due to illegal or over-harvesting, a source-sink dynamic with the declining regional population or increased predation from recovering fish populations within TMNP MPA. However, no-take zones had a positive effect on rock lobster abundance. No change in abalone abundance was detected over the years in the TMNP MPA nor with no-take zones. However, the regional abalone population has declined drastically over a similar period. Policing has likely prevented the abalone within the MPA from following suit. Giant periwinkle abundance increased since the establishment of TMNP MPA, but not specifically from the no-take zones, suggesting general harvest restrictions in TMNP MPA are affording them sufficient protection. The TMNP MPA, with its varied no-take and harvest zones, provided an excellent opportunity to test the effectiveness of spatial protection in a complex marine community and supports the use of MPAs, especially no-take zones, as a protection measure for over-exploited macro-invertebrates.

Chadwick *et al.* (2014) highlight that a strategic management plan and a conservation development framework (including direct stakeholder involvement) are essential for the effective management of the MPA. The management plan also needs to articulate its needs, requirements, and restrictions regarding land-based development and pollution issues (Chadwick *et al.,* 2014).

7.2 Species of conservation concern

The MPA's threatened and protected species include white sharks, abalone, African penguins, and severely depleted fish such as Hottentot seabream, galjoen, roman, and pyjama catshark, white and red steenbras.

TMNP Boulders Beach is one of two land-based African Penguin colonies in South Africa and plays a crucial role in African Penguin conservation. Boulders Beach forms part of Simon's Town colony, formed in 1985, with around 850 breeding pairs estimated in 2016 (Vanstreels *et al.,* 2019). The City of Cape Town manages the section from Seaforth Beach to Water's Edge Beach, and Burghers Walk to Franks Bay, while SANParks manages the section between Boulder's Beach. Being a land-based colony rather than an island exposes the penguins to land-based predators such as caracals or domestic dogs (Vanstreels *et al.,* 2019).

Without appropriate behavioural responses and defence mechanisms, these penguins are vulnerable to predation, so managing these atypical penguin predators is critical for the survival of this mainland colony (Vanstreels *et al.,* 2019). Coordinated management between SANParks and the City of Cape Town is crucial. Management actions to conserve African Penguins at Simon's Town include working collaboratively with SANCCOB and hiring four penguin monitors as part of the Simon's Town Penguin and Seabird Ranger Project – this is a coordinated plan in partnership with the Environmental Management Department and Cape Town Environmental Education Trust (CTEET).

To bolster the Endangered African penguin population, injured adults or abandoned eggs and chicks are taken to SANCCOB to be hand-reared and then released back into the colony © SANParks

A major challenge for management is the illegal extractions of marine resources in the TMNP MPA, particularly abalone (*Haliotis midae*) and West Coast rock lobster – two species of high value and demand. South African abalone stocks are severely threatened due to large-scale poaching and ecological changes in parts of its distributional range (Brill and Raemaekers, 2013; Griffiths *et al.,* 2004). The illegal abalone trade is estimated to be almost double that of the legal trade (National Biodiversity Assessment 2018). Poaching can have impacts extending beyond species conservation, such as affecting park visitors and the local tourism economy. However, monitoring MPA compliance effectively is challenging, given the lack of sufficient staff. Collaboration between SANParks and other enforcement agencies, including City of Cape Town Marine Unit, South African Police Services Water-wing, DFFE compliance) has been an effective means of managing compliance (Chadwick *et al.,* 2014).

7.3 Social ecology

7.3.1 Education and awareness

The Table Mountain National Park's Environmental Experience (EE) Programme, aimed primarily at Cape Town's disadvantaged youth, provides an opportunity to visit Cape Point, Boulders, Silvermine, and Oudekraal. This programme also arranges beach clean-ups and does some marine environmental education. The TMNP MPA would benefit by having a full-time dedicated marine environmental officer.

National Marine Week, celebrated annually during the second week of October, is an awareness campaign led by the Department of Forestry, Fisheries and the Environment. It aims to create awareness about marine pollution, particularly plastics and micro-plastics, in the marine and coastal environment and promote sustainable use and conservation of the ocean's resources for the benefit of present and future generations. Each year a theme is chosen to highlight a particular issue. Various initiatives occur throughout the week, including exhibitions and coastal clean-ups to educate the public, especially the youth, about relevant issues related to the ocean. While focused on the youth (high school students), it has a broad target audience, including coastal communities, marine sector industries, stakeholders, environmentalists, media and the general public (Department of Environmental Affairs 2019). International African Penguin awareness day occurs annually during National Marine week, highlighting the plight of African Penguins.

Several local NGOs focus on marine issues. Focus areas include direct action to improve the environment, such as beach clean-ups (e.g., Beach Coop, Curb Beach Plastic, Project Noordhoeked, KEAG), mitigating human-wildlife conflict (Shark Spotters) or marine wildlife rescue and rehabilitation (e.g., SANCCOB, Two Oceans Aquarium). Education through experiential learning is also popular on the rocky shores and tidal pools (e.g., I am Water Foundation, LIMPET, Two Oceans Education Foundation, Save Our Seas Shark Centre). Popularising marine stories using various media are rising (e.g., Sea Change Trust), as are citizen science programmes (e.g., Cape Research and Diver Development, iNaturalist, South African Elasmobranch Monitoring). There are many more local organisations doing incredible work along the Cape Peninsula. While some collaboration occurs between NGOs, NGOs, and authorities, the MPA and surrounding coastal and marine environment would benefit from a coordinated approach to ocean and coastal conservation. Increased collaboration and coordination would maximise scarce resources and outputs while avoiding duplication.

SANParks works closely with non-governmental agencies to raise awareness of the importance of MPAs and participate in beach clean-ups © Alison Kock

7.3.2 Recreation, tourism and marketing

The TMNP MPA and its coastline provide a range of recreational activities, including walking on the beach, swimming, surfing, sea kayaking, snorkelling and SCUBA diving. These low impact activities are compatible with the conservation of the MPA and rely on a clean and healthy environment.

South Africa's marine and coastal tourism have large economic value. Tourism associated with the TMNP MPA includes penguin viewing, charter fishing, boat-based whale watching, yacht sailing, snorkelling with seals, SCUBA diving, sea kayaking and surfing and related events. Attracting over 800,000 visitors in 2019 (Wesgro Annual Report 2019), the Boulders Penguin Colony forms an integral part of the Western Cape Tourism industry. Although statistics are limited, it is estimated that the Simon's Town penguin colony has a value of ~R6.87 billion in future expenditure flows and will create 885 jobs over the next 30 years (Van Zyl and Kinghorn 2018).

Given the substantial economic benefits it offers and its heritage value, ongoing management and improvement are critical to support it as an excellent conservation and tourist destination. Van Zyl and Kinghorn (2018) estimate that an investment of R22 million is needed to meet the area's medium-term (10 year) requirements.

SCUBA diving businesses must obtain an annual permit from the TMNP to operate inside the MPA. These permits cost R455, and less than 15 are issued yearly (SANParks, unpublished data). This generates a nominal amount to cover the basic administration of the process. A marine species access permit is needed for the Cape Point section of the TMNP. It costs R868 and allows 12 entries into the Cape of Good Hope section of the park to access marine resources (a valid DFFE recreational fishing permit is still needed).

Besides the penguins, SCUBA businesses, and marine species access fees, no other marine-based tourism activities generate revenue for managing the MPA. One of these consequences is that the resources and capacity to manage the MPA are much lower than the terrestrial national park. DFFE issues permits to operate boat-based whale or shark watching. Numerous local ocean-based businesses operate inside the MPA or part thereof, but do not contribute funds to MPA governance. A socio-economic assessment of the MPA would provide a valuable baseline to understand the social and economic benefits derived from the MPA (Mann-Lang *et al.,* 2021).

7.3.3 Ecosystem services and socio-economic considerations

The TMNP MPA likely provides a range of ecosystem services, including provisioning ecosystem services (e.g., fishing), regulation and maintenance services (e.g., water filtration, nutrient cycling, coastal protection) and cultural services (e.g., recreational and spiritual use of nature) (Haines-Young and Potschin 2018). However, to date, only two scientific studies on the socio-economic value of the TMNP MPA have been conducted, and these focused on fishing/resource use (Mann-Lang *et al.,* 2021). A detailed study of the ecosystem services the TMNP MPA provides is an important area that needs to be evaluated.

7.3.3.1 Resource use

Integrating human dimensions into MPA management is needed to improve conservation outcomes (Mann-Lang *et al.,* 2021). The communities adjacent to the TMNP MPA, including Ocean View, Masiphumele, Hangberg, Hout Bay, Redhill, Simon's Town, Fish Hoek and Kalk Bay, rely heavily on fish for food security and selling fish for income. There are multiple small-scale, commercial and recreational fisheries inside and adjacent to the MPA. However, overexploitation of fish stocks (de Vos 2012) has had significant economic, ecological, and social consequences, e.g., abalone can no longer be harvested legally for personal use. Managing fisheries sustainably from the growing coastal populations and increasing pressure on overexploited fish is a big challenge, especially given continued user conflicts and perceptions of bias towards commercial fishing. Furthermore, issues from South Africa's Apartheid history persist, e.g., forced removals due to the Group Areas Act, which meant that small-scale fishers have not had access to their traditional fishing grounds, creating further friction with commercial fisheries and the management authorities.

Previous fishing restrictions that imposed bag and size limits were insufficient to protect overexploited fish stocks. Consequently, South Africa invested in establishing MPAs to conserve marine systems and rebuild fish populations (Brill and Raemaekers 2013). However, it has been debated whether these MPAs were established primarily as conservation tools without considering adjacent communities' socio-economic and historical situations (Sowman *et al.,* 2011; Brill and Raemaekers, 2013). Despite regulations, SANParks has reported increasing illegal fishing during the recreational fishing season; most confiscations involved exceeding daily bag limits and collecting undersized marine resources (Brill and Raemaekers 2013).

Several social studies have been conducted on illegal fishing in the TMNP MPA (Hauck 2008; Brill and Raemaekers 2013). Brill and Raemaekers (2013) conducted a survey in the TMNP MPA to evaluate illegal fishing and marine resource confiscations in the area surrounding Simon's Town and Glencairn. The data from the SANParks report logbooks dated 1 January 2000 and 31 December 2009 mainly focused on abalone *Haliotis midae* and West Coast rock lobster *Jasus lalandii* (Brill and Raemaekers 2013). These are high-value marine species exported for sale to the international market. Park officials believed most illegal abalone harvesting occurred south of Simon's Town towards Miller's Point and further towards Cape Point (Brill and Raemaekers 2013). The officials of TMNP MPA geo-referenced 93% of abalone confiscated in False Bay and 87.6% abalone-related incidents (Brill and Raemaekers 2013). Confiscations of West Coast rock lobster occurred across TMNP MPA, especially Kommetjie and Hout Bay, contributing 25.6% and 16.2%, respectively (Brill and Raemaekers 2013). There is a need to consider an efficient plan or approach to minimise illegal fishing in the TMNP MPA. Brill and Raemaekers (2013) suggested that law enforcement should be increased within the no-take zones, but this should be aligned with a developmental implementation of the small-scale fisheries policy to secure preferential access and livelihoods to the small-scale fishers residing in the communities adjacent to the TMNP MPA. Further interaction with stakeholders and communities is needed for a long-term solution to the ongoing conflict around Hangberg and Ocean View.

Small-scale fishers were legally recognised in 1998 by the government for the first time in South Africa through the Marine living resource Act MRLA ('subsistence fisher'). This was done to recognise the traditional rights of subsistence fishers to lawfully harvest marine resources (Sowman 2006; Hauck 2008). A new policy for small-scale fisheries was gazetted (RSA 2012) and awaiting implementation (Brill and Raemaekers 2013). ABALOBI (isiXhosa for small-scale fisher) was developed by academic researchers, several representatives of small-scale fishers and the Department of Forestry, Fisheries and the Environment (DFFE). This app was introduced to the small-scale fisher to complete fishery data instead of using a logbook. This allows catch transparency and makes the catch easier to sell. While some believe the app will contribute to conservation efforts, it has raised some concerns as it can increase the risk of overfishing by providing direct access to where the fish are found in the ocean.

The case study of Nkomo (2015) examined fisheries policies that affected the livelihoods and food security of small-scale fishers using the fishing community of Kalk Bay. Small-scale fishers were included in the Marine Living Resources Act of 1998 (MRLA), but they lack clarity on what the basket will contain and the size of the basket allocation. Therefore, the Kalk Bay fishing community requires awareness and sharing of information about the small-scale fisheries policy.

7.4 Climate change adaptation

Under climate change, protected areas can be classified as either resistant (able to remain unchanged), resilient (changing but able to return to their original state) or likely to transition to a new state (Lawler 2009). It is not always clear how protected areas will respond, but strategies to enhance resilience and assist transition are required to improve adaptive capacity. The most obvious of these is the reduction of other stressors, such as habitat loss and fragmentation, alien species, pollution and overharvesting (Lawler, 2009, Mawdsley *et al.,* 2009, van Wilgen and Herbst, 2017). Another obvious strategy to increase resilience is protected area expansion, particularly to include gradients in climatic and habitat conditions and replicate similar areas (termed increasing redundancy) to provide species with opportunities in multiple locations (Lawler 2009). There is general acceptance in the climate change community that we will no longer be managing to retain or restore historical conditions, but rather facilitate change and retain ecological processes rather than particular species (Mawdsley *et al.,* 2009, Prober *et al.,* 2019). Prober *et al.* (2019) have developed a typology of adaptation options to assess whether the standard set of management actions available to conservation practitioners will be sufficient in the face of a rapidly changing climate and introduce several new 'climate targeted' type management interventions. One of the critical drawbacks of the proposed climate-targeted options is that several conflicts with traditional conservation principles and wilderness values (e.g., genetic modification or engineering of environments). The authors conclude that we are perhaps running out of time and may need to experiment with less conventional adaptation options to test their effectiveness before climate change impacts become irreversible, i.e., "ecological renovation" instead of "restoration of a prior state".

In the context of the TMNP MPA, a trial adaptation project assesses the use of different artificial and natural nests to provide a heatwave-friendly nesting habitat for African penguins. The project seeks to optimize the temperatures experienced in the nests while retaining protection from predation (Foden *et al.,* 2021). At the same time, information gathered from a local weather station provides insight into an early warning system for the proactive management of extreme events. An early warning system will allow interventions such as removing chicks and eggs ahead of extreme weather. Chicks hand-reared at SANCCOB and released into the wild have been shown to show similar survival probabilities as chicks reared by their parents (Sherley *et al.,* 2014; Klusener *et al.*, 2018).

8. RESEARCH AND MONITORING

8.1 Research permits

MPA regulations stipulate that a permit is required to conduct research inside an MPA. Prospective external researchers must submit research proposals outlining research questions, methods, anticipated study period, and requirements for support from SANParks. The Cape Research Centre Research Node overseas the research permits for the TMNP MPA. Research proposals must be submitted online via the SANParks portal.

An internal research committee evaluates each research proposal regarding its logistics and possible risks to the environment or the quality of national parks or marine protected area visitor experiences. If the proposal involves handling animals, it will be referred to the SANParks Animal Use and Care Committee. Projects may be rejected if they are incompatible with the environment, visitor experiences or with the ethical treatment of animals, if they are deemed unfeasible, or if SANParks does not have the capacity to meet the project's requirements. If the proposal is accepted, researchers undertake to provide SANParks with reports on the outcomes of the project and copies of data and publications. Researchers are encouraged to share their results and, where possible, their data via the SANParks Data Repository. The Cape Research Centre maintains a database of all registered research projects for the TMNP MPA.

Besides being a legal requirement for conducting research in the TMNP MPA, there are several benefits of registering a research project with SANParks. SANParks scientists provide feedback on your proposal, often providing insider knowledge on making the project more beneficial for managing protected areas where applicable. Results and subsequent recommendations are communicated directly to MPA scientists and managers. Early identification of overlap with similar research in the area offers the opportunity to collaborate with other researchers where applicable or adapt research to avoid or minimize overlap. Furthermore, it allows the management authority to identify too many projects in the same place or on the same species and consider cumulative effects that may need to be managed.

8.2 Research

Due to its proximity to Cape Town and several universities and higher learning institutions, the ecology of the TMNP MPA is well studied. A permit to the universities from the DFFE covers most undergraduate research projects. However, all other research and monitoring projects, including post-graduate research projects, must be registered with SANParks.

Since the establishment of the TMNP MPA, 65 monitoring and research projects covering various topics have been registered with the Cape Research Centre (Fig 3). To date most registered research has involved seabirds, with the least on governance and poaching (Fig 3). The number of registered research projects has increased in diversity and number since the MPA was declared (Fig. 4). However, many research projects are not registered with SANParks or fall under a permit from DFFE.

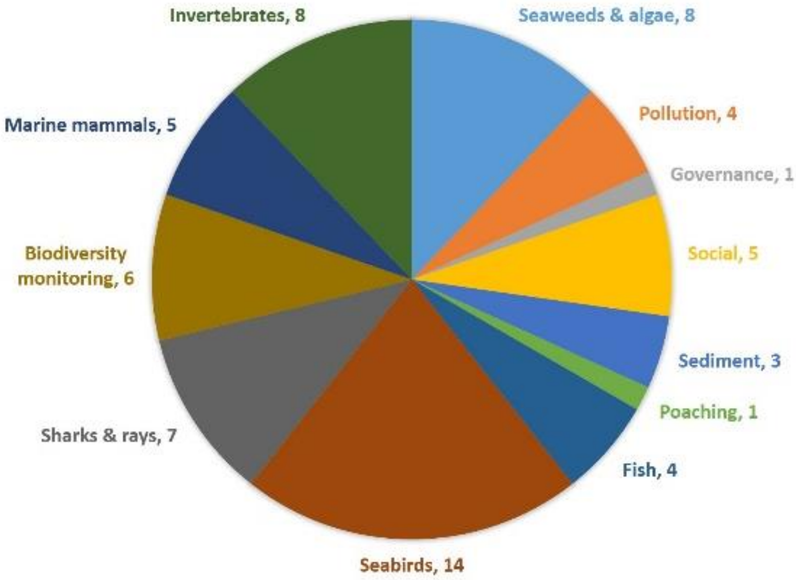


Figure 3. *Since the establishment of the TMNP MPA, 65 monitoring and research projects covering various topics have been registered with the Cape Research Centre. Most registered research has involved seabirds, with the least on governance and poaching.*

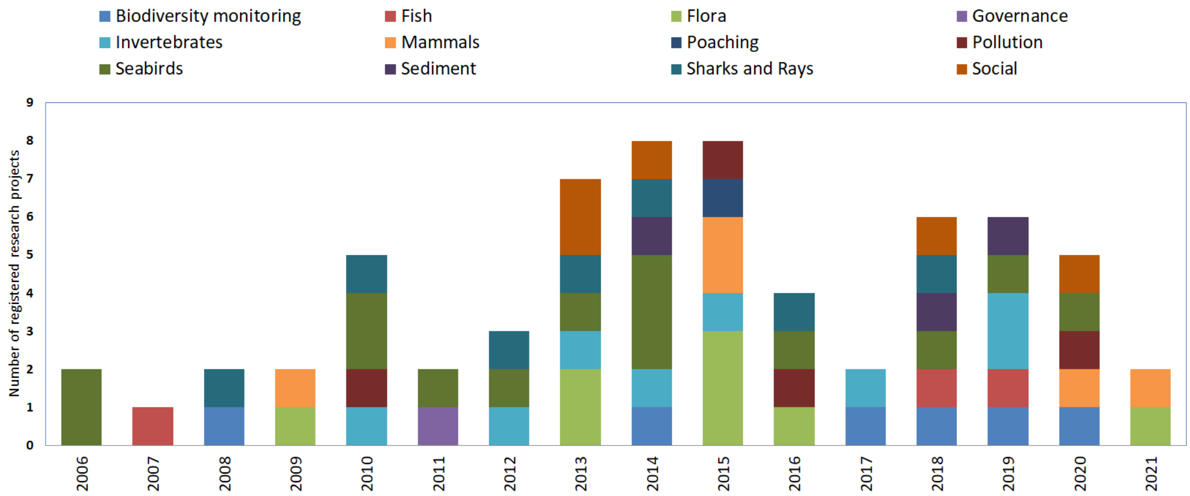


Figure 4. *The number and diversity of research projects registered with SANParks have increased since the MPA was declared in 2004, and many research projects are not registered with SANParks.*

8.3 Long-term ecological monitoring

Research and monitoring are critical for the implementation and good governance of MPAs. SANParks monitoring and research are guided by an overarching strategy (SANParks Research Strategy 2020), national and internal policies and priorities, gazetted objectives of protected areas and management plans. Long-term ecological monitoring is essential to inform our understanding of the factors driving changes in biodiversity and the impacts of pressures on ecosystem function. Several long-term ecological monitoring projects are registered with the Cape Research Centre, including internal and external monitoring. Scientists from the Cape Research Centre and rangers from Table Mountain National Park conduct internal monitoring of fish and sharks using baited remote underwater video surveys (BRUVs) annually during the summer months. Scientists from the DFFE and their partners conduct long-term benthic monitoring. The University of Cape Town conducts long-term ecological monitoring of South African seaweeds in the TMNP MPA. The South African Environmental Observation Network (SAEON) and the South African Institute for Aquatic Biodiversity (SAIAB) are leading large-scale, long-term oceanographic and ecological monitoring across South Africa, with a key focus on MPAs, including the TMNP MPA.

Monitoring is an essential component of resource management. It provides science- or evidence-based information to guide key management decisions. These include:

- informing adaptive management, which is managing through learning and evaluating
- improving conservation planning
- guiding capacity and financial needs to effectively manage
- prioritising conservation and management actions

Whelks, like the papery burnupena (Burnupena papyracea), *are abundant in the MPA. They are usually covered by a toxic orange or purple bryozoan* (Alcyonidium nodosum)*, which protects the whelks from predators © Alison Kock*

Baited remote underwater video (BRUV) surveys are a non-invasive, relatively low-cost method to monitor the diversity and abundance of fish and sharks in the MPA © Steve Benjamin

Scientists from SANParks and DFFE collect records and biological samples from stranded whales in the TMNP MPA © Alison Kock

9. REFERENCES

Acton QA. Heavy Metals—Advances in Research and Application: 2013 Edition.

Acuña FH, Griffiths CL. 2004. Species richness, endemicity and distribution patterns of South African sea anemones (Cnidaria: Actiniaria and Corallimorpharia). African Zoology **39**:193–200.

Agasi R. Socio-economic impact assessment of permit re-allocations in the South African West Coast Rock Lobster industry (Master's thesis, University of Cape Town).

Anderson RJ, Bolton JJ, Molloy FJ, Rotmann KWG. 2003. Commercial seaweed production and research in southern Africa. Pages 1–12 Proceedings of the 17th International Seaweed Symposium. Oxford University Press.

Anderson RJ, Carrick P, Levitt GJ, Share A. 1997. Holdfasts of adult kelp Ecklonia maxima provide refuges from grazing for recruitment of juvenile kelps. Marine Ecology Progress Series **159**:265–273. Inter-Research Science Center. Available from http://www.jstor.org/stable/24844852.

Andreassen H. 2010. The Forgotten Cave and the Still Bay. The University of Oslo.

Andrews WRH, Hutchings L. 1980. Upwelling in the Southern Benguela Current. Progress in Oceanography **9**:1–81. Available from http://www.sciencedirect.com/science/article/pii/0079661180900154.

Athiros G, Athiros L. 2007. The best of The Cape Odyssey: a journey into the colourful and fascinating history of the Cape. Tokai, Historical Media.

Attwood CG. Dynamics of the fishery for galjoen Dichistius capensis, with an assessment of monitoring methods. African Journal of Marine Science. 2003 Jun 1;25(1):311-30.

Attwood CG, Mann BQ, Beaumont J, Harris JM. 1997. Review of the state of marine protected areas in South Africa. South African Journal of Marine Science **7615**:341–367.

Azam F, Fenchel T, Field JG, Gray JS, Meyer-Reil LA, Thingstad F. 1983. The Ecological Role of Water-Column Microbes in the Sea. Marine Ecology Progress Series **10**:257–263. Inter-Research Science Center. Available from http://www.jstor.org/stable/24814647.

Ballantine B. 2014. Fifty years on: Lessons from marine reserves in New Zealand and principles for a worldwide network. Biological Conservation **176**:297–307. Available from http://www.sciencedirect.com/science/article/pii/S0006320714000160.

Baliwe NG. 2021. The effectiveness of Table Mountain National Park Marine Protected Area in the conservation of intertidal rocky shore biodiversity. MSc thesis, University of Cape Town, South Africa.

Barkai A. 1991. The effect of water movement on the distribution and interaction of three holothurian species on the South African West Coast. Journal of Experimental Marine Biology and Ecology **153**:241–254.

Bayne BL, Klumpp DW, Clarke KR. 1984. Aspects of feeding, including estimates of gut residence time, in three mytilid species (Bivalvia, Mollusca) at two contrasting sites in the Cape Peninsula, South Africa. Oecologia **64**:26–33.

Bax N, Williamson A, Aguero M, Gonzalez E, Geeves W. Marine invasive alien species: a threat to global biodiversity. Marine policy. 2003 Jul 1;27(4):313-23.

Bennett BA. 1993. The fishery for white steenbras *Lithognathus* off the Cape coast, South Africa, with some considerations for its management. South African Journal of Marine Science **13**:1–14. Taylor and Francis. Available from https://doi.org/10.2989/025776193784287185.

Bennett BA, Griffiths CL. 1984. Factors affecting the distribution, abundance and diversity of rock-pool fishes on the Cape Peninsula, South Africa. South African Journal of Zoology **19**:97–104.

Bennett RH, Lamberth SJ, Mann BQ. White steenbras (Lithognathus lithognathus). Southern African Marine Linefish Species Profiles Special Publication Oceanographic Research Institute. 2013:239-41.

Best LN, Attwood CG, da Silva C, Lamberth SJ. Chondrichthyan occurrence and abundance trends in False Bay, South Africa, spanning a century of catch and survey records. African Zoology. 2013 Oct 1;48(2):201-27.

Best PB. 2001. Distribution and population separation of Bryde's whale Balaenoptera edeni off southern Africa. Marine Ecology-progress Series - MAR ECOL-PROGR SER **220**:277–289.

Best PB, Folkens, PA. 2007. Whales and dolphins of the southern African subregion. Cambridge University Press.

Best PB, Ross G. 1989. Whales and whaling. Pages 315–338 Oceans of life off southern Africa. Cape Town: Vlaeberg Publishers.

BirdLife International. 2020. Species factsheet: Spheniscus demersus. Downloaded from http://www.birdlife.org on 03/10/2020.

Blamey LK, Shannon LJ, Bolton JJ, Crawford RJ, Dufois F, Evers-King H, Griffiths CL, Hutchings L, Jarre A, Rouault M, Watermeyer KE. Ecosystem change in the southern Benguela and the underlying processes. Journal of Marine Systems. 2015 Apr 1;144:9-29.

Bolton JJ, Levitt GJ. 1987. The influence of upwelling on South African West Coast seaweeds. South African Journal of Marine Science **5**:319–325.

Boyd AJ, Tromp BBS, Horstman DA. 1985. The hydrology off the South African south-western coast between Cape Point and Danger Point in 1975. South African Journal of Marine Science **3**:145–168.

Branch GM. 1971. The ecology of *Patella Linnaeus* from the Cape Peninsula, South Africa 1. Zonation, Movements and Feeding. Zoologica Africana **6**:1–38. Taylor and Francis. Available from https://doi.org/10.1080/00445096.1971.11447402.

Branch GM. 1974a. The ecology of *Patella Linnaeus* from the Cape Peninsula, South Africa, 3. Growth-rates. Transactions of the Royal Society of South Africa **41**:161–193.

Branch GM. 1974b. The ecology of *Patella linnaeus* from the Cape Peninsula, South Africa. 2. Reproductive cycles. Transactions of the Royal Society of South Africa **41**:111–160. Taylor and Francis. Available from https://doi.org/10.1080/00359197409520068.

Branch GM. 1975a. Ecology of Patella species from the Cape Peninsula, South Africa. IV. Desiccation. Marine Biology **32**:179–188.

Branch GM. 1975b. The Ecology of *Patella* from the Cape Peninsula South Africa V. Commensalism. Zoologica Africana **10**:133–162.

Branch GM, Griffiths CL, Branch ML, Beckley LA. 2005. Two oceans: a guide to marine life in southern Africa. David Philip, Cape Town.

Branch GM. Living Shores. Penguin Random House South Africa; 2018 Feb 8.

Branch ML. 1994. Two oceans' influence on algae. Veld and Flora:74–77.

Breitbart M, Rohwer F. 2005. Breitbart M, Rohwer F. Here a virus, there a virus, everywhere the same virus? Trends Microbiol 13: 278-284. Trends in microbiology **13**:278–284.

Breitbart M, Salamon P, Andresen B, Mahaffy JM, Segall AM, Mead D, Azam F, Rohwer F. 2002. Genomic analysis of uncultured marine viral communities. Proceedings of the National Academy of Sciences **99**:14250 LP – 14255. Available from http://www.pnas.org/content/99/22/14250.abstract.

Branch GM, Steffani CN. Can we predict the effects of alien species? A case-history of the invasion of South Africa by Mytilus galloprovincialis (Lamarck). Journal of Experimental Marine Biology and Ecology. 2004 Mar 31;300(1-2):189-215.

Brill GC. The tip of the iceberg: Spatio-temporal patterns of marine resource confiscations in the Table Mountain National Park (Doctoral dissertation, Stellenbosch: Stellenbosch University).

Brill, G. C., and S. J.P.N. Raemaekers. "A Decade of Illegal Fishing in Table Mountain National Park (2000-2009): Trends in the Illicit Harvest of Abalone *Haliotis Midae* and West Coast Rock Lobster *Jasus Lalandii*." African Journal of Marine Science 35, no. 4 (2013): 491–500. https://doi.org/10.2989/1814232X.2013.850443.

Brown AC. 1964. Food-relationships on the intertidal sandy beaches of the Cape Peninsula. South African Journal of Science **60**:35–41.

Brown AC. 1971. The ecology of the sandy beaches of the Cape Peninsula, South Africa. Part 1: Introduction. Transactions of the Royal Society of South Africa **39**:247–279. Taylor and Francis. Available from https://doi.org/10.1080/00359197109519119.

Brown A. 2000. Is the sandy-beach isopod *Tylos granulatus* an endangered species? South African Journal of Science 96, 466-473.

Brown PC, Painting SJ, Cochrane KL. 1991. Estimates of phytoplankton and bacterial biomass and production in the northern and southern Benguela ecosystems. South African Journal of Marine Science **11**:537–564.

Brundrit G, Cartwright A. Understanding the risks to Cape Town of inundation from the sea. Climate Change at the City Scale: Impacts, Mitigation and Adaptation in Cape Town. Oxon, UK: Routledge. 2012 Jun 14:21-37.

Brussaard CPD *et al.,* 2008. Global-scale processes with a nanoscale drive: the role of marine viruses. The ISME journal **2**:575–578. England.

Bruton M. 1998. The essential guide to whales. Cape Town: New Africa Books.

Buchan A, Lecleir GR, Gulvik CA, González JM. 2014. Master recyclers: features and functions of bacteria associated with phytoplankton blooms. Nature Publishing Group **12**:686–698. Nature Publishing Group. Available from http://dx.doi.org/10.1038/nrmicro3326.

Campbell EE. 1996. The global distribution of surf diatom accumulations. Revista Chilena De Historia Natural 69, 495-501.

Centre for Marine Studies. 2001. Stock Assessment of Exploited Invertebrate Subtidal Reef Species and Characterisation of Habitat Types along the Coast of the Cape Peninsula National Park ZA 5027. Cape Town.

Chadwick P, Duncan J, Tunley KL. 2014. State of Management of South Africa's Marine Protected Areas. WWF South Africa Report Series – 2014/Marine/001.

Church JA, White NJ. A 20th century acceleration in global sea-level rise. Geophysical research letters. 2006 Jan 16;33(1).

Cho B, Azam F. 1990. Biogeochemical significance of bacterial biomass in the ocean's euphotic zone. Marine Ecology Progress Series **63**:253–259.

City of Cape Town. 2020. Know your coast. This report can be found online at:

www.capetown.gov.za

Clark BM. 2001. Cape Peninsula National Park Marine Component - Feasibility Study Report. https://www.sanparks.org/parks/table_mountain/library/marine_feasibility.pdf

Coetzee JA, Praglowski J. 1988. Winteraceae pollen from the Miocene of the southwestern Cape (South Africa). Grana **27**:27–37.

Coetzee JC, van der Lingen CD, Hutchings L, Fairweather TP. 2008. Has the fishery contributed to a major shift in the distribution of South African sardine? ICES Journal of Marine Science **65**:1676–1688.

Cole M, Lindeque P, Halsband C, Galloway TS. Microplastics as contaminants in the marine environment: a review. Marine pollution bulletin. 2011 Dec 1;62(12):2588-97.

Colenbrander D, Oelofse G, Cartwright A, Gold H, Tsotsobe S. Adaptation Strategies for the City of Cape Town: Finding the Balance Within Social-Ecological Complexity. InResilient Cities 2011 (pp. 311-318). Springer, Dordrecht.

Compton JS. 2004. The rocks and mountains of Cape Town. Compton, J., 2004. The Rocks And Mountains of Cape Town. Lannsdowne: Double Storey.

Conan G. The long-term effects of the Amoco Cadiz oil spill. Philosophical Transactions of the Royal Society of London. B, Biological Sciences. 1982 Jun 1;297(1087):323-33.

Copat C, Arena G, Fiore M, Ledda C, Fallico R, Sciacca S, Ferrante M. Heavy metals concentrations in fish and shellfish from eastern Mediterranean Sea: consumption advisories. Food and chemical toxicology. 2013 Mar 1;53:33-7.

Coppin R, Rautenbach C, Ponton TJ, Smit AJ, Bell TW. 2020. Investigating Waves and Temperature as Drivers of Kelp Morphology. Frontiers in Marine Science **7**:1–21.

Cowling RM, Macdonald IAW, Simmons MT. 1996. The Cape Peninsula, South Africa: physiographical, biological and historical background to an extraordinary hot-spot of biodiversity **5**:527–550.

Crawford RJM *et al.,* 2011. Collapse of South Africa's penguins in the early 21st century. African Journal of Marine Science **33**:139–156.

Crawford RJ, Dyer BM, Brown PC. Absence of breeding by African Penguins at four former colonies. South African Journal of Marine Science. 1995 Jun 1;15(1):269-72.

Crawford RJM, Shannon LJ, Whittington PA, Murison G. 2000. Factors influencing growth of the African penguin colony at Boulders, South Africa, 1985–1999. South African Journal of Marine Science **22**:111–119. Taylor and Francis. Available from https://doi.org/10.2989/025776100784125780.

Croxall JP, Butchart SHM, Lascelles BEN, Stattersfield AJ, Sullivan B, Symes A, Taylor P. 2012. Seabird conservation status and threats: A global assessment of priorities. Bird Conservation International **22**:1–34.

Darwin 1809-1882 C. 1959. The voyage of the Beagle. London: Dent; New York : Dutton, [1959] [©1959]. Available from https://search.library.wisc.edu/catalog/999467080402121.

David JHM. 1987. Diet of the South African fur seal (1974–1985) and an assessment of competition with fisheries in southern Africa. South African Journal of Marine Science **5**:693–713. Taylor and Francis. Available from https://doi.org/10.2989/025776187784522568.

Dawut M, Sym SD, Suda S, Horiguchi T. 2018. Bysmatrum austrafrum sp. nov. (Dinophyceae), a novel tidal pool dinoflagellate from South Africa. Phycologia **57**:169–178.

Day E. 1998. Ecological interactions between abalone (Haliotis midae) juveniles and echinoids (Parechinus angulosus) off the southwest Coast of South Africa. The University of Cape Town.

Day J, Dudley N, Hockings M, Holmes G, Laffoley D, Stolton S, Wells S, Wenzel L. 2019. Guidelines for applying the IUCN protected area management categories to marine protected areas. Page (Day J, Dudley N, Hockings M, Holmes G, Laffoley D, Stolton S, Wells S, Wenzel L, editors) Second. Gland. Switzerland: IUCN.

DEFF (Department of Environment, Forestry and Fisheries) 2020a. Status of the South African marine fishery resources 2020. Cape Town: DEFF.

DEFF (Department of Environment, Forestry and Fisheries) 2020b. Review of the South African National Plan of Action for the Conservation and Management of Sharks. Cape Town: DEFF.

De Greef K. "The Booming Illegal Abalone Fishery in Hangberg: Tough Lessons for Small-Scale Fisheries Governance in South Africa," no. February 2013 (2013): 129–129.

De Vos A, Justin O'Riain M, Meÿer MA, Kotze PGH, Kock AA. 2015. Behavior of Cape fur seals (Arctocephalus pusillus pusillus) in response to spatial variation in white shark (Carcharodon carcharias) predation risk. Marine Mammal Science **31**:1234–1251.

Díez B, Pedrós-Alió C, Massana R. 2001. Study of genetic diversity of eukaryotic picoplankton in different oceanic regions by small-subunit rRNA gene cloning and sequencing. Applied and environmental microbiology **67**:2932–2941. American Society for Microbiology. Available from https://pubmed.ncbi.nlm.nih.gov/11425705.

Digka N, Tsangaris C, Torre M, Anastasopoulou A, Zeri C. Microplastics in mussels and fish from the Northern Ionian Sea. Marine Pollution Bulletin. 2018 Oct 1;135:30-40.

Dufois F, Rouault M. 2012. Sea surface temperature in False Bay (South Africa): Towards a better understanding of its seasonal and inter-annual variability. Continental Shelf Research **43**:24–35.

Dulvy NK, Fowler SL, Musick JA, Cavanagh RD, Kyne PM, Harrison LR, Carlson JK, Davidson LN, Fordham SV, Francis MP, Pollock CM. Extinction risk and conservation of the world's sharks and rays. elife. 2014 Jan 21;3:e00590.

Eggers, J., 2021. Quantifying the ecological and socio-economic implications of a recovery/collapse of South Africa's West Coast rock lobster fishery.

Engelbrecht TM, Kock AA, O'Riain MJ. 2019. Running scared: when predators become prey. Ecosphere **10**.

Field JG, Griffiths CL, Griffiths RJ, Jarman N, Zoutendyk P, Velimirov B, Bowes A. 1980. Variation in structure and biomass of kelp communities along the southwest Cape coast. Transactions of the Royal Society of South Africa **44**:145–203. Taylor and Francis. Available from https://doi.org/10.1080/00359198009520561.

Field JG, Jarman NG, Dieckmann GS, Griffitsh CL, Velimirov B, Zourendyk P. 1977. Sun, waves, seaweed and lobsters: the dynamics of a West Coast Kelp-bed. South African Journal of Science **73**:7.

FitzGerald DM, Fenster MS, Argow BA, Buynevich IV. Coastal impacts due to sea-level rise. Annual review of earth and planetary sciences. 2008 May 30;36(1):601-47.

Flaviani F, Schroeder DC, Balestreri C, Schroeder JL, Moore K, Paszkiewicz K, Pfaff MC, Rybicki EP. 2017. A pelagic microbiome (Viruses to protists) from a small cup of seawater. Viruses **9**.

Fricke AH. 1979. Kelp grazing by the common sea urchin Parechinus angulosus Leske in False Bay, Cape. South African Journal of Zoology **14**:143–148.

Fricke AH. 1980. Aspects of Population Structure of Parechinus Angulosus Leske, Around the Cape Peninsula. South African Journal of Zoology **15**:177–185.

Frost PG, Siegfried WR, Cooper J. Conservation of the jackass penguin (Spheniscus demersus (L.)). Biological Conservation. 1976 Feb 1;9(2):79-99.

Fuhrman JA. 2009. Microbial community structure and its functional implications. Nature **459**:193–199. England.

Gardner, K. 2021. Effects of protection and environmental factors on rock lobster, abalone and giant periwinkle abundances in the Table Mountain National Park Marine Protected Area. MSc thesis, DST/NRF Centre of Excellence at the Percy Fitzpatrick Institute of African Ornithology, University of Cape Town, Rondebosch 7701, South Africa

Gaylord B, Reed DC, Raimondi PT, Washburn L, McLean SR. 2002. A physically based model of macroalgal spore dispersal in the wave and current-dominated nearshore. Ecology **83**:1239–1251. Available from https://doi.org/10.1890/0012-9658 (2002)083[1239: APBMOM] 2.0.CO

Glass JGK. 1980. Geology, morphology, sediment cover and movement. Pages 15–25 in B. Gasson, editor. The Future Management of False Bay. Cape Town: False Bay Cons. Soc.

Glassom D, Prochazka K, Branch GM. Short-term effects of an oil spill on the West coast of the Cape Peninsula, South Africa. Journal of Coastal Conservation. 1997 Sep;3(2):155-68.

Goodwin AJH. 1929. Preliminary Report on the Archaeology, the Fish Hoek – Nord Hoek Valley: 1-10.

Govender R, Chinsamy-Turan A. 2013. Early Pliocene (5 MA) Shark-cetacean trophic interaction from Langebaanweg, western coast of South Africa. PALAIOS **28**:270–277.

Govender R, Chinsamy-Turan A, Ackermann R. 2012. Anatomical and landmark morphometric analysis of fossil phocid seal remains from Langebaanweg, West Coast of South Africa. Transactions of the Royal Society of South Africa **67**.

Grant WS, Cherry MI. 1985. Mytilus galloprovincialis Lmk. in Southern Africa. Journal of Experimental Marine Biology and Ecology **90**:179–191.

Griffiths MH. Long-term trends in catch and effort of commercial linefish off South Africa's Cape Province: snapshots of the 20th century. African Journal of Marine Science. 2000; 22.

Griffiths CL, Hockey PAR. 1987. A model describing the interactive roles of predation, competition and tidal elevation in structuring mussel populations. South African Journal of Marine Science **5**:547–556.

Griffiths CL, Hockey PA, Van Erkom Schurink C, Le Roux PJ. Marine invasive aliens on South African shores: implications for community structure and tropillc functioning. South African Journal of Marine Science. 1992 Jun 1;12(1):713-22.

Griffiths CL, Mead A, Robinson TB. 2009. A brief history of marine bio-invasions in South Africa: invited paper. African Zoology, 44(2), 241-247.

Griffiths CL, Robinson TB, Lange L, Mead A. 2010. Marine biodiversity in South Africa: An evaluation of current states of knowledge. PLoS ONE **5**.

Griffiths CL, Seiderer JL. 1980. Rock-lobsters and mussels — Limitations and preferences in a predator-prey interaction. Journal of Experimental Marine Biology and Ecology **44**:95–109. Available from http://www.sciencedirect.com/science/article/pii/0022098180901045.

Griffiths M *et al.,* 2004. Impacts of human activities on marine animal life in the Benguela: A historical overview. Oceanography and Marine Biology **42**.

Grindley JR. 1967. South African Archaeological Society The Cape Rock Lobster Jasus lalandii from the Bonteberg Excavation Author (s): John R. Grindley Source: The South African Archaeological Bulletin, Vol. 22, No. 87 (Nov ., 1967), pp. 94-102 Published by : Sou. South African Archaeological Bulletin **22**:94–102.

Grosholz ED, Ruiz GM. Predicting the impact of introduced marine species: lessons from the multiple invasions of the European green crab Carcinus maenas. Biological Conservation. 1996 Oct 1;78(1-2):59-66.

Gründlingh ML, Hunter IT, Potgieter E. 1989. Bottom currents at the entrance to False Bay, South Africa. Continental Shelf Research **9**:1029–1048. Available from http://www.sciencedirect.com/science/article/pii/0278434389900563.

Haines-Young R. and MB Potschin. 2018. Common International Classification of Ecosystem Services (CICES) V5.1 and Guidance on the Application of the Revised Structure. Available from www.cices.eu

Hampton SL, Griffiths CL. Why Carcinus maenas cannot get a grip on South Africa's wave-exposed coastline. African Journal of Marine Science. 2007 Jan 1;29(1):123-6.

Harris LR, Campbell EE, Nel R, Schoeman DS. 2014. Rich diversity, strong endemism, but poor protection: addressing the neglect of sandy beach ecosystems in coastal conservation planning. Diversity and Distributions 20, 1120-1135.

Harris LR, Holness S, Finke G, Kirkman S, Sink K. 2019. Systematic conservation planning as a tool to advance ecologically or biologically significant area and marine spatial planning processes. In: Zaucha, J., Gee, K. (Eds.), Maritime Spatial Planning: Past, Present, Future. Springer International Publishing, Cham, pp. 71–96. https://doi.org/10.1007/978-3-319-98696-8_4

Harris LR, Bessinger M, Dayaram A, Holness S, Kirkman S, Livingstone TC, Lombard AT, Lück-Vogel M, Pfaff M, Sink KJ, Skowno AL, Van Niekerk L. 2019a. Advancing land-sea integration for ecologically meaningful coastal conservation and management. Biological Conservation 237, 81-89.

Harris LR, Campbell EE, Nel R, Schoeman DS. 2014. Rich diversity, strong endemism, but poor protection: addressing the neglect of sandy beach ecosystems in coastal conservation planning. Diversity and Distributions 20, 1120-1135.

Harris LR, Holness SD, Finke G, Amunyela M, Braby R, Coelhop N, Gee K, Kirkman SP, Kreiner A, Mausolf E, Majiedt P, Maletzky E, Nsingi K, Russo V, Sink KJ, Sorgenfrei R. 2022. Practical marine spatial management of Ecologically or Biologically Significant Marine Areas: emerging lessons from evidence-based planning and implementation in a developing-world context. Frontiers in Marine Science 9, 831678.

Harris LR, Majiedt P, Sink KJ, Skowno AL, Van Niekerk L, Holness S, Adams JB, Currie JC, Dunga LV, Lamberth S, MacKay CF, Miza S, Perschke M, Taljaard S. 2019c. Chapter 5: Pressures and ecological condition, In South African National Biodiversity Assessment 2018: Technical Report. Volume 5: Coast. eds L.R. Harris, K.J. Sink, A.L. Skowno, L. Van Niekerk. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6374.

Harris LR, Sink KJ, Skowno AL, Van Niekerk L, Holness S, Sibanda SM. 2019b. Chapter 6: Ecosystem assessments, In South African National Biodiversity Assessment 2018: Technical Report. Volume 5: Coast. eds L.R. Harris, K.J. Sink, A.L. Skowno, L. Van Niekerk. South

African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6374.

Harris, L.R., Holness, S.D., Kirkman, S.P., Sink, KJ, P., Majiedt., Driver, A., 2021. National Coastal and Marine Spatial Biodiversity Plan Version 1.1.

Hartnady CJH, Newton AR, Theron JN. 1974. The stratigraphy and structure of the Malmesbury Group in the southwestern Cape.

Hauck M. 2008. Rethinking small-scale fisheries compliance. Marine Policy 32: 635–642.

Hauck M, Kroese M. 2006. Fisheries compliance in South Africa: a decade of challenges and reform 1994–2004. Marine Policy 30: 74–83.

Heese JA. 1972. Die herkoms van die Afrikaner, 1657-1867. A.A. Balkema, Kaapstad.

Heithaus MR, Frid A, Wirsing AJ, Worm B. Predicting ecological consequences of marine top predator declines. Trends in ecology & evolution. 2008 Apr 1;23(4):202-10.

Hennig, H.F-K.O. 1985. Review of metal concentrations in Southern African coastal waters, sediments and organisms. S. Afr. Nat. Sci. Progr. Unpublished report no. 108.

Hochner B, Shomrat T, Fiorito G. 2006. The octopus: a model for a comparative analysis of the evolution of learning and memory mechanisms. The Biological bulletin **210**:308–317. United States.

Hockey PAR, Dean WRJ, Ryan PG. 2005. Roberts birds of southern Africa, 7th edition. Cape Town: John Voelcker Bird Book Fund.

Hockey PA, van Erkom Schurink C. The invasive biology of the mussel Mytilus galloprovincialis on the southern African coast. Transactions of the Royal Society of South Africa. 1992 Jan 1;48(1):123-39.

Holligan PM. 1992. Do Marine Phytoplankton Influence Global Climate? Page in V. K. Falkowski P.G., Woodhead A.D., editor. Primary Productivity and Biogeochemical Cycles in the Sea. Environmental Science Research, Vol 43. Springer, Boston, MA.

Horstman D A. 1981. Reported red-water outbreaks and their effects on fauna of the west and south coasts of South Africa, 1959–1980. Fish. Bull. S. Af., 15: 71-88Hubbard DM, Dugan JE, Schooler NK, Viola SM. 2014. Local extirpations and regional declines of endemic upper beach invertebrates in southern California. Estuarine, Coastal and Shelf Science 150, 67-75.

Huggett J, Verheye H, Escribano R, Fairweather T. 2009. Copepod biomass, size composition and production in the Southern Benguela: Spatio-temporal patterns of variation, and comparison with other eastern boundary upwelling systems. Progress in Oceanography **83**:197–207. Elsevier Ltd. Available from http://dx.doi.org/10.1016/j.pocean.2009.07.048.

Hunter C. 1987. Ancient tracks on Table Mountain. Sagittarius **2**:2–3.

Hurd CL. 2000. Water motion, marine macroalgal physiology, and production. Journal of Phycology **36**:453–472. Available from https://doi.org/10.1046/j.1529-8817.2000.99139.x.

Hutchings K, Forsythe K, Clark BM. 2016. City of Cape Town Surface Stormwater Systems, Disa Estuary Impact Assessment. Prepared by Anchor Environmental Consultants for the City of Cape Town.

Hutchings K, Griffiths MH. Life-history strategies of Umbrina robinsoni (Sciaenidae) in warm-temperate and subtropical South African marine reserves. African Journal of Marine Science. 2010 Jun 4;32(1):37-53.

Hutchings L *et al.,* 2009. The Benguela Current: An ecosystem of four components. Progress in Oceanography **83**:15–32. Available from http://www.sciencedirect.com/science/article/pii/S0079661109001104.

Jager HS, Drenman MR, Kieth A, Van Riet Lowe C, Peers V, Goodwin AJH, Malan BD, Gill EL. 1941. The Peers Cave (skildergat), the Home of Ancient Man at Fish Hoek, Cape Peninsula. The Fish Hoek Municipality.

Jager HS, Drennan MR, Kieth A, Breuil H, Van Riet Lowe C, Goodwin AJH. 1942. Guide to the Peers Cave – Tunnel Cave and Rock Shelters at Skildergat, Fish Hoek - the Home of prehistoric Man. The Fish Hoek Municipality 2nd Ed.

Jambeck JR, Geyer R, Wilcox C, Siegler TR, Perryman M, Andrady A, Narayan R, Law KL. Plastic waste inputs from land into the ocean. Science. 2015 Feb 13;347(6223):768-71.

Jamieson AJ, Brooks LS, Reid WD, Piertney SB, Narayanaswamy BE, Linley TD. Microplastics and synthetic particles ingested by deep-sea amphipods in six of the deepest marine ecosystems on Earth. Royal Society open science. 2019 Feb 27;6(2):180667.

Johnston SJ, Butterworth DS. 2017. A summary of the West Coast rock lobster fishery. Unpublished report, MARAM document MARAM/IWS/2017/WCRL/BG1:1–8. Available from https://drupalupload.uct.ac.za/maram/Documents/pub/2017/IWS 2017/MARAM_IWS_2017_WCRL_BG1.pdf.

Jones G. 2008. A field guide to the marine animals of the Cape Peninsula. SURG, Cape Town.

Keith A. 1931. New Discoveries Relating to the Antiquity of Man. Page Williams and Norgate. London. Available from https://doi.org/10.2307/2569870.

Keller LF, Waller DM. Inbreeding effects in wild populations. Trends in ecology & evolution. 2002 May 1;17(5):230-41.

Kemper J. African penguin (Jackass penguin) Spheniscus demersus. Birds to watch in Namibia: Red, rare and endemic species. 2015:183-5.

Kimon de Greef. 2013. The booming illegal abalone fishery in Hangberg: Tough lessons for small--scale fisheries governance in South Africa: 129. Available from https://open.uct.ac.za/bitstream/handle/11427/9187/thesis_sci_2014_degreef_k.pdf?sequence=1.

King WB. 1983. Geomorphology of the Cape Peninsula. The University of Cape Town.

Kirezci E, Young IR, Ranasinghe R, Muis S, Nicholls RJ, Lincke D, Hinkel J. Projections of global-scale extreme sea levels and resulting episodic coastal flooding over the 21st Century. Scientific reports. 2020 Jul 30;10(1):1-2.

Kirkman S, Yemane D, Oosthuizen W, Meyer M, Kotze P, Skrypzeck H, Velho F, Underhill L. 2013. Spatio-temporal shifts of the dynamic Cape fur seal population in Southern Africa based on aerial censuses (1972-2009). Marine Mammal Science **29**:497–524.

Kirkman SP. 2009. Evaluating seal-seabird interactions in southern Africa: A critical review. African Journal of Marine Science **31**:1–18.

Kirkman SP, Costa DP, Harrison AL, Kotze PGH, Oosthuizen WH, Weise M, Botha JA, Arnould JPY. 2019. Dive behaviour and foraging effort of female Cape fur seals *Arctocephalus pusillus*. Royal Society Open Science **6**.

Kirkman SP, Oosthuizen WH, Meÿer MA, Kotze PGH, Roux J-P, Underhill LG. 2007. Making sense of censuses and dealing with missing data: trends in pup counts of Cape fur seal Arctocephalus pusillus for the period 1972–2004. African Journal of Marine Science **29**:161–176. Taylor and Francis. Available from https://doi.org/10.2989/AJMS.2007.29.2.2.185.

Klusener R, Hurtado R, Parsons NJ, Vanstreels RE, Stander N, van der Spuy S, Ludynia K. From incubation to release: Hand-rearing as a tool for the conservation of the endangered African penguin. PloS one. 2018 Nov 7;13(11):e0205126.

Knapp JL, Bridges CR, Krohn J, Hoffman LC, Auerswald L. The effects of hypercapnia on the West Coast rock lobster (Jasus lalandii) through acute exposure to decreased seawater pH—Physiological and biochemical responses. Journal of experimental marine biology and ecology. 2016 Mar 1; 476:58-64.

Kock AA, O'Riain MJ, Mauff K, Meÿer M, Kotze D, Griffiths C. 2013. Residency, Habitat Use and Sexual Segregation of White Sharks, Carcharodon carcharias in False Bay, South Africa. PLoS ONE **8**.

Kock AA, Titley S, Petersen W, Sikweyiya M, Tsotsobe S, Colenbrander D, Gold H, Oelofse G. 2012. Shark Spotters: A pioneering shark safety program in Cape Town, South Africa. In: Domeier M, editor. Global perspectives on the biology and life history of the Great White Shark. Boca Raton: CRC Press. 447–466.

Kock AA, Gardner K, Holness S, Goodall V, Harris L, Hutchings K, Clarke B, Lombard AT, Attwood C. 2022. Re-assessing the biodiversity and status of marine resources in the Table Mountain National Park Marine Protected Area. Internal Report 02/2022, Scientific Services, South African National Parks

Koop K, Griffiths C. 1982. The relative significance of bacteria, meio- and macrofauna on an exposed sandy beach. Marine Biology 66, 295-300.

Koop K, Newell RC, Lucas MI. 1982. Microbial Regeneration of Nutrients from the Decomposition of Macrophyte Debris on the Shore. Marine Ecology Progress Series 9, 91-96.

Kopp RE, DeConto RM, Bader DA, Hay CC, Horton RM, Kulp S, Oppenheimer M, Pollard D, Strauss BH. Evolving understanding of Antarctic ice-sheet physics and ambiguity in probabilistic sea-level projections. Earth's Future. 2017 Dec;5(12):1217-33.

Kruger LM, Griffiths CL. 1998. Sea anemones as secondary consumers on rocky shores in the South-Western Cape, South Africa. Journal of Natural History **32**:629–644.

Kudela R, Pitcher G, Probyn T, Figueiras F, Moita T, Trainer V. 2005. Harmful algal blooms in a coastal upwelling system. Oceanography **18**:184–197.

Laird MC, Griffiths CL. Present distribution and abundance of the introduced barnacle Balanus glandula Darwin in South Africa. African Journal of Marine Science. 2008 May 1;30(1):93-100.

Laird MC, Griffiths CL. 2016. Additions to the South African sea anemone (Cnidaria, Actiniaria) fauna, with expanded distributional ranges for known species. African Invertebrates **57**:15–37.

Lamberth SJ, Clark BM, Bennett BA. Seasonality of beach-seine catches in False Bay, South Africa, and implications for management. South African Journal of Marine Science. 1995a Jun 1; 15(1):157-67.

Lamberth SJ, Bennett BA, Clark BM. The vulnerability of fish to capture by commercial beach-seine nets in False Bay, South Africa. South African Journal of Marine Science. 1995b Jun 1; 15(1):25-31.

Lamberth SJ, Bennett BA, Clark BM, Janssens PM. The impact of beach-seine netting on the benthic flora and fauna of False Bay, South Africa. South African Journal of Marine Science. 1995 Jun 1; 15(1):115-22.

Lamont T, Barlow RG, Kyewalyanga MS. 2014. Physical drivers of phytoplankton production in the southern Benguela upwelling system. Deep Sea Research Part I: Oceanographic Research Papers **90**:1–16. Available from http://www.sciencedirect.com/science/article/pii/S0967063714000399.

Landschoff J. 2018. Contributions to the taxonomy of South African hermit crabs (Crustacea: Decapoda: Paguroidea) – integrating microCT scanning and barcoding. The University of Cape Town.

Laubscher M. 2018. Mapping cetacean distribution in the Western Cape to explore potential range shifts in light of climate change. The University of Pretoria.

Law KL, Thompson RC. Microplastics in the seas. Science. 2014 Jul 11; 345(6193):144-5.

Lawler JJ. Climate change adaptation strategies for resource management and conservation planning. Annals of the New York Academy of Sciences. 2009 Apr; 1162(1):79-98.

Leaper R, Cooke J, Trathan P, Reid K, Rowntree V, Payne R. 2006. Global climate drives southern right whale (Eubalaena australis) population dynamics. Biology Letters **2**:289–292. Royal Society. Available from https://doi.org/10.1098/rsbl.2005.0431.

Lechanteur YA. The ecology and management of reef fishes in False Bay, Southwestern Cape South Africa.

Leliaert F, Anderson RJ, Bolton JJ, Coppejans E. 2000. Subtidal understorey algal community structure in kelp beds around the Cape Peninsula (Western Cape, South Africa). Botanica Marina **43**:359–366.

Lemm S, Attwood CG. 2003. State of Marine Protected Area Management in South Africa. WWF-SA. Cape Town.

Le Quesne WJ, Pinnegar JK. The potential impacts of ocean acidification: scaling from physiology to fisheries. Fish and Fisheries. 2012 Sep; 13(3):333-44.

Lewis SEF, Turpie JK, Ryan PG. 2012. Are African penguins worth saving? The ecotourism value of the Boulders Beach colony. African Journal of Marine Science **34**:497–504. Taylor and Francis. Available from https://doi.org/10.2989/1814232X.2012.716008.

Linol B, De Wit MJ. 2016. Origin and Evolution of the Cape Mountains and Karoo Basin. Springer International Publishing, Switzerland.

Loewenthal D, Paijmans DM, Hockey PA. How do African Black Oystercatchers Haematopus moquini recruit into high-density populations?. Ostrich. 2015 May 4; 86(1-2):1-8.

Longhurst AR, Glen Harrison W. 1989. The biological pump: Profiles of plankton production and consumption in the upper ocean. Progress in Oceanography **22**:47–123. AA(Department of Fisheries and Oceans, Biological Oceanography Division, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada), AB(Department of Fisheries and Oceans, Biological Oceanography Division, Bedford Institute of Oceanography, Dartmo. Available from https://ui.adsabs.harvard.edu/abs/1989PrOce...22...47L.

Mabin CA, Wilson JR, Le Roux JJ, Robinson TB. Reassessing the invasion of South African waters by the European shore-crab Carcinus maenas. African Journal of Marine Science. 2017 Oct 25;39(3):259-67.

Maggs T, Speed E. 1967. Bonteberg Shelter Author (s): T. Maggs and E. Speed Source : The South African Archaeological Bulletin, Nov. 1967, Vol. 22, No. 87 (Nov., Published by : South African Archaeological Society Stable URL : http://www.jstor.com/stable/3888441 REF. The South African Archaeological Bulletin **22**:80–93.

Mangold K. 1983. Octopus vulgaris. Pages 335–361 in P.R. Boyle, editor. Cephalopod Life Cycles. New York: Academic Press.

Mangold K. 1987. Reproduction. Pages 157–200 Boyle PR (ed) Cephalopod life cycles. Vol 2. Academic Press, London.

Mann BQ, Buxton CD, Pollard D, Carpenter KE, Iwatsuki Y. 2014. Lithognathus. The IUCN Red List of Threatened Species 2014: e.T12137A505458. https://dx.doi.org/10.2305/IUCN.UK.2014-3.RLTS.T12137A505458.en. Downloaded on 02 October 2020.

Mann-Lang, JB, Branch GM, Mann BQ, Sink KJ, Kirkman SP, Adams R. 2021. Social and economic effects of marine protected areas in South Africa, with recommendations for future assessments, African Journal of Marine Science, **43**:3, 367-387, DOI: 10.2989/1814232X.2021.1961166.

Martin RA, Hammerschlag N, Collier RS, Fallows C. 2005. Predatory behaviour of white sharks (Carcharodon carcharias) at Seal Island, South Africa. Journal of the Marine Biological Association of the United Kingdom **85**:1121–1135.

Martínez JM, Swan BK, Wilson WH. 2014. Marine viruses, a genetic reservoir revealed by targeted viromics. The ISME Journal **8**:1079–1088. Available from https://doi.org/10.1038/ismej.2013.214.

Mather AA. Sea level rise and it's likely financial impacts. IMFO: Official Journal of the Institute of Municipal Finance Officers. 2008 Sep 1; 8(3):8-9.

Mather AA, Garland GG, Stretch DD. Southern African sea levels: corrections, influences and trends. African Journal of Marine Science. 2009 Aug 1; 31(2):145-56.

Mather JA, Dickel L. 2017. Cephalopod complex cognition. Current Opinion in Behavioral Sciences **16**:131–137. Available from http://www.sciencedirect.com/science/article/pii/S2352154617300189.

Mawdsley JR, O'Malley RO, Ojima DS. A review of climate-change adaptation strategies for wildlife management and biodiversity conservation. Conservation Biology. 2009 Oct; 23(5):1080-9.

Mayfield CS, Prochazka K, Heijnis C. 2001. Stock Assessment of Exploited Invertebrate Subtidal Reef Species and Characterisation of Habitat Types along the Coast of the Cape Peninsula National Park.

McGeoch MA, Spear D, Kleynhans EJ, Marais E. Uncertainty in invasive alien species listing. Ecological Applications. 2012 Apr; 22(3):959-71.

McLachlan A. Defeo O. 2018. The Ecology of Sandy Shores (Third Edition). Academic Press, United Kingdom.

McQuaid CD, Branch GM. 1984. Influence of sea temperature, substratum and wave exposure on rocky intertidal communities: an analysis of fauna1 and floral biomass. Marine Ecology - Progress Series **19**:145–151.

Meadows ME, Compton JS. 2015. Table Mountain: Wonder of Nature at the Foot of Africa. Landscapes and Landforms of South Africa: 97–103. Available from http://link.springer.com/10.1007/978-3-319-03560-4.

Meert J, Van der Voo R. 1997. The assembly of Gondwana 800-550 Ma. Journal of Geodynamics **23**:223–235.

Nkomo GM. Fish in the life of Kalk Bay–Examining how fisheries policies are affecting the access to fish for the food security of the fishing community of Kalk Bay. https://etd.uwc.ac.za/bitstream/handle/11394/4718/Nkomo_gm_ma_ems_2015.pdf?sequence=1&isAllowed=y

Minchin D, Gollasch S, Cohen AN, Hewitt CL, Olenin S. Characterizing vectors of marine invasion. InBiological invasions in marine ecosystems 2009 (pp. 109-116). Springer, Berlin, Heidelberg.

Mirimin L, Kerwath S, Macey B, Lamberth SJ, Cowley PD, Bester-van der Merwe A, Bloomer P, Roodt-Wilding R. Genetic analyses of overfished silver kob Argyrosomus inodorus (Scieanidae) stocks along the southern African coast. Fisheries research. 2016 Apr 1; 176: 100-6.

Moldan A. Impact of a major oil spill. Conservation. 1994; 9(5):8-11.

Naidoo T, Glassom D, Smit AJ. Plastic pollution in five urban estuaries of KwaZulu-Natal, South Africa. Marine pollution bulletin. 2015 Dec 15; 101(1):473-80.

National Biodiversity Assessment. 2018. The status of South Africa's ecosystems and biodiversity. Synthesis Report.

Neethling M, Matthee CA, Bowie RC, Von der Heyden S. Evidence for panmixia despite barriers to gene flow in the southern African endemic, Caffrogobius caffer (Teleostei: Gobiidae). BMC Evolutionary Biology. 2008 Dec; 8(1):1-9.

Newman GG, Pollock DE. 1974. Growth of the rock lobster Jasus lalandii and its relationship to the benthos. Marine Biology **24**:339–346. Available from https://doi.org/10.1007/BF00396100.

Nixon M. 1987. Cephalopod diets. Pages 201–219 in P. R. Boyle, editor. Cephalopod Life Cycles, vol. 2. New York: Academic Press.

Odebrecht C, Du Preez DR, Abreu PC, Campbell EE. 2013. Surf zone diatoms: A review of the drivers, patterns and role in sandy beaches food chains. Estuarine, Coastal and Shelf Science 150, 24-35.

Ojemaye CY, Onwordi CT, Pampanin DM, Sydnes MO, Petrik L. Presence and risk assessment of herbicides in the marine environment of Camps Bay (Cape Town, South Africa). Science of the Total Environment. 2020 Oct 10; 738:140346.

Okes NC and O'Riain MJ. 2017. Otter occupancy in the Cape Peninsula: estimating the probability of river habitat use by Cape clawless otters, *Aonyx capensis*, across a gradient of human influence. Aquatic Conservation 27, 706–716.

Packard A. 1972. Cephalopods and fish: the limits of convergence. Biological Reviews **47**:241–307. John Wiley and Sons, Ltd. Available from https://doi.org/10.1111/j.1469-185X.1972.tb00975.x.

Pagès F, Gili J, Bouillon J. 1992. Medusae (Hydrozoa, Scyphozoa, Cubozoa) of the Benguela Current (southeastern Atlantic). Scientia Marina **56**:1–64.

Painting S, Science A, Moloney C. 1993. Simulation and field measurements of phytoplankton-bacteria-zooplankton interactions in the southern Benguela upwelling region. Marine Ecology - Progress Series.

Pardoe A. A public opinion of Shark Exclusion Net and Shark Management on Fish Hoek Beach.

Peers B. 1927. Excavation report of 1927 on Peers Cave, Fishhoek, Cape. From the archives of Iziko, South African Museum.

Peers B. 1928. Notes from a lecture on Peers Cave. From the archives of Iziko, South African

Museum.

Peers B. 1929. Excavation report on Peers Cave, Fish Hoek, Cape. From the archives of Iziko, South African Museum.

Peters K, Robinson TB. First record of the marine alien amphipod Caprella mutica (Schurin, 1935) in South Africa.

Petrik L, Green L, Abegunde AP, Zackon M, Sanusi CY, Barnes J. Desalination and seawater quality at Green Point, Cape Town: A study on the effects of marine sewage outfalls. South African Journal of Science. 2017 Dec;113(11-12):1-0.

Penney AJ. 1991. The interaction and impact of net and line fisheries in False Bay Twenty-one Years on. 1991:663.

Peters K, Griffiths C, Robinson TB. Patterns and drivers of marine bioinvasions in eight Western Cape harbours, South Africa. African Journal of Marine Science. 2014 Jan 2;36(1):49-57.

Pfaff M, Flaviani F, Plessis G, Rybicki E, Schroeder D. 2015a. The overlooked foundation: marine microbes in the oceans surrounding South Africa. Pages 100–121.

Pfaff MC *et al.,* 2019. A synthesis of three decades of socio-ecological change in False Bay, South Africa: setting the scene for multidisciplinary research and management. Elementa Science of the Anthropocene **7**.

Pfaff MC, Flaviani F, Plessis G, Rybicki E. 2015b. The overlooked foundation: marine microbes in the oceans surrounding South Africa. Pages 232–239 Reflections on the State of Research and Technology in South Africa's Marine and Maritime Sectors.

Pfennig N. 1967. Photosynthetic Bacteria. Annual Review of Microbiology **21**:285–324. Annual Reviews. Available from https://doi.org/10.1146/annurev.mi.21.100167.001441.

Pienaar RN, Sakai H, Horiguchi T. 2007. Description of a new dinoflagellate with a diatom endosymbiont, Durinskia capensis sp. nov. (Peridiniales, Dinophyceae) from South Africa. Journal of Plant Research **120**:247–258.

Pillar SC. 1986. Temporal and spatial variations in copepod and euphausiid biomass off the southern and south-western coasts of South Africa in 1977/78. South African Journal of Marine Science **4**:219–229.

Pitcher GC, Calder D. 2000. Harmful algal blooms of the southern Benguela Current: a review and appraisal of monitoring from 1989 to 1997. South African Journal of Marine Science **22**:255–271. Taylor and Francis. Available from https://doi.org/10.2989/025776100784125681.

Pitman R, Ensor P. 2003. Three forms of killer whales (Orcinus orca) in Antarctic waters. Journal of Cetacean Research and Management **5**:131–140.

Poggenpoel CA, Robertshaw PT. 1981. The Excavation of Smitswinkelbaai Cave, Cape Peninsula. The South African Archaeological Bulletin **36**:29–35.

Pollock DE. 1979. Predator-prey relationships between the rock lobster Jasus lalandii and the mussel Aulacomya ater at Robben Island on the Cape West Coast of Africa. Marine Biology **52**:347–356. Available from https://doi.org/10.1007/BF00389076.

Pollock DE, Cockcroft AC, Goosen PC. 1997. A note on reduced rock lobster growth rates and related environmental anomalies in the southern Benguela, 1988-1995. South African Journal of Marine Science: 287–293.

Potts WM, Götz A, James N. Review of the projected impacts of climate change on coastal fishes in southern Africa. Reviews in fish biology and fisheries. 2015 Dec; 25(4):603-30.

Prieto A, Barber-Lluch E, Hernández-Ruiz M, MartÍnez-GarcÍa S, Fernández E, Teira E. 2016. Assessing the role of phytoplankton–bacterioplankton coupling in the response of microbial plankton to nutrient additions. Journal of Plankton Research **38**:55–63. Available from https://doi.org/10.1093/plankt/fbv101.

Prober SM, Doerr VA, Broadhurst LM, Williams KJ, Dickson F. Shifting the conservation paradigm: a synthesis of options for renovating nature under climate change. Ecological Monographs. 2019 Feb; 89(1):e01333.

Proctor LM, Fuhrman JA. 1990. Viral mortality of marine bacteria and cyanobacteria. Nature **343**:60–62. Available from https://doi.org/10.1038/343060a0.

Reid DL, Erlank AJ, Rex DC. 1991. Age and correlation of the False Bay dolerite dyke swarm, South-western Cape, Cape Province. South African Journal of Geology **94**:155–158.

Rightmire PG. 1974. The Later Pleistocene and recent evolution of man in Africa. MSS Modular Publications, Module **27**:1–38.

Rightmire PG. 1978. Human skeletal remains from the southern Cape Province and their bearing on the Stone Age prehistory of South Africa. Quaternary Research **9**:219–230.

Robinson TB, Peters K, Brooker B. Coastal invasions: the South African context. In Biological Invasions in South Africa 2020 (pp. 229-247). Springer, Cham.

Rocke E, Cheung S, Gebe Z, Dames NR, Liu H, Moloney CL, Mount AS. 2020. Marine microbial community composition during the upwelling season in the Southern Benguela. Frontiers in Marine Science **7**:1–18.

Roux S, Faubladier M, Mahul A, Paulhe N, Bernard A, Debroas D, Enault F. 2011. Metavir: a webserver dedicated to virome analysis. Bioinformatics **27**:3074–3075. Available from https://doi.org/10.1093/bioinformatics/btr519.

Roy C, van der Lingen CD, Coetzee JC, Lutjeharms JRE. 2007. Abrupt environmental shift associated with changes in the distribution of Cape anchovy Engraulis encrasicolus spawners in the southern Benguela. African Journal of Marine Science **29**:309–319.

Rudner I, Rudner J. 1956. Excavation of the Logie's Rock Cave, Llandudno. The Journal of Wildlife Management **11**:77–80.

Rust IC. 1991. Environmental geology of the coastal zone: a South African perspective. South African Journal of Marine Science **10**:397–405.

Ryan PG. The transport and fate of marine plastics in South Africa and adjacent oceans. South African Journal of Science. 2020 Jun; 116(5-6):1-9.

Samaai T, Gibbons MJ. 2005. Demospongiae taxonomy and biodiversity of the Benguela region on the West Coast of South Africa. Africa.

Samaai T, Payne RP, Maduray S, Janson L. 2018. Phylum Porifera. Pages 37–64 in L. J. Atkinson and K. J. Sink, editors. Field Guide to the Offshore Marine Invertebrates of South Africa. Malachite Marketing and Media, Pretoria.

Sanguinetti CA. Patterns in reef fish assemblages as determined by baited remote underwater video (BRUV) along the western side of False Bay: effects of site, depth and protection status (Master's thesis, University of Cape Town).

SANParks (2016). Table Mountain National Park – Park Management Plan: 2015-2025. https://www.sanparks.org/assets/docs/conservation/park_man/tmnp_approved_plan.pdf

Schulze BR. 1965. Climate of South Africa. Part 8, General Survey.

Setälä O, Norkko J, Lehtiniemi M. Feeding type affects microplastic ingestion in a coastal invertebrate community. Marine pollution bulletin. 2016 Jan 15; 102(1):95-101.

Seyboth E, Groch KR, Secchi ER, Dalla Rosa L. 2015. Habitat use by southern right whales, Eubalaena australis (Desmoulins, 1822), in their main northernmost calving area in the western South Atlantic. Marine Mammal Science **31**:1521–1537. John Wiley and Sons, Ltd. Available from https://doi.org/10.1111/mms.12241.

Shannon L V. 1985. The Benguela ecosystem. I: Evolution of the Benguela physical features and processes. Oceanography and Marine Biology: An Annual Review **23**:105–182.

Shannon L V., Pillar SC. 1986. The Benguela ecosystem. 3. Plankton. Pages 65–170 in M. B. A. U. Press, editor. Oceanography and marine biology. An annual review.

Suchanek TH. Oil impacts on marine invertebrate populations and communities. American Zoologist. 1993 Dec 1; 33(6):510-23.

Schlegel RW, Oliver ECJ, Wernberg T, and Smit AJ (2017) Nearshore and offshore co-occurrence of marine heatwaves and cold-spells. Progress in Oceanography, 151, 189-205.

CRAWFORD RJ, SHANNON LJ, WHITTINGTON PA. Population dynamics of the African Penguin Spheniscus demersus at Robben Island, South Africa. Marine Ornithology. 1999 Oct 15; 27:139-47.

Sherley RB, Waller LJ, Strauss V, Geldenhuys D, Underhill LG, Parsons NJ. Hand-rearing, release and survival of African penguin chicks abandoned before independence by moulting parents. PloS one. 2014 Oct 22;9(10):e110794.

Sherley RB, Barham BJ, Barham PJ, Leshoro TM, Underhill LG. Artificial nests enhance the breeding productivity of African Penguins (Spheniscus demersus) on Robben Island, South Africa. Emu-Austral Ornithology. 2012 Jun 1; 112(2):97-106.

Simpson GG. 1971. Fossil penguin from the late Cenozoic of South Africa. Science **171**:1144–1145.

Simpson GG. 1973. Tertiary penguins (Sphenisciformes, Spheniscidae) from Ysterplaats [sic], Cape Town, South Africa. South African Journal of Science **69**:342–344.

Simpson GG. 1979a. A new genus of Late Tertiary penguin from Langebaanweg, South Africa. Annals of the South African Museum **78**:1–9.

Simpson GG. 1979b. Tertiary penguins from the Duinefontein site, Cape Province, South Africa. Annals of the South African Museum **79**:1–17.

Sink KJ, Van der Bank M, Majiedt P, Harris L, Atkinson L, Kirkman S, Karenyi N. 2019. South African National Biodiversity Assessment 2018 Technical Report Volume 4: Marine Realm. South African National Biodiversity Institute, Pretoria, South Africa.

Singh R, Gautam N, Mishra A, Gupta R. Heavy metals and living systems: An overview. Indian journal of pharmacology. 2011 May; 43(3):246.

Skowno AL, Poole C, Raimondo D, Sink K, van Niekerk L, van Deventer H, Smith-Adao L, Harris L, Tolley K, Zengeya T, Midgley G, Driver A. 2019. National Biodiversity Assessment 2018: An assessment of South Africa's ecosystems, species and genes. Synthesis Report.

Smit AJ, Roberts M, Anderson RJ, Dufois F, Dudley SFJ. 2013. A Coastal Seawater Temperature Dataset for Biogeographical Studies: Large Biases between In Situ and Remotely-Sensed Data Sets around the Coast of South Africa **8**.

Smith CD. 1999. Population biology and ecology of octopuses in the southwestern cape: a study towards the establishment of a small-scale Octopus fishery. The University of Cape Town.

Solonenko SA, Ignacio-Espinoza JC, Alberti A, Cruaud C, Hallam S, Konstantinidis K, Tyson G, Wincker P, Sullivan MB. 2013. Sequencing platform and library preparation choices impact viral metagenomes. BMC Genomics **14**:320. Available from https://doi.org/10.1186/1471-2164-14-320.

Songelwa N *et al.,* 2015. Park management plan. Available from https://www.sanparks.org/assets/docs/conservation/park_man/tmnp_approved_plan.pdf .

Sowman M. Subsistence and small-scale fisheries in South Africa: A ten-year review. Marine Policy. 2006 Jan 1;30(1):60-73.

Sowman M, Hauck M, Van Sittert L, Sunde J. 2011. Marine protected area management in South Africa: New policies, old paradigms. Environmental Management **47**:573–583.

Sowman M, Malan N. 2018. Review of progress with integrated coastal management in South Africa since the advent of democracy. African Journal of Marine Science **40**:121–136.

Sparks C, Immelman S. Microplastics in offshore fish from the Agulhas Bank, South Africa. Marine Pollution Bulletin. 2020 Jul 1;156:111216.

Sparks C, J. Odendaal, R. Snyman. Metal concentrations in intertidal water and surface sediment along the west coast of the Cape Peninsula, Cape Town, South Africa WaterSA, 43 (1) (2017), pp. 17-24, 10.4314/wsa.v43i1.03

Stynder DD. 2006. A quantitative assessment of variation in Holocene Khoesan crania from South Africa's western, south-western, southern and south-eastern coasts and coastal forelands. University of Cape Town, South Africa.

Stynder DD, Brock F, Sealy JC, Wurz S, Morris AG, Volman TP. 2009. A mid-Holocene AMS 14C date for the presumed upper Pleistocene human skeleton from Peers Cave, South Africa. Journal of Human Evolution **56**:431–434.

Suttle CA. 2005. Viruses in the sea. Nature **437**:356–361. Available from https://doi.org/10.1038/nature04160.

Suttle CA. 2007. Marine viruses — major players in the global ecosystem. Nature Reviews Microbiology **5**:801–812. Available from https://doi.org/10.1038/nrmicro1750.

Suttle CA, Chan AM, Cottrell MT. 1990. Infection of phytoplankton by viruses and reduction of primary productivity. Nature **347**:467–469. Available from https://doi.org/10.1038/347467a0.

Sydeman WJ, Hunt Jr GL, Pikitch EK, Parrish JK, Piatt JF, Boersma PD, Kaufman L, Anderson DW, Thompson SA, Sherley RB. South Africa's experimental fisheries closures and recovery of the endangered African penguin. ICES Journal of Marine Science. 2021 Dec; 78(10):3538-43.

Turpie, Jane K., Lynnath E. Beckley, and Stephen M. Katua. "Biogeography and the Selection of Priority Areas for Conservation of South African Coastal Fishes." Biological Conservation 92, no. 1 (2000): 59–72. https://doi.org/10.1016/S0006-3207 (99)00063-4

William J Sydeman, George L Hunt, Jr, Ellen K Pikitch, Julia K Parrish, John F Piatt, P Dee Boersma, Les Kaufman, Daniel W Anderson, Sarah Ann Thompson, Richard B Sherley, South Africa's experimental fisheries closures and recovery of the endangered African penguin, ICES Journal of Marine Science, Volume 78, Issue 10, December 2021, Pages 3538–3543, https://doi.org/10.1093/icesjms/fsab231.

Terhorst A. 1988. The seafloor environment off Simon's Town in False Bay revealed by side-scan-sonar, bottom sampling, diver observations and underwater photography.

Theron JN, Gresse PG, Siegfried HP, Rogers J. 1991. The geology of the Cape Town area. Explanation Sheet 3318. Department of Mineral and Energy Affairs, Geological Survey, South Africa.

Theron JN, Gresse PG, Siegfried HP, Rogers J. 1992. Explanation sheet 3318 – The Geology of the Cape Town Area.

Thomsen MS, Wernberg T, Staehr PA, Schiel D. Ecological interactions between marine plants and alien species. Marine Macrophytes as Foundation Species. 2016 Nov 25; 226.

Thompson WW. 1913. The Sea Fisheries of the Cape Colony, from Van Riebeeck's days to the Eve of the Union with a Chapter on Trout and other freshwater fishes. Cape Town: Maskew Miller.

Toerien I. 2000. The story of whaling in False Bay.

Tunley KL. 2009. State of Management of South Africa's Marine Protected Areas. WWF South Africa Report Series-2009/Marine/001.

Underhill LG, Bartlett PA, Baumann L, Crawford RJ, Dyer BM, Gildenhuys A, Nel DC, Oatley TB, Thornton M, Upfold L, Williams AJ. Mortality and survival of African Penguins *Spheniscus demersus* involved in the Apollo Sea oil spill: an evaluation of rehabilitation efforts. Ibis. 1999 Jan; 141(1):29-37.

van Doorn AC, O'Riain MJ, Swedell L. 2010. The effects of extreme seasonality of climate and day length on the activity budget and diet of semi-commensal chacma baboons (Papio ursinus) in the Cape Peninsula of South Africa. American Journal of Primatology **72**:104–112.

Van Wilgen NJ, Herbst M. Taking stock of parks in a changing world: The SANParks Global Environmental Change Assessment. SANParks, Cape Town. 2017.

Van Zyl FW. 2018. Geological mapping of the inner shelf off Cape Town's Atlantic Seaboard, South Africa. The University of Cape Town.

Van Zyl HW, Kinghorn JW. 2018. The Economic Value and Contribution of the Simon's Town Penguin Colony. Report to the City of Cape Town.

Vanstreels RET, Parsons NJ, McGeorge C, Hurtado R, Ludynia K, Waller L, Ruthenberg M, Purves A, Pichegru L, Pistorius PA. 2019. Identification of land predators of African Penguins Spheniscus demersus through post-mortem examination. Ostrich **90**:359–372.

Velimirov B, Field JG, Griffiths CL, Zoutendyk P. 1977. The ecology of kelp bed communities in the Benguela upwelling system. Helgoländer wissenschaftliche Meeresuntersuchungen **30**:495–518. Available from https://doi.org/10.1007/BF02207857.

Verheye HM, Huggett JA, Lamont T. 2015. Plankton: life adrift in the ocean. Available from RP143/2015 - ISBN: 978-0-621-42765-3.

Werz BEJS. 2003. Cape of storms or Cape of Good Hope? The development of maritime archaeoiogica1 research in South Africa and prospects for the future. Transactions on the Built Environment **65**:75–85.

Wesgro Annual Report. 2019. Cape Town Regional Trends.

Williams GC. 1987. The aberrant and monotypic soft coral genus Malacacanthus thomson, 1910 (Octocorallia: Alcyoniidae) endemic to southern Africa. Journal of Natural History **21**:1337–1346.

Williams HA. 1993. Southern Lights. William Waterman Publications.

Williamson SJ *et al.,* 2008. The Sorcerer II Global Ocean Sampling Expedition: Metagenomic Characterization of Viruses within Aquatic Microbial Samples. PLOS ONE **3**:e1456. Public Library of Science. Available from https://doi.org/10.1371/journal.pone.0001456.

Williamson SJ, Allen LZ, Lorenzi HA, Fadrosh DW, Brami D, Thiagarajan M, McCrow JP, Tovchigrechko A, Yooseph S, Venter JC. 2012. Metagenomic Exploration of Viruses throughout the Indian Ocean. PLOS ONE **7**:e42047. Public Library of Science. Available from https://doi.org/10.1371/journal.pone.0042047.

Winker H, Kerwath S, Attwood C, da Silva C, Maggs J, Parker D. The 2017 assessment of Silver kob (Argyrosomus inodorus) for the South African linefishery. FISHERIES/LSWG/2017/04. Cape Town: Department of Agriculture, Forestry and Fisheries. 2017.

Wright SL, Thompson RC, Galloway TS. The physical impacts of microplastics on marine organisms: a review. Environmental pollution. 2013 Jul 1; 178:483-92.

Yi YJ, Zhang SH. The relationships between fish heavy metal concentrations and fish size in the upper and middle reach of Yangtze River. Procedia Environmental Sciences. 2012 Jan 1; 13:1699-707.

Young JZ. 1991. Computation in the Learning System of Cephalopods. Biological Bulletin **180**:200–208. Marine Biological Laboratory. Available from http://www.jstor.org/stable/1542389.

Zsilavecz G. 2005. Coastal fishes of the Cape Peninsula and False Bay. Southern Underwater Research Group.

Zsilavecz G. 2007. Nudibranchs of the Cape Peninsula and False Bay. Southern Underwater Research Group.

APPENDIX I: HISTORY

Table 1. Maritime cultural history and shipwrecks

Marine cultural heritage and shipwrecks				
Stromatolite	**Description**	**Location**	**GPS**	**Age**
Cape Point	Layered sedimentary formations created by photosynthetic cyanobacteria	Cape Point	34°20′48.42″S 18°27′48.16″E	
Venus Pools	Layered sedimentary formations created by photosynthetic cyanobacteria	Venus Pools		
Shell middens	**Description**	**Location**	**GPS**	**Age**
Peers Cave	Discovered by Victor Peers and his son, Bertie Peers, in the late 1920s. A cave containing beads, ochre and human skeletal remains. Initially, cave paintings were reported. However, later studies found no evidence of these paintings	Fish Hoek	S34°7.14' E18°24.49'	Late Stone Age
Logie's Bay	Artefacts include stone and bone implements, ornaments (e.g., ostrich shell beads) and pottery	Llandudno		Late Stone Age
Smitswinkel Bay Cave	Deposits of fish and shellfish remains and artefacts such as bone beads, ostrich eggshell beads and *Haliotis* shell pendants dated to ~1,400 years ago.	Simon's Town	S34°16' E18°28'	Late Stone Age
Bonteberg Shelter	Deposits of marine food, e.g., molluscs, crustaceans, seals and several fish species	Scarborough	S34°12' E18°23'	Late Stone Age
Shipwrecks	**Description**	**Location**	**GPS**	**Year of wreck**
West Coast of the peninsula				
RMS Athens	An iron steamship carrying mail to Mauritius shipwrecked during a hurricane in Table Bay. All 30 aboard drowned.	Mouille Point		1865
The São José Paquete Africa	A Portuguese slave ship en route from Mozambique to Brazil. Over 200 African slaves who were aboard	Off Clifton Beach		1794

	died when the ship sank. The wreck was rediscovered in the 1980s but was not identified until 2015.			
SS Oakburn	On a voyage from New York to Sydney, a British cargo steamer was wrecked in fog on 21st May 1906. Two lives were lost.	Karbonkelberg	S33°02.216' E018°18.573'	1906
BOS (Bouyge Offshore Services) 400	A recent wreck overlapping the SS Oakburg was the biggest floating crane in Africa that broke its towline during a north-westerly gale while under tow by the Russian tug "Tigr". Unsuccessful efforts were made to reconnect the tow and salvage the vessel.	Karbonkelberg	S33°02.216' E018°18.573'	1994
Het Huis Te Crayesteyn	A Dutch ship ran aground at Oudekraal while on her maiden voyage to the East. She carried 19 chests of silver (approximately 57 000 pieces), most recovered.	Oudekraal	S33°58.850' E018°21.650'	1698
Antipolis	Two recent wrecks - however, due to their visibility are important sites. Both vessels were under tow by the tug Kiyo Maru no.2 from Greece to scrap merchants in the Far East when towing cable broke during a north-westerly storm.	Oudekraal	S33°59.06' E018°21.37'	1977
Romelia		Llandudno	S34°00.732' E018°19.811'	1977
SS Maori	A Shaw Saville Line steamer ran aground in thick fog and drizzle while en route from London to Dunedin in New Zealand with a general cargo including crockery, wine and champagne, explosives, and railway tracks. Thirty-two of the 53 crew members lost their lives. This wreck, together with earlier Umhahli, resulted in the construction of Slangkop lighthouse in 1914	East of Duiker point	S34°02.062' E018°18.793'	1909
MV Aster	A recent wreck - South African registered lobster fishing vessel that was scuttled to form a diver-friendly artificial reef.	Hout Bay	S34°03.901' E18°20.967'	1977

MV Katsu Maru	A Japanese trawler that struck an unidentified object and was holed on the port side. While under tow to Hout Bay, the vessel flooded, and it sank.	Hout Bay	S34°03.910' E18°20.942	1978
SS Umhahli	A British steamer carrying cargo of railway lines, iron and dynamite and a valuable racehorse. One casualty (a baby) drowned when the lifeboat capsized.	Albatross Rock off Olifantsbos	S34°16.435' E18°22.487'	1909
MV Nolloth	A Dutch coaster. First time in South African maritime rescue history that helicopters were used to save the crew.	Albatross Rock off Olifantsbos	S34°16' E18°23'	1965
Holland	The Dutch frigate commanded by Captain Willem Silvester was a Dutch National frigate bound from Holland to Java. She was wrecked near Olifantsbos Point on 11 May 1786. Eight lives were lost.	Albatross Rock off Olifantsbos		1786
L'Alouette	A French naval ship from Rochefort-sur-Mer to Reunion sunk due to dense fog and rough seas. One boy drowned.	Albatross Rock off Olifantsbos		1817
SS Albatross	The first steam tug to be employed in the Cape. Carrying a cotton cargo en route from Simon's Town to Table Bay struck a sunken rock. The rock has since been known as Albatross Rock.	Albatross Rock off Olifantsbos		1863
Star of Africa	A British ship that carried cargo, mainly rice, from Calcutta to Cape Town. Only two people survived.	Albatross Rock off Olifantsbos		1880
RMS Kafir	A Union Company iron-steam coaster that carried passengers between Zanzibar and Cape Town. She struck Albatross Rock in fair weather, and with water pouring in amidships, the captain decided to make for shore. About 400 metres from the shore, she ran aground south of Olifantsbos Point.	Brightwater		1878

SS Bia	A Swedish freighter stuck Albatros Rock en route from Sierra Leone to Durban, mistaking the old Cape Town lighthouse for a steamer. Three crew lost their lives.	south of Olifantsbos	S34°16.217' E018°22.638'	1917
Le Napoleon	French pirate ship that sank after being chased ashore at Olifantsbos by the Royal Navy frigate, Narcissu	Olifantsbos		1805
Caterina Doge	An Italian wooden coal-carrying barque, five drowned while trying to swim ashore	Menskoppunt		1886
Carlotta B	Another Italian wooden barque wrecked two months after Caterina Doge and about 10 km further south.	Platboom Point		1886
La Rozette		Platboom Point		1786
SS Thomas T. Tucker	An American Liberty ship en route from New Orleans to Suez on her maiden voyage carrying a cargo of six Sherman tanks, spares, lorries, barbed wire and other war materials	2km south of Olifantsbos Point	S34°16'23.66" E18°22'48.33"	1942
East coast of the peninsula				
SS Clan Stuart	A British turret steamer ran aground after dragging its anchors in a south-easterly gale. Engine blocks are still visible above water, about 30m offshore.	Near Glencairn	S34°10.303' E018°25.842'	1914
Brunswick	Located about 120m offshore. A British vessel was captured by two French vessels off Ceylon and brought to Simon's Town as a prize of war. In 1993 it became the focus of the first non-commercial maritime archaeological project with limited excavations on this site	Long Beach, Simon's Town	S34°10.880' E018°25.607'	1805
Bato	Located about 50m offshore. A 74-gun Dutch vessel was used as a floating battery in Simon's Bay for several years. Set on fire and sunk off Long Beach, Simon's Town, three days after the Battle of Blaauwberg (9 January 1806).	Long Beach, Simon's Town	S34°10.998' E018°25.560'	1806

Phoenix	Located about 440m offshore near Phoenix shoal. A British vessel ran aground on a voyage from Ceylon.	East of Simon's Town Harbour	S34°11.388' E018°26.898'	1829
Nukteris	Ran aground while trying to leave False Bay for Cape Town, carrying a cargo of lime.	North of Buffelsbay		1897
SAS Pietermaritzburg	This was the leading ship at the D-Day invasion of France (1944). The SA Navy bought it in 1947 for use as a training vessel. It was later converted into a minesweeper. It was served until 1991 and scuttled in 1994. It is a relatively recent wreck, not currently protected by legislation as it is not of archaeological importance and is less than 60 years since it sank.	Miller's Point	S34°13.303' E018°28.465'	1994
SAS Transvaal	Northernmost of the 5 Smitswinkel Wrecks, the ship was sold for scrap and scuttled by explosive charges in Smitswinkel Bay to form an artificial reef on August 3rd 1978. Has successfully attracted diverse forms of marine life	Smitswinkel Bay	S34°16.005' E018°28.761'	1978
MV Oratava	2nd most northernmost of the 5 Smitswinkel Wrecks was donated to the False Bay Conservation Society and the MFV Princess Elizabeth by Irvin and Johnson. An obsolete trawler was scuttled in 1983	Smitswinkel Bay	S34°16.000' E018°28.774'	1983
Princess Elizabeth	Central of the 5 Smitswinkel Wrecks. The trawler was severely damaged by a fire and was donated to the False Bay Conservation Society along with the Orotava by Irvin and Johnson and was scuttled in 1983.	Smitswinkel Bay	S34°16.068' E018°28.839'	1983
SAS Good Hope	2nd from southernmost of the 5 wrecks in Smitswinkel bay. The ship was sold for scrap and scuttled by explosive charges in Smitswinkel Bay to form an artificial reef.	Smitswinkel Bay	S34°16.054' E018°28.850'	1978
Rockeater	Southernmost of the 5 wrecks in Smitswinkel bay. A diamond-	Smitswinkel Bay	S34°16.127' E018°28.890'	1972

	prospecting vessel, the first of the 5 to be scuttled.			
Unity	A British vessel. Wrecked while en route from Table Bay to East London. Ten crew and six passengers lost their lives	Bellows Rock, Cape Point		1859
Paralos	A French barque bound for Falmouth, from the island of Labuan in Borneo. All aboard survived.	Bellows Rock, Cape Point		1880
SS Lusitania	A Portuguese twin-screw liner wrecked on Bellows Rock off Cape Point on 18 April 1911 in fog while on a voyage from Lourenco Marques (now Maputo) with 800 passengers; eight died when a lifeboat capsized	Bellows Rock, Cape Point	S34°23.40’ E018°29.65’	1911

APPENDIX II: SPECIES LISTS

IUCN Status Acronyms: Extinct – EX, Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD), and Not Evaluated (NE). Note: Due to insufficient information, the IUCN status for algae and marine invertebrates has not been included (Tables 1 and 2).

Table 1. Algae

	Common name	Scientific name
1	Plain acrosorium	*Acrosorium acrospermum*
2	Curled acrosorium	*Acrosorium ciliolatum*
3	Slippery orbits	*Aeodes/Pachymenia orbitosa*
4	Complicated gymnogongrus	*Ahnfeltiopsis complicata*
5	Clustered gymnogongrus	*Ahnfeltiopsis glomerata*
6	Gymnogongrus	*Ahnfeltiopsis intermedia*
7	Fine gymnogongrus	*Ahnfeltiopsis polyclada*
8	Fine gymnogongrus	*Ahnfeltiopsis vermicularis*
9	Horsetail coralline	*Amphriroa (Amphiroa?) ephedraea*
10	Hinged corallines	*Arthrocardia* spp.
11	Constricted axils	*Axillariella constricta*
12	Hanging wrack	*Bifurcaria/Brassicophycus brassicaeformis*
13	Upright wrack	*Bifurcariopsis capensis*
14	Black spot	*Botrycarpa prolifera*
15	Botryoglossum	*Botryoglossum platycarpum*
16	Sea moss	*Bryopsis myosuroides*
17	Aristocratic plume-weed	*Callithamnion collabens*
18	Iridescent plume-weed	*Callithamnion stuposum*
19	Flaccid kelp-weed	*Carpoblepharis flaccida*
20	Spiky turf-weed	*Caulacanthus ustulatus*

21	Strap caulerpa	*Caulerpa filliformus*
22	Feathery caulerpa	*Caulerpa holmesiana*
23	*Centroceras clavulatum*	*Centroceras clavulatum*
24	Curl-claw	*Centroceras* spp.
25	Beaded ceramium	*Ceramium arenarium*
26	Black-red ceramium	*Ceramium atrorubescens*
27	Cape ceramium	*Ceramium capense*
28	Course ceramium	*Ceramium obsoletum*
29	Flat-fern ceramium	*Ceramium planum*
30	Hair weed	*Chaetomorpha linum*
31	Robust hair-weed	*Chaetomorpha robusta*
32	Compressed champia	*Champia compressa*
33	Earthworm champia	*Champia lumbricalis*
34	Arrowhead coralline	*Cheilosporum/Jania? cultratum*
35	Cape chondria	*Chondria capensis*
36	Furry slime-strings	*Chordariaceae* spp.
37	Cape cord-weed	*Chordariopsis capensis*
38	Cape cladophora	*Cladophora capensis*
39	Blue Whip cladophora	*Cladophora flagelliformis*
40	Fragile upright codium	*Codium fragile capense/fragile*
41	Lucas' codium	*Codium lucasii*
42	*Codium papenfussii*	*Codium papenfussii*
43	Flat-lobed codium	*Codium platylobium*
44	Stephens' codium	*Codium stephensiae*
45	Oyster theif	*Colpomenia sinuosa*
46	Feather coralline	*Corallina officinalis*

47	Bottlebrush	*Dasya scoparia*
48	Acid weed	*Desmarestia herbacea firma*
49	Spotted dictyota	*Dictyota naevosa*
50	Intricate dictyota	*Dictyota* spp.
51	Dicurella spp.	*Dicurella* spp.
52	Sea bamboo	*Ecklonia maxima*
53	Spined kelp	*Ecklonia radiata*
54	Ectocarpus	*Ectocarpus* spp.
55	Multi-fanned zonaria	*Exallosorus harveyanus*
56	Abbott's jelly-weed	*Gelidium abbottiorum*
57	Cape jelly-weed	*Gelidium capense*
58	Saw-edged jelly-weed	*Gelidium pristoides*
59	Fern-leafed jelly-weed	*Gelidium pteridifolium*
60	Turf jelly-weed	*Gelidium reptans*
61	Red ribbons	*Gelidium vittatum*
62	Red tongue-weed	*Gigartina bracteata*
63	Tongue-weed	*Gigartina polycarpa*
64	Gigartina spp.	*Gigartina scabiosa*
65	Gigartina spp.	*Gigartina stiriata*
66	Gigartina spp.	*Gigartina/Sarcothalia radula*
67	Agar-weed	*Gracilaria gracilis*
68	Corrugated red algae	*Grateloupia belangeri*
69	Tattered-rag weed	*Grateloupia capensis*
70	Rippled ribbon-weed	*Grateloupia longifolia*
71	Dilated gymnogongrus	*Gymnogongrus dilatatus*
72	Velvety coralline crust	*Heydrichia woelkerlingii*

73	Tar crust	*Hildenbrandia lecanellieri*
74	Veined oil-weed	*Hymenena venosa*
75	Staight-tipped hypnea	*Hypnea ecklonii*
76	Green tips	*Hypnea spicifera*
77	Fine hypnea	*Hypnea tenuis*
78	Starred cusion	*Iyengaria stellata*
79	Finely forked coalline	*Jania adhaerens*
80	Split-fan Kelp	*Laminaria pallida*
81	Foxtail stonewart	*Lamprothamnium papulosum*
82	Flexuose laurencia	*Laurencia flexuosa*
83	Grape laurencia	*Laurencia glomerata*
84	Brown brains	*Leathesia marina*
85	Thallioid red algae	*Lithophyllum* spp.
86	Bladder kelp	*Macrocystis pyrifera*
87	Spotted mazzaella	*Mazzaella capensis*
88	Convulated mazzaella	*Mazzaella convulata*
89	Lance-weed	*Nemastoma lanceolata/Tsengia lanceolata*
90	Veined tongues	*Neuroglossum binderianum*
91	Hedgehog seaweed	*Nothogenia erinacea*
92	Balloon weed	*Nothogenia ovalis*
93	Red rubber-weed	*Pachymenia carnosa*
94	Frilly broekies	*Paraglossum papenfussii*
95	Petalonia spp.	*Petalonia binghamiae*
96	Thin coralline crust	*Phymatolithon foveatum*
97	Coral plocamium	*Plocamium corallorhiza*
98	Horny plocamium	*Plocamium cornutum*

99	Rigid plocamium	*Plocamium rigida/rigidum?*
100	Constricted polyopes	*Polyopes constrictus*
101	Kelp fern	*Polysiphonia virgata*
102	Purple laver	*Porphyra capensis*
103	Little hands	*Portieria hornemannii*
104	Red feather-weed	*Pterosiphonia cloiophylla*
105	Ralfsia spp.	*Ralfsia verrucosa*
106	Roseleaf	*Rhodophyllis reptans*
107	Cape wine-weed	*Rhodymenia capensis*
108	Stalked roseweed	*Rhodymenia natalensis*
109	Broad wine weed	*Rhodymenia obtusa*
110	Palmate roseweed	*Rhodymenia pseudopalmata*
111	Forked gigartina	*Sarcothalia scutellata*
112	Twisted tongue-weed	*Sarcothalia stiriata*
113	Different-leafed sargassum	*Sargrassum heterophyllum/incisifolium*
114	Long-leafed sargassum	*Sargrassum/Anthophycus longifolium*
115	Orange sheets	*Schizymenia apoda*
116	Ramrod weed	*Scinaia salicornioides*
117	Sausage skins	*Scytosiphon simplicissimus/lomentaria*
118	Red fan-weed	*Sonderophycus capensis*
119	Dead man's fingers	*Splachnidium rugosum*
120	Scrolled coralline crust	*Spongites impar*
121	Cochlear coralline crust	*Spongites yendoi*
122	Broom-weed	*Stypocaulon funiculare*
123	Tayloriella spp.	*Tayloriella tenebrosa*
124	Split disc-weed	*Thamnophyllis discigera*

125	Comb-fan weed	*Trematocarpus flabellatus*
126	Tangleweed	*Ulva clathrata*
127	Green sea intestines	*Ulva intestinalis*
128	Rigid sea lettuce	*Ulva rigida*
129	Articulated zonaria	*Zonaria subarticulata*

Table 2. Marine Invertebrates

	Phylum	Common name	*Scientific name*
1	Amphipoda	Jumping sand	*Siphonoecetes* spp.
2	Annelida	Milky scaleworm	*Antinoe lactea*
3	Annelida	Bloodworm	*Arenicola loveni*
4	Annelida	Chaetopterus	*Chaetopterus variopedatus*
5	Annelida	Orange thread-gilled worm	*Cirriformia capensis*
6	Annelida	Case-worm	*Diopatra cuprea*
7	Annelida	Banded case-worm	*Diopatra neapolitana*
8	Annelida	Bamboo worms	*Euclymene* spp.
9	Annelida	Filigreed coral-worm	*Filograna implexa*
10	Annelida	Flabby bristleworm	*Flabelligera affinis*
11	Annelida	Glycerine worm	*Glycera tridactyla*
12	Annelida	Two-tone scaleworm	*Hemilepidia erythrotaenia*
13	Annelida	Common scaleworm	*Lepidonotus semitectus*
14	Annelida	Estuarine wonder-worm	*Marphysa elityeni*
15	Annelida	Feather-star myzostomid	*Myzostoma fuscomaculatum*
16	Annelida	Woolly worm	*Orbinia angrapequensis*
17	Annelida	Bar-toothed nereid	*Perinereis nuntia vallata*
18	Annelida	Red fanworm	*Protula bispiralis*
19	Annelida	Gregarious fanworm	*Pseudopotamilla reniformis*
20	Annelida	Pencil worm	*Sabella spallanzanii*
21	Annelida	Operculate flatworm	*Serpula vermicularis*
22	Annelida	Estuarine nereid	*Simplisetia erythraeensis*
23	Annelida	Blue coral worm	*Spirobranchus krausii*
24	Annelida	Lobed tangleworm	*Telothelepus capensis*

25	Annelida	Feather-duster worm	*Pseudobranchiomma longa*
26	Annelida	Sand mason	*Lanice conchilega*
27	Annelida	Nephtys' sand-worms	*Nephtys* spp.
28	Annelida	Shell-boring spinoids	*Polydora* spp.
29	Annelida	Warty leech	*Pontobdella* sp.
30	Annelida	Serpulidae spp.	*Serpulidae* spp.
31	Annelida	Spiral fanworms	*Spirorbis* spp.
32	Annelida	Bead worms	*Syllidae*
33	Annelida	Tangleworms	*Thelepus* spp.
34	Arthropoda	Chevron shore spider	*Amaurobioides africanus*
35	Arthropoda	Kelp-fly	*Coelopa africana*
36	Arthropoda	Intertidal Spider	*Desis formidabilis*
37	Arthropoda	Leptochelia spp.	*Leptochelia bamardi*
38	Arthropoda	Scarlet sea spider	*Nymphon signatum*
39	Arthropoda	Yellow sea spider	*Queubus jamesanus*
40	Arthropoda	Compact sea spider	*Tanystylum brevipes*
41	Arthropoda	Blue-lined hermit crab	*Anapagurus hendersoni*
42	Arthropoda	Giant barnacle	*Austromegabalanus cylindricus*
43	Arthropoda	Sumo or scrubbing-brush crab	*Dromidia aegibotus*
44	Arthropoda	Squat lobster	Galatheoidea
45	Arthropoda	Red-and-white shrimp	*Heteromysis fosteri*
46	Arthropoda	Octopus commensal shrimp	*Heteromysis octopodis*
47	Arthropoda	Goose barnacle	*Lepas testudinata*
48	Arthropoda	Agulhas spider crab	*Maja squinado var capensis*
49	Arthropoda	Microarcturus spp.	*Microarcturus dayi*
50	Arthropoda	Kelp mysid	*Mysidopsis major*

51	Arthropoda	Stargazer shrimp	*Mysidopsis zsilaveczi*
52	Arthropoda	Paguristes spp.	*Paguristes* spp.
53	Arthropoda	Pagurus spp.	*Pagurus cuanensis*
54	Arthropoda	Sea squirt amphipod	*Polycheria atolli*
55	Arthropoda	Pseudodromia spp.	*Pseudodromia rotunda*
56	Arthropoda	Sapphirina spp.	*Sapphirina* spp.
57	Arthropoda	Muscle crab	*Speodromia platyarthrodes*
58	Arthropoda	Acrothoracican barnacle	*Weltneria spinosa*
59	Ascidiacea	Crevice ascidian	*Ascidia caudata*
60	Brachiopoda	Disc lamp shell	*Discinisca tenuis*
61	Brachiopoda	Lamp shell	*Kraussina crassicostata*
62	Brachiopoda	Lamp shell	*Terebratulina meridionalis*
63	Bryozoa	Nodular bryozoan	*Alcyonidium nodosum*
64	Bryozoa	Soft false-coral	*Alcyonidium rhomboidale*
65	Bryozoa	Magellanic lace animal	*Beania magellanica*
66	Bryozoa	Bonsai bush	*Bicellariella bonsai*
67	Bryozoa	Bird's-head moss animal	*Bugulina avicularia*
68	Bryozoa	Spiny false-coral	*Celleporaria capensis*
69	Bryozoa	Hairy lace animal	*Electra pilosa*
70	Bryozoa	Staghorn false-coral	*Gigantopora polymorpha*
71	Bryozoa	Membranous lace animal	*Jellyella tuberculata*
72	Bryozoa	Pore-plated false-coral	*Laminopora jellyae*
73	Bryozoa	Cactus-bush bryozoan	*Margaretta levinseni*
74	Bryozoa	Rustic lace animal	*Membranipora rustica*
75	Bryozoa	Curled/fern moss animal	*Menipea crispa*
76	Bryozoa	Spiral moss animal	*Menipea triseriata*

77	Bryozoa	Beauteous bryozoan	*Navianipora pulcherrima*
78	Bryozoa	Busk's moss animal	*Onchoporella buskii*
79	Bryozoa	Lacy false-coral	*Schizoretepora tessellata*
80	Bryozoa	Cylindrical false-coral	*Turbicellepora cylindriformis*
81	Bryozoa	Forked false-coral	*Adeonella* spp.
82	Bryozoa	Large pore lacy false coral	*Adeonellopsis meandrina*
83	Bryozoa	Eyelash moss animal	*Bicellariella ciliata*
84	Bryozoa	Tree moss animal	*Crisularia plumosa*
85	Bryozoa	Calyptotheca spp.	*Calyptotheca nivea*
86	Bryozoa	Calyptotheca spp.	*Calyptotheca porelliformis*
87	Bryozoa	Cylindrical false coral	*Cellepora cylindriformis*
88	Bryozoa	Scrolled false-corals	*Chaperia* spp.
89	Bryozoa	Maroon scrolled false coral	*Chaperiopsis multifida*
90	Bryozoa	Encrusting bryozoan	*Escharoides* spp.
91	Bryozoa	Leafy moss animal	*Flustra* spp.
92	Bryozoa	Fan-shaped moss animal	*Menipea ornata*
93	Bryozoa	Bryozoan	*Tennysonia stellata*
94	Bryozoa	Cylindrical false-coral	*Turbicellepora valligera*
95	Bryozoa	Dentate moss animal	*Virididentula dentata*
96	Bryozoa	Red-rust bryozoan	*Watersipora subtorquata*
97	Bryozoa	Sub-ovoid bryozoan	*Watersipora subovoidea*
98	Cephalochordata	Cape lancelet	*Branchiostoma capense*
99	Chaetognatha	Common arrow worm	*Sagitta* sp.
100	Chordata	Crevice ascidian	*Ascidia incrassata*
101	Chordata	White-ringed ascidian	*Botrylloides magnicoecum*
102	Chordata	Seaweed ascidian	*Botryllus elegans*

103	Chordata	Variable ascidian	*Botryllus gregalis*
104	Chordata	Meandering ascidian	*Botryllus maeandrius*
105	Chordata	Elephant's ears	*Gynandrocarpa placenta*
106	Chordata	Choirboys	*Pycnoclavella narcissus*
107	Chordata	Herdman's redbait	*Pyura herdmani*
108	Chordata	Redbait	*Pyura stolonifera*
109	Chordata	Bulb ascidian	*Sigillina digitata*
110	Chordata	Angular ascidian	*Styela angularis*
111	Chordata	Fan ascidian	*Sycozoa arborescens*
112	Chordata	Brain ascidian	*Trididemnum cerebriforme*
113	Chordata	Mushroom ascidian	*Aplidium circulatum*
114	Chordata	Rosette sea squirt	*Aplidium flavolineatum*
115	Chordata	Ladder ascidian	*Botrylloides leachii*
116	Chordata	Fenced ascidian	*Botryllus closionis*
117	Chordata	Transparent ascidian	*Ciona intestinalis*
118	Chordata	Bell ascidian	*Clavelina lepadiformis*
119	Chordata	Sago pudding ascidian	*Cystodytes dellechiajei*
120	Chordata	Lattice ascidian	*Didemnum* spp.
121	Chordata	Snowball ascidian	*Distaplia skoogi*
122	Chordata	Choirboys	*Podoclavella* spp.
123	Chordata	Foam ascidian	*Polycitor porrecta*
124	Cnidaria	Plum anemone	*Actinia ebhayiensis*
125	Cnidaria	Crystal jellyfish	*Aequorea forskalea*
126	Cnidaria	Toothed-feather hydroid	*Aglaophenia pluma*
127	Cnidaria	Brown soft coral	*Tenerodus pollex*
128	Cnidaria	Purple soft-coral	*Tenerodus fallax*

129	Cnidaria	Wiry hydroid	*Amphisbetia operculata*
130	Cnidaria	Anthopleura spp.	*Anthopleura insignis*
131	Cnidaria	Crevice anemone	*Anthopleura michaelseni*
132	Cnidaria	Dwarf-spotted anemone	*Anthostella* spp.
133	Cnidaria	Violet-spotted anemone	*Anthostella stephensoni*
134	Cnidaria	Striped anemone	*Anthothoe stimpsonii*
135	Cnidaria	Moon/Common jellyfish	*Aurelia aurita*
136	Cnidaria	Cup coral	*Balanophyllia bonaespei*
137	Cnidaria	Cigar comb jelly	*Beroe cucumis*
138	Cnidaria	Knobbly anemone	*Bunodasoma capense*
139	Cnidaria	Symbiotic anemone	*Calliactis polypus*
140	Cnidaria	Box jellyfish	*Carybdea branchi*
141	Cnidaria	Tube anemone	*Ceriantheopsis austroafricanus*
142	Cnidaria	Compass (Redbanded) Jellyfish	*Chrysaora hysoscella*
143	Cnidaria	Strawberry anemone	*Corynactis annulata*
144	Cnidaria	Tubular/Pinkmouth hydroids	*Ectopleura crocea*
145	Cnidaria	Variable soft-coral	*Eleutherobia variabile*
146	Cnidaria	Cauliflower soft-coral	*Eunephthya thyrsoidea*
147	Cnidaria	Flagellar sea fan	*Eunicella albicans*
148	Cnidaria	Nipped sea fan	*Eunicella papillosa*
149	Cnidaria	Sinuous sea fan	*Eunicella tricoronata*
150	Cnidaria	Root-mouthed jellyfish	*Eupilema inexpectata*
151	Cnidaria	Brooding anemone	*Halianthella annularis*
152	Cnidaria	Burrowing anemone	*Haloclava capensis*
153	Cnidaria	High-spined commensal hydroid	*Hydractinia altispina*
154	Cnidaria	Ring-tentacle anemone	*Isanthus capensis*

155	Cnidaria	Cape zoanthid	*Isozoanthus capensis*
156	Cnidaria	Candy-striped anemone	*Korsaranthus natalensis*
157	Cnidaria	Gilchrist's sea fan	*Leptogorgia gilchristi*
158	Cnidaria	Palmate sea fan	*Leptogorgia palma*
159	Cnidaria	Smoky-feather hydroid	*Macrorhynchia filamentosa*
160	Cnidaria	Sunburst soft-coral	*Malacacanthus capensis*
161	Cnidaria	Multicoloured sea fan	*Melithaea rubra*
162	Cnidaria	Valdivian soft-coral	*Parasphaerasclera valdiviae*
163	Cnidaria	Night-light jellyfish	*Pelagia noctiluca*
164	Cnidaria	Blue bottle/Portuguese man o' war	*Physalia utriculus/physalis*
165	Cnidaria	Plumed hydroid	*Plumularia setacea*
166	Cnidaria	Blue button	*Porpita porpita*
167	Cnidaria	Hedgehog anemone	*Preactis millaridae*
168	Cnidaria	False plum anemone	*Pseudactinia flagellifera*
169	Cnidaria	Planar hydroid	*Sertularella arbuscula*
170	Cnidaria	Noble coral	*Stylaster nobilis*
171	Cnidaria	Jointed hydroid	*Thuiaria articulata*
172	Cnidaria	By-the-wind sailor	*Velella velella*
173	Cnidaria	Sandy anemone	*Bunodosoma raynaudi*
174	Cnidaria	Radial sea pen	*Actinoptilum molle*
175	Cnidaria	String jelly /barbed wire jelly	*Apolemia uvaria*
176	Cnidaria	Cross of pearls	*Calvadosia* spp.
177	Cnidaria	Gnome's hat hydroid	*Candelabrum capensis*
178	Cnidaria	Dreadlocks hydroid	*Candelabrum tentaculatum*
179	Cnidaria	Large cup coral	*Caryophyllia* spp.
180	Cnidaria	Fine hydroid	*Corhiza scotiae*

181	Cnidaria	Stalked trumpet jelly	*Depastromorpha africana*
182	Cnidaria	Bushy hydroids	*Eudendrium* spp.
183	Cnidaria	Net jelly	*Forskalia edwardsii*
184	Cnidaria	Snowdrop hydroid	*Gattya humilis*
185	Cnidaria	Shell mimic hydroid	*Hydrocorella africana*
186	Cnidaria	Bell stalked jelly	*Lipkea stephensoni*
187	Cnidaria	Sponge zoanthid	*Parazoanthus* spp.
188	Cnidaria	Feathery hydroid	*Pycnotheca mirabilis*
189	Cnidaria	Rhizostoma spp.	*Rhizostoma* spp.
190	Cnidaria	Grey fan hydroid	*Solanderia procumbens*
191	Cnidaria	Velella spp.	*Velella* spp.
192	Cnidaria	Feathery sea pen	*Virgularia schultzei*
193	Cnidaria	Tubular sponge hydroid	*Zyzzyzus warreni*
194	Crustacea	West Coast rock lobster	*Jasus lalandii*
195	Crustacea	Shoveller crayfish/Cape slipper lobster	*Scyllarides elisabethae*
196	Crustacea	Long-legged crab	*Afrophila punctata*
197	Crustacea	Cracker shrimp	*Alpheus macrochirus*
198	Crustacea	Pocket amphipod	*Amaryllis macrophthalma*
199	Crustacea	Four-eyed amphipod	*Ampelisca palmata*
200	Crustacea	Striped barnacle	*Amphibalanus amphitrite*
201	Crustacea	Slender tanaid	*Anatanais gracilis*
202	Crustacea	Fish louse	*Anilocra capensis*
203	Crustacea	Apanthura spp.	*Apanthura sandalensis*
204	Crustacea	Seaweed amphipod	*Apohyale grandicornis*
205	Crustacea	Blue-antenna hermit	*Areopaguristes engyops*
206	Crustacea	Giant barnacle	*Austromegabalanus cylindricus*

207	Crustacea	Balanus spp.	*Balanus algicola*
208	Crustacea	Balanus spp.	*Balanus maxillaris*
209	Crustacea	Commensal shrimp	*Betaeus jucundus*
210	Crustacea	Common sand prawn	*Callichirus kraussi*
211	Crustacea	Skeleton shrimp	*Caprella equilibra*
212	Crustacea	Pelagic copepods	*Centropages brachiatus*
213	Crustacea	Red-striped amphipod	*Ceradocus rubromaculatus*
214	Crustacea	Smith's swimming crab	*Charybdis smithii*
215	Crustacea	Tooth barnacle	*Chthamalus dentatus*
216	Crustacea	Cirolana spp.	*Cirolana cranchii*
217	Crustacea	Crimped cirolanid	*Cirolana undulata*
218	Crustacea	Crimped cirolanid	*Cirolana venusticauda*
219	Crustacea	Rabbit-ear barnacle	*Conchoderma auritum*
220	Crustacea	Whale-louse	*Cyamus boopis*
221	Crustacea	Shore crab	*Cyclograpsus punctatus*
222	Crustacea	Hump-tailed isopod	*Cymodoce valida*
223	Crustacea	Tube-tail isopod	*Cymodocella magna*
224	Crustacea	Ornate amphipod	*Cyproidea ornata*
225	Crustacea	Sandflat crab	*Danielita edwardsii*
226	Crustacea	Striated hermit	*Dardanus arrosor*
227	Crustacea	Toothed Decorator crab	*Dehaanius/Acanthonyx dentatus*
228	Crustacea	Horned isopod	*Deto echinata*
229	Crustacea	Bouy barnacle	*Dosima fasicularis*
230	Crustacea	Shaggy sponge-crab	*Dromidia hirsutissima*
231	Crustacea	Roll-tailed isopod	*Dynamenella australis*
232	Crustacea	Roll-tailed isopod	*Dynamenella dioxus*

233	Crustacea	Roll-tailed isopod	*Dynamenella huttoni*
234	Crustacea	Roll-tailed isopod	*Dynamenella scabricula*
235	Crustacea	Light euphausid	*Euphausia lucens*
236	Crustacea	Right-angled beach louse	*Eurydice kensleyi*
237	Crustacea	Wide-foot beach louse	*Excirolana latipes*
238	Crustacea	Natal beach louse	*Excirolana natalensis*
239	Crustacea	Exosphaeroma spp.	*Exosphaeroma antikraussi*
240	Crustacea	Exosphaeroma spp.	*Exosphaeroma kraussi*
241	Crustacea	Exosphaeroma spp.	*Exosphaeroma planum*
242	Crustacea	Exosphaeroma spp.	*Exosphaeroma truncatitelson*
243	Crustacea	Variegated spherical isopod	*Exosphaeroma varicolor*
244	Crustacea	Surf mysid	*Gastrosaccus psammodytes*
245	Crustacea	Keeled isopod	*Glyptidotea lichtensteini*
246	Crustacea	Spade-foot amphipod	*Griffithsius latipes*
247	Crustacea	Cape rock crab	*Guinusia chabrus*
248	Crustacea	Sandbank cumacean	*Heterocuma africanum*
249	Crustacea	Feather-star shrimp	*Hippolyte catagrapha*
250	Crustacea	Broken-backed shrimp	*Hippolyte kraussiana*
251	Crustacea	Hyale spp.	*Hyale diastema*
252	Crustacea	Hyale spp.	*Hyale grandicornis*
253	Crustacea	Crown crab	*Hymenosoma orbiculare*
254	Crustacea	Iais spp.	*Iais pubescens*
255	Crustacea	Ianiropsis spp.	*Ianiropsis palpalis*
256	Crustacea	Hairy isopod	*Iathrippa capensis*
257	Crustacea	Metallic isopod	*Idotea metallica*
258	Crustacea	Hunchback amphipod	*Iphimedia gibba*

259	Crustacea	Roll-tail isopod	*Ischyromene huttoni*
260	Crustacea	Hitchhiker amphipods	*Jassa* spp.
261	Crustacea	Stebbing's isopod	*Joeropsis stebbingi*
262	Crustacea	Yellow-rimmed goose barnacles	*Lepas anatifera*
263	Crustacea	Sponge amphipod	*Leucothoe spinicarpa*
264	Crustacea	Sea-slater	*Ligia dilatata*
265	Crustacea	Lysianassa spp.	*Lysianassa ceratina*
266	Crustacea	Compact amphipod	*Lysianassa ceratina*
267	Crustacea	Cape mantis shrimp	*Lysiosquilla (armata) capensis*
268	Crustacea	Surf or swimming shrimp	*Macropetasma africana*
269	Crustacea	Cape long-legged spider crab	*Macropodia falcifera*
270	Crustacea	Maera spp.	*Maera hirondellei*
271	Crustacea	Spade-headed isopod	*Marioniscus spatulifrons*
272	Crustacea	Brack-water amphipod	*Melita zeylanica*
273	Crustacea	Slender checkered isopod	*Mesanthura catenula*
274	Crustacea	Masked crab	*Mursia cristiata*
275	Crustacea	Hairy-legged cirolanid	*Natalolana hirtipes*
276	Crustacea	Cape leaf shrimp	*Nebalia capensis*
277	Crustacea	White dwarf barnacle	*Notomegabalanus algicola*
278	Crustacea	Ridgeback amphipod	*Ochlesis lenticulosus*
279	Crustacea	Eight-shell barnacle	*Octomeris angulosa*
280	Crustacea	Three-spot swimming crab	*Ovalipes trimaculatus*
281	Crustacea	Pink hermit	*Paguristes gamianus*
282	Crustacea	Blue-faced hermit	*Pagurus liochele*
283	Crustacea	Sand shrimp	*Palaemon peringueyi*
284	Crustacea	Paramoera spp.	*Paramoera bidentata*

285	Crustacea	Paramoera spp.	*Paramoera capensis*
286	Crustacea	Paranthura spp.	*Paranthura punctata*
287	Crustacea	Reticulate kelp louse	*Paridotea reticulata*
288	Crustacea	Green weed-louse	*Paridotea ungulata*
289	Crustacea	Spike-back isopod	*Parisocladus perforatus*
290	Crustacea	Spike-back isopod	*Parisocladus stimpsoni*
291	Crustacea	Pram bug amphipod	*Phronima sedentaria*
292	Crustacea	Kelp crab	*Pilumnoides rubus*
293	Crustacea	Pea crab	*Pinnotheres dofleini*
294	Crustacea	Columbus/Gulfweed crab	*Planes minutus*
295	Crustacea	Cryptic sponge-crab	*Platydromia spongiosa*
296	Crustacea	Cloaked sponge-crab	*Pseudodromia latens*
297	Crustacea	Furred sponge crab	*Pseudodromia rotunda*
298	Crustacea	Button isopod	*Sphaeramene polytylotos*
299	Crustacea	Three-legged crab	*Spiroplax spiralis*
300	Crustacea	Beach hopper / louse amphipod	*Capeorchestia capensis*
301	Crustacea	Sand hopper	*Africorchestia quadrispinosa*
302	Crustacea	Grey Volcano Barnacle	*Tetraclita serrata*
303	Crustacea	Bubble-eyed amphipod	*Themisto gaudichaudii*
304	Crustacea	Giant beach pill-bug	*Tylos granulatus*
305	Crustacea	Pill-bug	*Tylos capensis*
306	Crustacea	Estuarine mud prawn	*Upogebia africana*
307	Crustacea	Burrowing amphipod	*Urothoe grimaldi*
308	Crustacea	Swimming rock crab	*Varuna litterata*
309	Crustacea	Whale barnacle	*Coonula diadema*
310	Crustacea	Masked crab	*Nautilochoristes ocellata*

311	Crustacea	Hotlips spidercrab	*Achaeopsis spinulosus*
312	Crustacea	Cymodocella spp.	*Cymodocella* spp.
313	Crustacea	Dynamenella spp.	*Dynamenella* spp.
314	Crustacea	Exospaeroma spp.	*Exospaeroma* spp.
315	Crustacea	Haliophasma spp.	*Haliophasma* spp.
316	Crustacea	Lysianassa spp.	*Lysianassa* spp.
317	Crustacea	Paridotea spp.	*Paridotea* spp.
318	Crustacea	Benthic copepods	*Porcellidium* spp.
319	Ctenophora	Venus' girdle	*Cestum veneris*
320	Ctenophora	Benthic comb jelly	*Coeloplana* spp.
321	Ctenophora	Lobed comb jelly	*Leucothea* spp.
322	Ctenophora	Sea gooseberry	*Pleurobrachia bachei*
323	Echinodermata	Brooding snake star / Scaly-armed brittlestar	*Amphipholis squamata*
324	Echinodermata	Equal-tailed brittlestar	*Amphiura capensis*
325	Echinodermata	Basket star	*Astrocladus euryale*
326	Echinodermata	Sand starfish	*Astropecten irregularis*
327	Echinodermata	Pink sand star	*Astropecten irregularis pontoporeus*
328	Echinodermata	Granular starfish	*Fromia schultzei*
329	Echinodermata	Red starfish	*Callopatiria granifera*
330	Echinodermata	Common feather-star	*Comanthus wahlbergii*
331	Echinodermata	Heart urchin	*Echinocardium cordatum*
332	Echinodermata	Lamp urchin	*Echinolampas crassa*
333	Echinodermata	Reticulated starfish	*Henricia ornata*
334	Echinodermata	Spiny starfish	*Marthasterias africana*
335	Echinodermata	Snake-star	*Ophiactis carnea*
336	Echinodermata	Banded brittlestar	*Ophiarachnella capensis*

337	Echinodermata	Serpent-skinned brittlestar	*Ophioderma wahlbergii*
338	Echinodermata	Striped brittlestar	*Ophionereis dubia*
339	Echinodermata	Hairy brittlestar	*Ophiothrix fragilis*
340	Echinodermata	Cape sea urchin	*Parechinus angulosus*
341	Echinodermata	Granular cushion-star	*Parvulastra dyscrita*
342	Echinodermata	Dwarf cushion-star	*Parvulastra/Patriella exigua*
343	Echinodermata	Cask sea cucumber	*Pentacta doliolum*
344	Echinodermata	Red-chested sea cucumber	*Hemiocnus insolens / now Hemiocnus*
345	Echinodermata	Brooding cushion-star	*Pteraster capensis*
346	Echinodermata	Horseshoe sea cucumber	*Roweia frauenfeldii*
347	Echinodermata	Stephenson's sea cucumber	*Roweia stephensoni*
348	Echinodermata	Golden sea cucumber	*Thyone aurea*
349	Echinodermata	Elegant feather-star	*Tropiometra carinata*
350	Echinodermata	Dividing starfish	*Allostichaster capensis*
351	Echinodermata	Feather star	*Annametra occidentalis*
352	Echinodermata	Cobbled starfish	*Calliaster baccatus*
353	Echinodermata	Beautiful starfish	*Callopatiria formosa*
354	Echinodermata	Many-armed starfish	*Coscinasterias calamaria*
355	Echinodermata	Deepwater urchin	*Echinus gilchristi*
356	Echinodermata	Smooth-shelled heart urchin	*Spatagobrissus mirabilis*
357	Echiura	Opaque tongue worm	*Ochetostoma capense*
358	Golfingiidae	Common peanut worm	*Golfingia capensis*
359	Hemichordata	Cape acorn worm	*Balanoglossus capensis*
360	Mollusca	Brack-water mussel	*Brachidontes virgiliae*
361	Mollusca	Eelgrass false-limpet	*Siphonaria compressa*
362	Mollusca	Brush-tipped octopus	*Eledone schultzei*

363	Mollusca	Brooding oyster	*Ostrea atherstonei*
364	Mollusca	Tuberculate cuttlefish	*Sepia tuberculata*
365	Mollusca	Patchwork / common cuttlefish	*Sepia vermiculata*
366	Mollusca	Paper nautilus	*Argonauta argo*
367	Mollusca	Globular mud snail	*Assiminea globulus*
368	Mollusca	Elongate cone	*Conus mozambicus*
369	Mollusca	Southern giant octopus	*Enteroctopus magnificus*
370	Mollusca	Chokka squid	*Loligo reynaudii*
371	Mollusca	Cape Hope squid	*Loligo vulgaris reynaudii*
372	Mollusca	Common octopus	*Octopus vulgaris*
373	Mollusca	Pore-bellied cuttlefish	*Sepia typica*
374	Mollusca	Cape rock oyster	*Striostrea margaritacea*
375	Mollusca	Spiny chiton	*Acanthochitona garnoti*
376	Mollusca	Elongate whelk	*Afrocominella capensis simoniana*
377	Mollusca	Southern periwinkle	*Afrolittorina knynaensis*
378	Mollusca	Anemone nudibranch	*Anteaeolidiella saldanhensis*
379	Mollusca	Spotted sea hare	*Aplysia oculifera*
380	Mollusca	Dwarf sea hare	*Aplysia* sp.
381	Mollusca	Sea hare	*Aplysia gilchristi*
382	Mollusca	Sea hare	*Aplysia juliana*
383	Mollusca	Estuarine mussel	*Arcuatula capensis*
384	Mollusca	Pustular triton	*Argobuccinum pustulosum*
385	Mollusca	Scaly horse-mussel	*Atrina squamifera*
386	Mollusca	Ribbed Mussel	*Aulacomya atra/ater/magellanica*
387	Mollusca	Oblique ark shell	*Barbatia obliquata*
388	Mollusca	Lemon pleurobranch	*Berthellina granulata*

389	Mollusca	Gas flame nudibranch	*Bonisa nakaza*
390	Mollusca	Annulated plough shell	*Bullia annulata*
391	Mollusca	Finger plough shell	*Bullia digitalis*
392	Mollusca	Fat plough shell	*Bullia laevissima*
393	Mollusca	Pure plough shell	*Bullia pura*
394	Mollusca	Smooth plough shell	*Bullia rhodostoma*
395	Mollusca	Plough snail	*Bullia tenuis*
396	Mollusca	Flame-patterned burnupena	*Burnupena catarhacta/delalandii*
397	Mollusca	Ridged burnupena	*Burnupena cincta*
398	Mollusca	Variable burnupena	*Burnupena lagenaria*
399	Mollusca	Papery burnupena	*Burnupena papyracea*
400	Mollusca	Pubescent burnupena	*Burnupena pubescens*
401	Mollusca	Shaggy sea hare	*Bursatella leachii*
402	Mollusca	Furry-ridged triton	*Cabestana africana*
403	Mollusca	Ornate topshell	*Calliostoma ornatum*
404	Mollusca	Broad chiton	*Callochiton dentatus*
405	Mollusca	Chinese hat	*Calyptraea chinensis*
406	Mollusca	Rough false cockle	*Cardita caliculaeformis*
407	Mollusca	Hairy chiton	*Chaetopleura papilio*
408	Mollusca	Orange hairy chiton	*Chaetopleura pertusa*
409	Mollusca	Pink lady	*Charonia lampas*
410	Mollusca	Brooding chiton	*Chiton nigrovirescens*
411	Mollusca	Tulip chiton	*Chiton politus*
412	Mollusca	Black Mussel	*Choromytilus meridionalis*
413	Mollusca	Ribbed turrid	*Clionella sinuata*
414	Mollusca	Algoa cone	*Conus algoensis*

415	Mollusca	White-tipped nudibranch /orange eyed nudibranch	*Cratena capensis*
416	Mollusca	Slipper limpet	*Crepidula porcellana*
417	Mollusca	Kelp limpet	*Cymbula compressa*
418	Mollusca	Cinnabar/pink rayed limpet	*Cymbula miniata*
419	Mollusca	Dark-toothed cowry	*Cypraeovula fuscodentata*
420	Mollusca	Blue-speckled dorid	*Dendrodoris caesia*
421	Mollusca	Saddle-shaped keyhole limpet	*Dendrofissurella scutellum*
422	Mollusca	Colonial worm-shell	*Dendropoma corallinaceus*
423	Mollusca	Giant chiton or armadillo	*Dinoplax gigas*
424	Mollusca	Conical keyhole-limpet	*Diodora parviforata*
425	Mollusca	Common sand hermit	*Diogenes brevirostris*
426	Mollusca	White mussel	*Donax serra*
427	Mollusca	Butterfly wedge-shell	*Donax sordidus*
428	Mollusca	Warty dorid	*Doris granosa*
429	Mollusca	Greater heart-clam	*Dosinia lupinus orbignyi*
430	Mollusca	Wentletrap sea snail spp.	*Epitonium kraussi*
431	Mollusca	Cape keyhole limpet	*Fissurella mutabilis*
432	Mollusca	Long-siphoned whelk	*Fusinus ocelliferus*
433	Mollusca	Ridged tellin	*Gastrana matadoa*
434	Mollusca	Multicoloured topshell	*Gibbula multicolor*
435	Mollusca	Blue glaucus	*Glaucus atlanticus*
436	Mollusca	Four-tone nudibranch	*Godiva quadricolor*
437	Mollusca	Half-hairy mussel	*Gregariella petagnae*
438	Mollusca	South African abalone/ Perlemoen	*Haliotis midae*
439	Mollusca	Spiral-ridged siffie	*Haliotis parva*

440	Mollusca	Blood-spotted abalone	*Haliotis spadicea*
441	Mollusca	Green bubble-shell	*Haminoea alfredensis*
442	Mollusca	Variable limpet	*Helcion concolor*
443	Mollusca	Slim rayed-limpet	*Helcion dunkeri*
444	Mollusca	Prickly limpet	*Helcion pectunculus*
445	Mollusca	Broad-rayed limpet	*Helcion pruinosus*
446	Mollusca	Cape dorid	*Hypselodoris capensis*
447	Mollusca	Ribbed-scale chiton	*Ischnochiton bergoti*
448	Mollusca	Dwarf chiton	*Ischnochiton oniscus*
449	Mollusca	Textile chiton	*Ischnochiton textilis*
450	Mollusca	Cape silvertip nudibranch	*Antiopella capensis*
451	Mollusca	Common Violet snail	*Janthina*
452	Mollusca	Ruby lamp shell	*Kraussina rubra*
453	Mollusca	Dwarf rusty clam	*Lasaea adansoni turtoni*
454	Mollusca	File shell	*Limaria tuberculata*
455	Mollusca	Orange-clubbed nudibranch	*Limacia lucida*
456	Mollusca	Otter shell	*Lutraria*
457	Mollusca	Smooth mactra	*Mactra glabrata*
458	Mollusca	Smooth trough shell	*Mactra glabrata*
459	Mollusca	Cloudy marginella	*Marginella nebulosa*
460	Mollusca	Pinch-lipped marginella	*Marginella rosea*
461	Mollusca	Cowled nudibranch	*Melibe rosea*
462	Mollusca	Brown mitre	*Mitra picta*
463	Mollusca	Cape dogwhelk	*Nassarius capensis*
464	Mollusca	Tick shell	*Nassarius kraussianus*
465	Mollusca	Purple-lipped dogwhelk	*Nassarius speciosus*

466	Mollusca	Common dogwhelk	*Nucella dubia*
467	Mollusca	Air-breathing sea slug	*Onchidella maculata*
468	Mollusca	Black chiton	*Onithochiton literatus*
469	Mollusca	Variegated topshell	*Oxystele antoni*
470	Mollusca	Pink-lipped topshell	*Oxystele sinensis*
471	Mollusca	Tiger topshell	*Oxystele tigrina*
472	Mollusca	Variegated topshell	*Oxystele variegata/impervia*
473	Mollusca	Port Alfred tellin	*Pallidea palliderosea*
474	Mollusca	Granite limpet	*Patella granatina/Cymbula granatina*
475	Mollusca	Goat's Eye limpet	*Patella/Cymbula oculus*
476	Mollusca	Edible scallop	*Pecten sulcicostatus*
477	Mollusca	Brown mussel	*Perna*
478	Mollusca	Shelled sand slug	*Philine aperta*
479	Mollusca	Coral nudibranch	*Phyllodesmium horridum*
480	Mollusca	Zigzag clam	*Pitar hebraeus*
481	Mollusca	Warty pleurobranch	*Pleurobranchaea bubala*
482	Mollusca	Crowned nudibranch	*Polycera capensis*
483	Mollusca	Hooked murex	*Pteropurpura uncinaria*
484	Mollusca	Mantled keyhole-limpet	*Pupillaea aperta*
485	Mollusca	Dove snail	*Pyrene/Anachis kraussi*
486	Mollusca	Angular surf clam	*Scissodesma spengleri*
487	Mollusca	Long-spined limpet	*Scutellastra longicosta*
488	Mollusca	Argenville's limpet	*Scutellastra/Patella argenvillei*
489	Mollusca	Barbara/Bearded Limpet	*Scutellastra/Patella barbara*
490	Mollusca	Spoon/Pear Limpet	*Scutellastra/Patella cochlear*
491	Mollusca	Granular limpet	*Scutellastra/Patella granularis*

492	Mollusca	Giant limpet	*Scutellastra tabularis*
493	Mollusca	Helmet-shell	*Semicassis labiata zeylanica*
494	Mollusca	Cape False limpet	*Siphonaria capensis*
495	Mollusca	Ribbed false-limpet	*Siphonaria concinna*
496	Mollusca	False limpet	*Siphonaria deflexa*
497	Mollusca	Eyed false-limpet	*Siphonaria oculus*
498	Mollusca	Serrate false-limpet	*Siphonaria serrata*
499	Mollusca	Pencil bait	*Solen capensis*
500	Mollusca	Mottled venus	*Sunetta contempta bruggeni*
501	Mollusca	Dwarf fan shell	*Talochlamys multistriata*
502	Mollusca	Black nudibranch	*Tambja capensis*
503	Mollusca	Mottled necklace-shell	*Tectonatica tecta*
504	Mollusca	Gilchrist's tellin	*Tellina gilchristi*
505	Mollusca	Trilateral tellin	*Tellina trilatera*
506	Mollusca	Scaly dogwhelk	*Thais/Nucella squamosa*
507	Mollusca	Rock snail	*Thais/Thaisella/Indothais dubia*
508	Mollusca	Dead man's hand	*Thecalia concamerata*
509	Mollusca	Solitary worm-shell	*Thylacodes natalensis*
510	Mollusca	Streaked sand-clam	*Tivela compressa*
511	Mollusca	Knobbly dogwhelk	*Tricolia capensis*
512	Mollusca	Pheasant shell	*Tricolia neritina*
513	Mollusca	Girdled dogwhelk	*Trochia cingulata*
514	Mollusca	Smooth and ridged turban shells	*Turbo cidaris*
515	Mollusca	Alikreukel	*Turbo sarmaticus*
516	Mollusca	Waxy screw-shell	*Turritella capensis*
517	Mollusca	Threaded screw-shell	*Turritella carinifera*

518	Mollusca	Fenestrate oyster-drill	*Vaughtia fenestrata*
519	Mollusca	Corrugated venus	*Venerupis corrugatus/ corrugata*
520	Mollusca	Corrugated venus	*Venerupis corrugata*
521	Mollusca	Warty venus	*Venus verrucosa*
522	Mollusca	Zoned marginella	*Volvarina zonata*
523	Mollusca	Soft coral nudibranch	*Marionia* sp.
524	Mollusca	Fluffy nudibranch	*Acanthodoris planca*
525	Mollusca	Knobbly nudibranch	*Aegires ninguis*
526	Mollusca	Elongate whelk	*Afrocominella elongata*
527	Mollusca	Three spot nudibranch	*Aldisa trimaculata*
528	Mollusca	Marine snail	*Amalda obesa*
529	Mollusca	Night sky nudibranch	*Amanda armata*
530	Mollusca	Well-ribbed dovesnail	*Anachis kraussii*
531	Mollusca	Giraffe spot nudibranch	*Ancula* sp.
532	Mollusca	Cape silvertip nudibranch	*Antiopella capensis*
533	Mollusca	Medallion silvertip nudibranch	*Antiopella longidentata*
534	Mollusca	Variable nudibranch	*Aphelodoris brunnea*
535	Mollusca	Choc chip nudibranch	*Aphelodoris* sp.*1*
536	Mollusca	Spiky dorid	*Aphelodoris* sp.*3*
537	Mollusca	Variable sea hare	*Aplysia juliana*
538	Mollusca	Dwarf sea hare	*Aplysia* sp.
539	Mollusca	Samurai sap sucker	*Aplysiopsis sinusmensalis*
540	Mollusca	Gilchrist's armina	*Armina gilchristi*
541	Mollusca	Striped sand slug	*Armina* spp.
542	Mollusca	Rugby ball nudibranch	*Atagema* sp. *(was rugosa)*
543	Mollusca	Saddled nudibranch	*Cadlina* sp.*1*

544	Mollusca	Brown-dotted nudibranch	*Cadlina* sp.*2*
545	Mollusca	Galaxy nudibranch	*Cadlina* sp.*3*
546	Mollusca	Black dot nudibranch	*Caloria* sp.*1*
547	Mollusca	Yellow-tipped nudibranch	*Caloria* sp.*2*
548	Mollusca	Inkspot nudibranch	*Ceratosoma ingozi*
549	Mollusca	Ribbed turrid	*Clionella rosario*
550	Mollusca	Crazed nudibranch	*Corambe* spp.
551	Mollusca	Elegant nudibranch	*Cratena* spp.
552	Mollusca	Cape peppercorn nudibranch	*Crimora* spp.
553	Mollusca	Cypraeovula spp.	*Cypraeovula algoensis*
554	Mollusca	Cypraeovula spp.	*Cypraeovula coronata*
555	Mollusca	Football snail	*Demoulia abbreviata*
556	Mollusca	Saddle-shaped keyhole limpet	*Dendrofissurella scutellum*
557	Mollusca	Wide-ridged nudibranch	*Dermatobranchus albineus*
558	Mollusca	Narrow-ridged nudibranch	*Dermatobranchus arminus*
559	Mollusca	Scribbled nudibranch	*Doriopsilla areolata*
560	Mollusca	Tan nudibranch	*Doriopsilla capensis*
561	Mollusca	Crowned doto	*Doto africoronata*
562	Mollusca	Feathered doto	*Doto pinnatifida*
563	Mollusca	Splendid doto	*Doto splendidissima*
564	Mollusca	Sap-sucker	*Elysia rubropunctata*
565	Mollusca	Eubranchus spp.	*Eubranchus* sp.*2*
566	Mollusca	Fireworks nudibranch	*Eubranchus* sp.*4*
567	Mollusca	Candelabra nudibranch	*Eubranchus* sp.*5*
568	Mollusca	Amber nudibranch	*Eubranchus* sp. *Thick*
569	Mollusca	Olive nudibranch	*Facelina olivacea*

570	Mollusca	Goose barnacle nudibranch	*Fiona pinnata*
571	Mollusca	White-edged nudibranch	*Fjordia capensis*
572	Mollusca	Cow nudibranch	*Gargamella bovina*
573	Mollusca	Ocellate dorid	*Gargamella gravastella*
574	Mollusca	Blotchy dorid	*Geitodoris capensis*
575	Mollusca	Gibberula spp.	*Gibberula dulcis*
576	Mollusca	Cape topshell	*Gibbula capensis*
577	Mollusca	Red-spotted nudibranch	*Goniobranchus heatherae*
578	Mollusca	Citrine nudibranch	*Goniodoris brunnea*
579	Mollusca	Tugboat nudibranch	*Goniodoris mercurialis*
580	Mollusca	Velvet nudibranch	*Jorunna tomentosa*
581	Mollusca	Tasseled nudibranch	*Kaloplocamus* spp. *(previously thought to be ramosus)*
582	Mollusca	Naartjie nudibranch	*Atalodoris* sp.
583	Mollusca	Ghost nudibranch	*Lecithophorus capensis*
584	Mollusca	Frilled nudibranch	*Leminda millecra*
585	Mollusca	Kelp orange clubbed nudibranch	*Limacia jellyi*
586	Mollusca	Opera house sap sucker	*Lobiger* spp.
587	Mollusca	Short-siphoned whelk	*Lugubrilaria lugubris*
588	Mollusca	Mandela's nudibranch	*Mandelia mirocornata*
589	Mollusca	Marginella spp	*Marginella beltmani*
590	Mollusca	Marginella spp	*Marginella confortini*
591	Mollusca	Marginella spp	*Marginella diadochus*
592	Mollusca	Marginella spp	*Marginella elephantina*
593	Mollusca	Marginella spp	*Marginella falsebayensis*
594	Mollusca	Marginella spp	*Marginella fishoekensis*

595	Mollusca	Marginella spp	*Marginella houtbaaiensis*
596	Mollusca	Marginella spp	*Marginella musica*
597	Mollusca	Sandy marginella	*Marginella piperata*
598	Mollusca	Marginella spp	*Marginella san*
599	Mollusca	Marginella spp	*Marginella textilis*
600	Mollusca	Dinosaur nudibranch	*Melibe liltvedi*
601	Mollusca	Mediterranean mussel	*Mytilus galloprovincialis*
602	Mollusca	Hooked murex	*Nassarius plicatellus*
603	Mollusca	Iridescent nudibranch	*Notobryon thompsoni*
604	Mollusca	Girdled dogwhelk	*Nucella singulata*
605	Mollusca	Scaly dogwhelk	*Nucella squamosa*
606	Mollusca	Fiery nudibranch	*Okenia amoenula*
607	Mollusca	Shrek sap-sucking slug	*Oxynoe* sp.
608	Mollusca	Small spot nudibranch	*Paradoris* sp.
609	Mollusca	Purple lady	*Paraflabellina funeka*
610	Mollusca	Cape slipper slug	*Philinopsis capensis*
611	Mollusca	Mop sap sucking slug	*Placida capensis*
612	Mollusca	Dwarf warty pleurobranch	*Pleurobranchaea tarda*
613	Mollusca	Mosaic pleurobranch	*Pleurobranchus nigropunctatus*
614	Mollusca	Dark crowned nudibranch	*Polyera hedgpethi*
615	Mollusca	Twin-crowned nudibranch	*Polycera* sp.*1*
616	Mollusca	Orange-stripe crowned nudibranch	*Polycera* sp.*2*
617	Mollusca	Yellow knot crowned nudibranch	*Polycera* sp.*3*
618	Mollusca	Single ridged triton	*Ranella australasia gemmifera*
619	Mollusca	Red sponge nudibranch	*Rostanga elandsia*

620	Mollusca	Beautiful cuttlefish	*Sepia pulchra*
621	Mollusca	Sunset nudibranch	*Tenellia casha*
622	Mollusca	Taloned nudibranch	*Tergipes* sp.*2*
623	Mollusca	Feathered nudibranch	*Thecacera* sp. *(previously thought to be pennigera)*
624	Mollusca	South African variegated tun	*Tonna variegata*
625	Mollusca	White-lined nudibranch	*Trapania cirrita*
626	Mollusca	Sea snail	*Tricolia* spp.
627	Mollusca	Congregating limpet	*Trimusculus* spp.
628	Mollusca	Candy nudibranch	*Trinchesia speciosa*
629	Mollusca	Yellow candy nudibranch	*Trinchesia* sp.
630	Mollusca	Whip fan nudibranch	*Duvaucelia sp.*
631	Mollusca	Brush nudibranch	*Tritonia sp.*
632	Mollusca	West Coast baby's toes	*Triviella millardi*
633	Mollusca	Baby's toes	*Triviella ovulata*
634	Mollusca	Turritella spp.	*Turritella sanguinea*
635	Mollusca	Protea dorid	*Verconia protea*
636	Mollusca	Cape marginella	*Volvarina capensis*
637	Mollusca	Woven whelk	*Zemiropsis papillaris*
638	Neanuridae	Seashore springtail	*Anurida maritima*
639	Platyhelminthes	Limpet flatworm	*Notoplana patellarum*
640	Platyhelminthes	Gilchrist's flatworm	*Planocera gilchristi*
641	Platyhelminthes	Flatworm	*Polyclad* spp.
642	Platyhelminthes	Striped flatworm	Platyhelminthes
643	Platyhelminthes	Freckled flatworm	Platyhelminthes
644	Platyhelminthes	Carpet flatworm	*Thysanozoon* sp.
645	Polychaeta	Iridescent worm	*Arabella iricolor*

646	Polychaeta	Tentacular cirriform polychaete	*Cirriformia tentaculata*
647	Polychaeta	Black boring worm	*Dodecaceria pulchra*
648	Polychaeta	Wonder-worm	*Eunice aphroditois*
649	Polychaeta	Plump bristleworms	*Euphrosine capensis*
650	Polychaeta	Flabby bristle-worm	*Flabelligera affinis*
651	Polychaeta	Cape reef worms	*Gunnarea capensis/gaimardi*
652	Polychaeta	Lepidonotus spp.	*Lepidonotus semitectus*
653	Polychaeta	False earthworm	*Lumbrineris coccinea*
654	Polychaeta	Three-antennae worm	*Lysidice natalensis*
655	Polychaeta	*Naineris laevigata*	*Naineris laevigata*
656	Polychaeta	Nicolea spp.	*Nicolea macrobranchia*
657	Polychaeta	Club worm	*Notomastus latericeus*
658	Polychaeta	Cone-tube worm	*Pectinaria capensis*
659	Polychaeta	Perinereis spp.	*Perinereis capensis*
660	Polychaeta	Dumeril's clam worm	*Platynereis dumerilii*
661	Polychaeta	Large hydroid worm	*Pomatoleios kraussi*
662	Polychaeta	Mussel-worm	*Pseudonereis variegata*
663	Polychaeta	Boa worm	*Sthenelais boa*
664	Polychaeta	*Syllis variegata*	*Syllis variegata*
665	Polychaeta	Polychaete worm	*Orbinia* spp.
666	Porifera	Nodular spomge	*Clathria hooperi*
667	Porifera	Stellar sponge	*Crambe acuta*
668	Porifera	Tree sponge	*Echinoclathria dichotoma*
669	Porifera	Crumb-of-bread sponge	*Hymeniacedon perlevis*
670	Porifera	Atlantic teat sponge	*Polymastia atlantica*
671	Porifera	Teat sponge	*Polymastia mamillaris/littoralis*

672	Porifera	Golf-ball sponge	*Tethya aurantium*
673	Porifera	Vented sponge	*Trachycladus spinispirulifera*
674	Porifera	Yellow encrusting sponge	*Biemna anisotoxa*
675	Porifera	Scroll sponge	*Chondropsis* sp.
676	Porifera	Broad-bladed tree sponge	*Clathria dayi*
677	Porifera	Red encrusting sponge	*Clathria oudekraalensis*
678	Porifera	Boring sponge	*Cliona* sp.
679	Porifera	Turret sponge	*Haliclona anonyma*
680	Porifera	Encrusting turret sponge	*Haliclona stilensis*
681	Porifera	Black stink sponge	*Ircinia arbuscula*
682	Porifera	Brain sponge	*Isodictya grandis*
683	Porifera	Branching-ball sponge	*Leucosolenia* spp.
684	Porifera	Grey wall sponge	*Stelletta agulhana*
685	Porifera	Dusty sponge	*Suberites aff. Ficus*
686	Porifera	Hairy tube sponges	*Sycon* spp.
687	Urochordata	Fire roller	*Pyrosoma* spp.
688	Urochordata	Three-tailed salp	*Thalia* spp.
689	Xenacoelomorpha	Xenocoelomorpha spp.	Blue with white stripe
690	Xenacoelomorpha	Xenocoelomorpha spp.	Casper ghost flatworm

Table 3: Sharks and rays

	Family	Common name	Scientific name	IUCN (status)
1	Alopiidae	Thintail thresher shark	*Alopias vulpinus*	VU
2	Callorhinchidae	St. Joseph shark/Cape elephantfish	*Callorhinchus capensis*	LC
3	Carcharhinidae	Dusky shark	*Carcharhinus obscurus*	EN
4	Carcharhinidae	Blacktip shark	*Carcharhinus limbatus*	NT
5	Carcharhinidae	Blue shark	*Prionace glauca*	NT
6	Carcharhinidae	Copper shark	*Carcharhinus brachyurus*	VU
7	Carcharhinidae	Spinner shark	*Carcharhinus brevipinna*	VU
8	Carcharhinidae	Sandbar shark	*Carcharhinus plumbeus*	VU
9	Dasyatidae	Short-tail stingray	*Bathytoshia brevicaudata*	LC
10	Dasyatidae	Thorntail stingray	*Dasyatis thetidis*	LC
11	Dasyatidae	Diamond ray/butterfly ray	*Gymnura natalensis*	LC
12	Dasyatidae	Blue stingray	*Dasyatis chrysonota*	NT
13	Dasyatidae	Whiptail stingrays	*Dasyatis* spp.	
14	Etmopteridae	Southern lantern shark	*Etmopterus granulosus*	LC
15	Hexanchidae	Broadnose sevengill shark	*Notorynchus cepedianus*	DD
16	Lamnidae	Shortfin mako	*Isurus oxyrinchus*	NT
17	Lamnidae	Great white shark	*Carcharodon carcharias*	VU
18	Myliobatidae	Common Eagle ray	*Myliobatis aquila*	DD
19	Myliobatidae	Bull ray	*Aetomylaeus bovinus*	DD
20	Narkidae	Cape Sleeper ray/Onefin electric ray	*Narke capensis*	LC
21	Odontaspididae	Spotted ragged-tooth/Sand Tiger shark	*Carcharias taurus*	CR
22	Pristiophoridae	Sixgill sawshark	*Pliotrema warreni*	NT
23	Rajidae	Biscuit skate/Spotted skate	*Raja straeleni*	DD
24	Rajidae	Spearnose skate	*Rostroraja alba*	EN

25	Rajidae	Twineye skate/Brown ray	*Raja miraletus*	LC
26	Rajidae	Thornback skate	*Raja clavata*	NT
27	Rhincodontidae	Whale shark	*Rhincodon typus*	EN
28	Rhinobatidae	Lesser guitarfish/sandshark	*Acroteriobatus annulatus*	CR
29	Scyliorhinidae	Puffadder shyshark/Happy eddie	*Haploblepharus edwardsii*	EN
30	Scyliorhinidae	Dark shyshark	*Haploblepharus pictus*	LC
31	Scyliorhinidae	Striped catshark/Pajama shark	*Poroderma africanum*	LC
32	Scyliorhinidae	Leopard catshark	*Poroderma pantherinum*	LC
33	Scyliorhinidae	Yellowspotted catshark	*Scyliorhinus capensis*	NT
34	Scyliorhinidae	Tiger catshark	*Halaelurus natalensis*	EN
35	Sphyrnidae	Smooth hammerhead	*Sphyrna zygaena*	VU
36	Squalidae	Bluntnose spiny dogfish (Shortnose spurdog)	*Squalus megalops*	NT
37	Squalidae	Spiny (Picked) dogfish	*Squalus acanthias*	VU
38	Squalidae	Dogfish	*Squalis* spp.	
39	Torpedinidae	Black-spotted torpedo	*Torpedo fuscomaculata*	DD
40	Torpedinidae	Marbled torpedo/Marbled electric ray	*Torpedo marmorata*	DD
41	Torpedinidae	Torpedo rays	*Torpedo* spp.	
42	Triakidae	Tope/Soupfin shark	*Galeorhinus galeus*	CR
43	Triakidae	Whitespotted smooth-hound	*Mustelus palumbes*	LC
44	Triakidae	Spotted gully shark	*Triakis megalopterus*	LC
45	Triakidae	Common smooth-hound shark	*Mustelus*	VU

Table 4. Fish

	Family	Common name	Scientific name	IUCN (status)
1	Antennariidae	Sargassum fish	*Histrio*	LC
2	Ariidae	White seacatfish	*Galeichthyes feliceps*	NE
3	Atherinidae	Cape Silverside	*Atherina brevireps*	LC
4	Batrachoididae	Snakehead toadfish	*Batrichthys apiatus*	NE
5	Batrachoididae	pleated toadfish	*Chatrabus felinus*	NE
6	Blennidae	Two-eyed blenny	*Chalaroderma ocellata*	LC
7	Blennidae	Horned blenny	*Parablennius cornutus*	LC
8	Bythitidae	Bighead brotula	*Grammonoides opisthodon*	DD
9	Carangidae	Yellowtail Amberjack	*Seriola lalandi*	LC
10	Carangidae	Leer fish	*Lichia amia*	LC
11	Carangidae	Southern pompano	*Trachinotus africanus*	LC
12	Carangidae	Cape Horse mackerel	*Trachurus capensis*	LC
13	Carangidae	Maasbanker (Horse Mackerel)	*Trachurus*	VU
14	Caristiidae	Manefishes	*Caristius fasciatus*	NE
15	Chaetodontidae	Doublesash butterflyfish	*Chaetodon marleyi*	LC
16	Cheilodactylidae	Redfingers	*Cheilodactylus fasciatus*	LC
17	Cheilodactylidae	Twotone fingerfin	*Chirodactylus brachydactylus*	NE
18	Cheilodactylidae	Barred fingerfin	*Cheilodactylus pixi*	NE
19	Clinidae	Ornate klipfish	*Clinus ornatus*	DD
20	Clinidae	False Bay klipfish	*Clinus latipennis*	EN
21	Clinidae	Lace klipvis	*Blennioclinus brachycephalus*	LC
22	Clinidae	Sad klipvis	*Clinus acuminatus*	LC
23	Clinidae	Agile klipvis	*Clinus agilis*	LC

24	Clinidae	Snakey klipvis	*Clinus/Blennophis anguillaris*	LC
25	Clinidae	Onrust klipvis	*Clinus berrisfordi*	LC
26	Clinidae	Cape klipvis	*Clinus brevicristatus*	LC
27	Clinidae	Barbelled klipvis	*Cirrhibarbis capensis*	LC
28	Clinidae	Bluntnose klipvis	*Clinus cottoides*	LC
29	Clinidae	Nosestripe klipvis	*Muraenoclinus dorsalis*	LC
30	Clinidae	Westcoast klipvis	*Clinus heterodon*	LC
31	Clinidae	Super klipvis	*Clinus superciliosus*	LC
32	Clinidae	Bull klipvis	*Clinus taurus*	LC
33	Clinidae	Speckled klipvis	*Clinus venustris*	LC
34	Clinidae	Mousy klipvis	*Pavoclinus/Fucomimus mus*	LC
35	Clinidae	Peacock klipfish	*Pavoclinus pavo*	LC
36	Clinidae	Cancelloxus spp.	*Cancelloxus longior*	LC
37	Clinidae	Grassy klipfish	*Pavoclinus graminis*	LC
38	Clinidae	Striped klipfish	*Blennophis striatus*	LC
39	Clinidae	Slender platanna klipfish	*Cancelloxus burrelli*	LC
40	Clinidae	Barbelled klipvis	*Cirrhibarbis capensis*	LC
41	Clinidae	Chinese klipfish	*Clinus nematopterus*	LC
42	Clinidae	Robust klipfish	*Clinus robustus*	LC
43	Clinidae	Kelp klipfish	*Clinus rotundifrons*	LC
44	Clinidae	Mousey klipfish	*Fucomimus mus*	LC
45	Clinidae	Nosestripe klipvis	*Muraenoclinus dorsalis*	LC
46	Clinidae	bluespotted klipfish	*Pavoclinus caeruleopunctatus*	LC
47	Clinidae	Deep water klipfish	*Pavoclinus profundus*	LC
48	Clinidae	Deepreef klipfish	*Pavoclinus smalei*	LC
49	Clinidae	Leafy klipfish	*Smithichthys fucorum*	LC

50	Clinidae	Platanna klipfish	*Xenopoclinus kochi*	LC
51	Clinidae	Leprous platanna klipfish	*Xenopoclinus leprosus*	LC
52	Clinidae	Mosaic klipfish	*Clinus musaicus*	NE
53	Clupeidae	Sardine / pilchard	*Sardinops sagax*	LC
54	Clupeidae	Estuarine pround herring	*Gilchristella aestuaria*	LC
55	Clupeidae	South American pilchard	*Sardinops ocellatus/Sardinops sagax* spp. *sagax*	LC
56	Congrogadidae	Snakelet	*Halidesmus scapularis*	LC
57	Congrogadidae	Spinynose horsefish	*Congiopodus spinifer*	LC
58	Congrogadidae	Smooth horsefish	*Congiopodus torvus*	LC
59	Cynoglossidae	Sand tonguefish	*Cynoglossus capensis*	DD
60	Dichistiidae	Galjoen	*Dichistius capensis*	NE
61	Dichistiidae	Banded galjoen	*Dichistius multifasciatus*	NE
62	Dinematichthyidae	Lesser orange brotula	*Dermatopsoides talboti*	LC
63	Diodontidae	Birdbeak burrfish	*Cyclichthys orbicularis*	LC
64	Diodontidae	Balloon/Long-spine porcupinefish	*Diodon holocanthus*	LC
65	Echeneidae	Shark remora	*Echeneis naucrates*	LC
66	Engraulidae	European Anchovy	*Engraulis encrasicolus*	LC
67	Exocoetidae	Smallhead flyingfish	*Cheilopogon altipennis*	NE
68	Gempylidae	Snoek	*Thyrsites atun*	NE
69	Gobidae	Commafin goby	*Caffrogobius saldanhae*	LC
70	Gobiesocidae	Rocksucker	*Chorisochismus dentex*	LC
71	Gobiesocidae	Weed sucker	*Eckloniaichthys scylliorhiniceps*	LC
72	Gobiesocidae	Chubby clingfish	*Apletodon pellegrini*	LC
73	Gobiidae	Barehead goby	*Caffrogobius nudiceps*	DD
74	Gobiidae	Banded goby	*Caffrogobius caffer*	LC

75	Gobiidae	Knysna sandv goby	*Psammogobius knysnaensis*	LC
76	Gonorynchidae	Beaked sandfish	*Gonorynchus*	LC
77	Haemulidae	Spotted grunter	*Pomadasys commersonnii*	LC
78	Haemulidae	Olive grunt/Piggy	*Pomadasys olivaceus*	LC
79	Istiophoridae	Sailfish	*Istiophorus platypterus*	LC
80	Kyphosidae	Brown/Grey Chub	*Kyphosus bigibbus*	LC
81	Latridae	Bank steenbras	*Chirodactylus grandis*	NE
82	Lophiidae	Monkfish	*Lophius* sp.	LC
83	Merlucciidae	Shallow-water Cape hake	*Merluccius capensis*	LC
84	Molidae	Trunk fish/Slender Sunfish	*Ranzania laevis*	LC
85	Molidae	Ocean Sunfish	*Mola*	VU
86	Monocentridae	Japanese Pineapple fish	*Monocentris japonica*	LC
87	Mugilidae	Groovy mullet	*Liza/Chelon dumerilii*	DD
88	Mugilidae	Flathead mullet	*Mugil cephalus*	LC
89	Mugilidae	Harders	*Liza richardsonii*	NE
90	Mugilidae	Stripped mullet	*Liza/Chelon tricuspidens*	NE
91	Myctophidae	Lantern fish	*Lampanyctodes hectoris*	LC
92	Myxinidae	Six-gill hagfish	*Eptatretus hexatrema*	LC
93	Nomeidae	Man-of-War fish/Bluebottle fish	*Nomeus gronovii*	LC
94	Ophidiidae	Kingklip	*Genypterus capensis*	NE
95	Oplegnathidae	Cape knifejaw	*Oplegnathus conwayi*	NE
96	Oreosomatidae	Ox-eyed oreo	*Oreosoma atlanticum*	NE
97	Ostraciidae	Backspine cowfish (Thornback cowfish)	*Lactoria fornasini*	NE
98	Parascorpididae	Jutjaw	*Parascorpis typus*	NE
99	Pomatomidae	Bluefish/Elf	*Pomatomus saltatrix*	VU

100	Sciaenidae	Slender baardman	*Umbrina robinsoni*	DD
101	Sciaenidae	Canary drum	*Umbrina canariensis*	LC
102	Sciaenidae	Geelbek/African weakfish	*Atractoscion aequidens*	NT
103	Sciaenidae	Silver kob	*Argyrosomus inodorus*	VU
104	Scombridae	Chub mackerel	*Scomber japonicus*	LC
105	Scombridae	Skipjack tuna	*Katsuwonus pelamis*	LC
106	Scombridae	Atlantic bonito	*Sarda*	LC
107	Scorpaenidae	Tassled scorpionfish	*Scorpaenopsis oxycephala*	LC
108	Scorpinidae	Stonebream	*Neoscorpis lithophilus*	NE
109	Sebastidae	Blackbelly Rosefish/Jacopever	*Helicolenus dactylopterus*	LC
110	Sebastidae	False jacopever	*Sebastes capensis*	LC
111	Serranidae	Comber/African seabass	*Serranus cabrilla*	LC
112	Serranidae	Yellow-belly rockcod	*Epinephelus marginatus*	VU
113	Soleidae	East Coast sole	*Austroglossus pectoralis*	DD
114	Soleidae	Lemon sole	*Solea fulvomarginata*	DD
115	Soleidae	Lace sole	*Synapturichthys kleini*	DD
116	Soleidae	Blackhand sole	*Solea bleekeri/ turbynei*	LC
117	Soleidae	Cape sole	*Heteromycteris capensis*	NT
118	Sparidae	Seventy-four seabream	*Polysteganus undulosus*	CR
119	Sparidae	Dageraad	*Chrysoblephus cristiceps*	CR
120	Sparidae	Santer seabream	*Cheimerius nufar*	DD
121	Sparidae	White steenbras	*Lithognathus.*	EN
122	Sparidae	Red stumpnose seabream	*Chrysoblephus gibbiceps*	EN
123	Sparidae	Red steenbras	*Petrus rupestris*	EN
124	Sparidae	Hottentot seabream	*Pachymetopon blochii*	LC
125	Sparidae	Blacktail	*Diplodus sargus capensis*	LC

126	Sparidae	Karanteen/Strepie	*Sarpa salpa*	LC
127	Sparidae	Striped seabream	*Lithognathus mormyrus*	LC
128	Sparidae	Fransmadam / Karel grootoog	*Boopsoidea inornata*	LC
129	Sparidae	Zebra	*Diplodus hottentotus*	LC
130	Sparidae	John Brown / Janbruin	*Gymnocrotaphus curvidens*	LC
131	Sparidae	Blue Hottentot	*Pachymetopon aeneum*	LC
132	Sparidae	Panga seabream	*Pterogymnus laniarius*	LC
133	Sparidae	Steentjie	*Spondyliosoma emarginatum*	LC
134	Sparidae	Cape stumpnose	*Rhabdosargus holubi*	LC
135	Sparidae	Roman seabream	*Chrysoblephus laticeps*	NT
136	Sparidae	Carpenter	*Argyrozona*	NT
137	Sparidae	Bronze Bream	*Pachymetopon grande*	NT
138	Sparidae	Musselcracker seabream	*Sparodon durbanensis*	NT
139	Sparidae	White stumpnose	*Rhabdosargus globiceps*	VU
140	Sparidae	Black musselcracker	*Cymatoceps nasutus*	**VU**
141	Sternoptychidae	Lightfish	*Maurolicus walvisensis*	LC
142	Syngnathidae	Longsnout pipefish	*Syngnathus acus/temminckii?*	LC
143	Synodiontidae	Snakefish	*Trachinocephalus myops*	LC
144	Tetraodontidae	Evileye blaasop	*Amblyrhynchotes honckenii*	LC
145	Tetrarogidae	Smoothskin scorpionfish	*Coccotropsis gymnoderma*	DD
146	Triglidae	Bluefin gurnard	*Chelidonichthys kumu*	LC
147	Triglidae	Cape gurnard	*Chelidonichthys capensis*	LC
148	Tripterygiidae	Cape triplefin	*Cremnochorites capensis*	LC
149	Zeidae	Atlantic John Dory	*Zeus faber*	DD

Table 5. Seabirds and shorebirds

	Family	Common name	Scientific name	IUCN (status)
1	Anhingidae	African darter	*Anhinga rufa*	LC
2	Ardeidae	Grey heron	*Ardea cinerea*	LC
3	Ardeidae	Little egret	*Egretta garzetta*	LC
4	Ardeidae	Intermediate egret	*Egretta intermedia*	LC
5	Charadriidae	Black oyster catcher	*Haematopus bachmani*	LC
6	Charadriidae	Grey plover/black-bellied plover	*Pluvialis squatarola*	LC
7	Charadriidae	White-fronted plover	*Charadrius marginatus*	LC
8	Diomedeidae	Indian yellow-nosed albatross	*Thalassarche carteri*	EN
9	Diomedeidae	Shy albatross	*Thalassarche cauta*	NT
10	Diomedeidae	Black-browed albatross	*Thalassarche melanophris*	NT
11	Haematopodidae	African oystercatcher	*Haemotopus moquini*	LC
12	Laridae	Southern African kelp gull	*Larus dominicanus vetula*	LC
13	Laridae	Greater crested/swift tern	*Thalasseus bergii*	LC
14	Laridae	Sabine's gull	*Xema sabini*	LC
15	Laridae	Hartlaub's gull	*Larus hartlaubii*	LC
16	Laridae	Grey-headed gull	*Larus cirrocephalus*	LC
17	Laridae	Caspian tern	*Hydropogne caspia*	LC
18	Laridae	Common tern	*Sterna hirundo*	LC
19	Laridae	Antarctic tern	*Sterna vittata*	LC
20	Laridae	Sandwich tern	*Thalasseus sandvicensis*	LC
21	Laridae	Damara tern	*Sternula balaenarum*	VU
22	Oceanitidae	Wilson's Storm-petrel	*Oceanites oceanicus*	LC
23	Pelecanidae	Great white pelican	*Pelicanus onocrotalus*	LC
24	Phalacrocoracidae	Cape cormorant	*Phalocrocorax capensis*	EN

25	Phalacrocoracidae	Bank cormorant	*Phalocrocorax neglectus*	EN
26	Phalacrocoracidae	Great/White-breasted cormorant	*Phalocrocoax cargo*	LC
27	Phalacrocoracidae	Crowned cormorant	*Microcarbo coronatus*	NT
28	Phoenicopteridae	Greater flamingo	*Phoenicopterus roseus*	LC
29	Procellariidae	Pintado/Cape petrel	*Daption capense*	LC
30	Procellariidae	Southern giant petrel	*Macronectes giganteus*	LC
31	Procellariidae	Sooty shearwater	*Puffinus griseus*	NT
32	Procellariidae	White-chinned petrel	*Procellaria aequinoctialis*	VU
33	Scolopacidae	Whimbrel	*Numenius phaeopus*	LC
34	Scolopacidae	Ruddy turnstone	*Arenaria interpres*	LC
35	Scolopacidae	Sanderling	*Calidris alba*	LC
36	Scolopacidae	Bar-tailed Godwit	*Limosa lapponica*	NT
37	Scolopacidae	Red knot	*Calidris canutus*	NT
38	Spheniscidae	African penguin	*Spheniscus demersus*	EN
39	Stercorariidae	Brown skua	*Stercorarius antarcticus*	LC
40	Sulidae	Cape gannets	*Morus capensis*	EN
41	Threskiornithidae	African Sacred ibis	*Threskiornis aethiopicus*	LC

Table 6. Marine mammals

	Family	Common name	Scientific name	IUCN (status)
1	Balaenidae	Southern right whale	*Eubalaena australis*	LC
2	Balaenopteridae	Common minke whale	*Balaenoptera acutorostrata*	LC
3	Balaenopteridae	Bryde's whale	*Balaenoptera edeni*	LC
4	Balaenopteridae	Humpback whale	*Megaptera novaeangliae*	LC
5	Delphinidae	Killer whale/orca	*Orcinus orca*	DD
6	Delphinidae	Long-beaked common Dolphin	*Delphinus capensis*	DD
7	Delphinidae	Common bottlenose dolphin	*Tursiops truncatus*	LC
8	Delphinidae	Dusky dolphin	*Lagenorhynchus obscurus*	LC
9	Delphinidae	Striped dolphin	*Stenella coeruleoalba*	LC
10	Delphinidae	Heaviside's dolphin	*Cephalorhynchus heavisidii*	NT
11	Delphinidae	False Killer whale	*Pseudorca crassidens*	NT
12	Mustelidae	Cape clawless otter	*Aonyx capensis*	LC
13	Neobalaenidae	Pygmy Right whale	*Caperea marginata*	LC
14	Otariidae	Cape fur seal	*Arctocephalus pusillus (pusillus)*	LC
15	Phocidae	Leopard seal	*Hydrurga leptonyx*	LC
16	Phocidae	Southern elephant seal	*Mirounga leonina*	LC

Table 7. Marine reptiles

	Family	Family II	Common name	Scientific name
1	Reptilia	Dermochelydae	Leatherback sea turtle	*Dermochelys coriacea*
2	Reptilia	Cheloniidae	Loggerhead Sea turtles	*Caretta*
3	Reptilia	Elapidae	Yellow-bellied sea snake	*Hydrophis platurus*

APPENDIX III: INVASIVE SPECIES

Table 1. Invasive species and their origin

	Family	Common name	Scientific name	Origin
1	Cnidaria: Hydrozoa	Ringed tubularia	*Tubularia/Ectopleura larynx*	North atlantic
2	Crustacea: Amphipoda	Japanese skeleton shrimp	*Caprella mutica*	North-east Asia coastal waters
3	Mollusca: Bivalva	Mediterrean mussel	*Mytilus galloprovincialis*	Mediterrean sea
4	Annelida	Estuarine tube-worm	*Ficopomatus enigmaticus*	Southern hemisphere, Indian Ocean and coastal waters of Australia?
5	Ascidiacea	Bell ascidian	*Clavelina lepadiformis*	Europe
6	Ascidiacea	Golden star ascidian	*Botryllus schlosseri*	Northeastern atlantic
7	Ascidiaceae	solitary sea squirt	*Ascidiella aspersa*	European
8	Ascidiaceae	Star tunicate	*Botryllus schlosseri*	European
9	Ascidiaceae	Yellow-green sea squirt	*Ascidia sydneiensis*	Pacific ocean
10	Ascidiaceae	Leathery sea squirt	*Cnemidocarpa humilis*	Unknown
11	Ascidiaceae	Orange-tipped sea squirt	*Corella eumyota*	Unknown; currently Cosmopolitan
12	Ascidiaceae	Sago pudding ascidian	*Cystodytes dellechiajei*	Unknown; found in warm waters
13	Ascidiaceae	Brain ascidian	*Trididemnum cerebriforme*	Western Indian Ocean, Australia, Japan and the western tropical Pacific Ocean
14	Bryozoa	Red-rust bryozoan	*Watersipora subtorquata*	Carribean

15	Bryozoa	Colonial bryozoan	*Cryptosula pallasiana*	European
16	Bryozoa	Colonial arborescent bryozoa	*Bugula flabellata*	Global
17	Bryozoa	Common bugula	*Bugula neritina*	Global except for cold polar or sub-Arctic/Antarctic regions
18	Bryozoa	Blue-green bryozoan	*Bugula dentata*	Indo-pacific
19	Bryozoa	Dentate moss animal	*Virididentula dentata*	Indo-pacific
20	Bryozoa	Fouling moss animal	*Bugula neritina*	Unknown
21	Bryozoa	Fan-shaped moss animal	*Bugulina flabellata*	Unknown
22	Chlorophyata	Rough cladophora	*Cladophora prolifera*	Cosmopoliton
23	Chlorophyta	Ribbon sea lettuce	*Ulva fasciata/linza*	Unknown; currently widespread
24	Cionidae	Sea vase	*Ciona intestinalis*	Possibly the North Atlantic
25	Cnidaria: Anthozoa	Rooted anemone	*Sagartia ornata*	Europe
26	Cnidaria: Anthozoa	Feather-duster anemone	*Metridium senile*	Northern hemisphere
27	Cnidaria: Hydrozoa	Thin-walled obelia	*Obelia dichotoma*	Worldwide
28	Crustacea: Amphipoda	Tube-building amphipod	*Corophium triaenonyx*	Asia
29	Crustacea: Amphipoda	*Melita zeylanica*	*Melita zeylanica*	Australia and Indian Ocean
30	Crustacea: Amphipoda	Fat-feeler amphipod	*Monocorophium acherusicum*	Europe
31	Crustacea: Amphipoda	*Cerapus abditus*	*Cerapus abditus/Ericthonius punctatus?*	North America
32	Crustacea: Amphipoda	*Erichthonius brasiliensis*	*Erichthonius brasiliensis*	North Atlantic

33	Crustacea: Amphipoda	*Ischyrocerus anguipes*	*Ischyrocerus anguipes*	North Atlantic
34	Crustacea: Amphipoda	Hitchhiker amphipods	*Jassa morinoi*	North pacific
35	Crustacea: Amphipoda	Hitchhiker amphipods	*Jassa slatteryi*	North pacific
36	Crustacea: Amphipoda	Nesting amphipod	*Cymadusa filosa*	Pantropical
37	Crustacea: Amphipoda	Skeleton shrimp sp.	*Caprella penantis*	Unknown; current wide distribution from Hawaii, Japan, Australia, New Zealand and on both coasts of the United States
38	Crustacea: Amphipoda	Skeleton shrimp sp.	*Caprella equilibra*	Unknown; is now Global
39	Crustacea: Balanidae	Pacific glandula	*Balanus glandula*	Pacific coast of North America.
40	Crustacea: Decapoda	European shore-crab	*Carcinus maenas*	European and North African coasts
41	Crustacea: Isopoda	Gribble	*Limnoria quadripunctata*	Indo-pacific
42	Crustacea: Isopoda	*Synidotea hirtipes*	*Synidotea hirtipes*	West Coast of Africa to Suez Canal
43	Crustacea: Isopoda	Reddish wood-boring amphipod	*Chelura terebrans*	Widespread
44	Didemnidae	Diplosoma tunicate	*Diplosoma listerianum*	Eastern north Atlantic/Europe
45	Mollusca: Bivalva	Piddock	*Pholas dactylus*	Europe
46	Mollusca: Bivalva	Pacific oyster	*Crassostrea gigas*	Japan, northwestern pacific
47	Mollusca: Bivalva	Wrinkled rock-borer	*Hiatella arctica*	North atlantic

48	Mollusca: Bivalva	Bisexual mussel	*Semimytilus algosus*	South america
49	Mollusca: Bivalva	Ship-worm	*Lyrodus pedicellatus*	Unknown
50	Mollusca: Gastropoda	British periwinkle	*Littorina saxatilis*	Britain
51	Mollusca: Gastropoda	Sea-fan nudibranch	*Tritonia nilsodhneri*	Europe
52	Mollusca: Gastropoda	Aeolid nudibranch	*Anteaeolidiella indica*	Pacific ocean
53	Mollusca: Gastropoda	Winged thecacera	*Thecacera pennigera*	Pacific, Atlantic and Indian Ocean
54	Polychaeta	*Janua pagenstecheri*	*Janua pagenstecheri*	European estuaries
55	Polychaeta	*Hydroides elegans*	*Hydroides elegans*	Indo-pacific
56	Polychaeta	*Neodexiospira brasiliensis*	*Neodexiospira brasiliensis*	Indo-pacific
57	Rhodophyta	*Schimmelmannia elegans*	*Schimmelmannia elegans*	Tristan da Cunha and Venezuela

Table 2. Invasives with vectors

Family	Common name	Vector
Cnidaria: Hydrozoa	Ringed tubularia	Shipping and Ship fouling
Crustacea: Amphipoda	Japanese skeleton shrimp	Ship fouling (long distance); Ballast water (short distance); movement of Aquaculture and Infrastructure; drifting Macroalgae
Mollusca: Bivalva	Mediterrean mussel	Uncertain thought to be hull fouling or ballast water
Annelida	Estuarine tube-worm	Shipping; ballast water
Ascidiacea	Bell ascidian	shipping?
Ascidiacea	Golden star ascidian	shipping? Found in harbours
Ascidiaceae	solitary sea squirt	Ship fouling
Ascidiaceae	Star tunicate	Ship fouling
Ascidiaceae	Yellow-green sea squirt	Ship fouling
Ascidiaceae	Leathery sea squirt	Ship fouling
Ascidiaceae	Orange-tipped sea squirt	Ship fouling
Ascidiaceae	Sago pudding ascidian	Ship fouling
Ascidiaceae	Brain ascidian	Ship fouling
Bryozoa	Red-rust bryozoan	Ship fouling and Ballast water
Bryozoa	colonial bryozoan	Ship fouling
Bryozoa	colonial arborescent bryozoa	Ship fouling
Bryozoa	Common bugula	Ship fouling and Ballast water
Bryozoa	Blue-green bryozoan	Ship fouling
Bryozoa	Dentate moss animal	unknown
Bryozoa	Fouling moss animal	Shipping; fouling
Bryozoa	Fan-shaped moss animal	Shipping; fouling

Chlorophyata	Rough cladophora	could not find explanation
Chlorophyta	Ribbon sea lettuce	Ship fouling (?)
Cionidae	Sea vase	Ship fouling
Cnidaria: Anthozoa	Rooted anemone	
Cnidaria: Anthozoa	Feather-duster anemone	Shipping
Cnidaria: Hydrozoa	Thin-walled obelia	Shipping, dock piles, seaweed
Crustacea: Amphipoda	Tube-building amphipod	Ship fouling and Ballast water
Crustacea: Amphipoda	*Melita zeylanica*	Ship fouling and Ballast water
Crustacea: Amphipoda	Fat-feeler amphipod	ballast water
Crustacea: Amphipoda	*Cerapus abditus*	Ship fouling and Ballast water
Crustacea: Amphipoda	*Erichthonius brasiliensis*	Ship fouling
Crustacea: Amphipoda	*Ischyrocerus anguipes*	Ship fouling and Ballast water
Crustacea: Amphipoda	hitchhiker amphipods	Ship fouling and Ballast water
Crustacea: Amphipoda	hitchhiker amphipods	Ship fouling and Ballast water
Crustacea: Amphipoda	Nesting amphipod	unknown
Crustacea: Amphipoda	Skeleton shrimp sp.	Ship fouling and Ballast water
Crustacea: Amphipoda	Skeleton shrimp sp.	Ship fouling and Ballast water
Crustacea: Balanidae	Pacific glandula	Spread via larvae in shipping ballast water or hull-fouling
Crustacea: Decapoda	European shore-crab	Ship fouling; population was sampled in Hout Bay Harbour
Crustacea: Isopoda	Gribble	Shipping (wooden)
Crustacea: Isopoda	*Synidotea hirtipes*	Ship fouling
Crustacea: Isopoda	Reddish wood-boring amphipod	Ship fouling
Didemnidae	Diplosoma tunicate	Ship fouling
Mollusca: Bivalva	Piddock	shipping?
Mollusca: Bivalva	Pacific oyster	Cultivation

Mollusca: Bivalva	Wrinkled rock-borer	Ship fouling
Mollusca: Bivalva	Bisexual mussel	fouling?
Mollusca: Bivalva	ship-worm	Uncertain
Mollusca: Gastropoda	British periwinkle	shipping?
Mollusca: Gastropoda	Sea-fan nudibranch	shipping?
Mollusca: Gastropoda	aeolid nudibranch	Shipping
Mollusca: Gastropoda	Winged thecacera	Ship fouling and Ballast water
Polychaeta	*Janua pagenstecheri*	Uncertain
Polychaeta	*Hydroides elegans*	Fouling
Polychaeta	*Neodexiospira brasiliensis*	Uncertain
Rhodophyta	*Schimmelmannia elegans*	Possibly ballast water from fishing vessels from Tristan da Cunha; inlet pipe in harbour allows for transport of spores from aquarium to the Cape Town Waterfront harbour outlet pipe.