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SANParks Global Environmental Change Assessment: Aquatic Ecosystems

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SUMMARY

The principal objective of SANParks' Global Environmental Change Project is to improve our understanding of the status of, and trends in, environmental change in parks and using this information to produce science-based policy and management recommendations. Aquatic ecosystems were included as one of six drivers of environmental change, with alien species, climate change, habitat change, resource use/overexploitation, and disease.

For the aquatic ecosystem assessment we largely made use of data produced by two national developments: the identification of Freshwater Ecosystem Priority Areas (FEPAs) for South Africa (Nel et al., 2011); and the second National Biodiversity Assessment (NBA) for South Africa (Driver et al., 2012). Drawing extensively on the products from these two initiatives, this report aims to:

- Provide an overview of the:
  - ecological state of, and main pressures on, aquatic ecosystems in South Africa; and
  - conservation status and protection levels (through the national park system) of aquatic ecosystems in South Africa;
- Assess the contribution of each national park to the achievement of national conservation targets for aquatic ecosystems; and
- Propose general management/response guidelines for SANParks in context of its mandate to conserve aquatic ecosystems;

Moreover, we aimed to answer specific questions that are of particular relevance to SANParks: (a) To what degree does the National Parks (NPs) contribute to aquatic conservation targets in South Africa? (b) What is the contribution of each of the 19 NPs to aquatic conservation? (c) What can SANParks do to promote effective conservation of aquatic ecosystems?

In ***Section 2*** of this report we present key national-scale findings for rivers, wetlands, estuaries and marine ecosystems. These findings include an overview of the diversity and distribution of these ecosystems across South Africa, their threat status and the level of protection (inclusion in NPs) that different ecosystem types enjoy. We will not attempt to summarise the myriad of statistics presented in this section except to note that, although critically important as providers of ecosystem services, a large percentage of aquatic ecosystems are in a poor ecological state and continue to be threatened as a results of multiple pressures. Different aquatic ecosystem types are generally poorly represented in protected areas and even where they do occur in protected areas they may not enjoy full protection or be in an ecologically good condition.

In response to the national-scale findings presented in the previous section, ***Section 3*** focuses on management implications and recommendations for SANParks. First, a number of key messages are identified that can be used to communicate aquatic priorities in a coherent and consistent way throughout the organisation. For example, principles are provided that would help to make the design and potential expansion of parks friendly towards freshwater conservation. Secondly, seven systemic strategy guidelines are developed that, if properly enabled, would strengthen SANParks' ability to effectively conserve freshwater ecosystems. These systemic strategy guidelines (***Section 3.2***) are to (i) nurture strategic relationships, (ii) lead appropriate depth and breadth of research, (iii) maintain dynamic/adaptive monitoring, (iv) influence public understanding, (v) mainstream aquatic conservation throughout SANParks, (vi) attract key competencies and skills and maintain functional capacity, and (vii) be a learning unit.

In ***Section 4***, attention in shifted to a park-specific assessment to reveal the significance of each NP in terms of containing aquatic ecosystems and contributing to the achievement of national targets for aquatic conservation. Although valuable insights were gained during this exercise, it became clear that substantial addition work may be required to meaningfully connect national-scale assessments with local-scale action. As such, further park-level work, for which field validation, data collection and experts with local knowledge may be required, is one of the main recommendations made in this report (see concluding section).

In ***Section 5*** we conclude that the availability of national-scale spatial information on biodiversity and species is most useful for highlighting problem areas as well as relative threats and future priorities for South Africa. Such information can and should influence policy processes, national-level decision making and the public discourse on conservation issues. During the course of preparing this report, we have also seen that this information can be extremely useful to deriving conservation insights at smaller scales, but that substantial additional analysis and local-scale fieldwork might be required. While it was relatively straight-forward to extract information that is informative at the level of the SANParks estate (all 19 NPs), more work is required to translate the national assessments into park-specific priorities and management plans.

The following concluding paragraphs per aquatic ecosystem component are from ***Section 5***:

- National-scale information on **river** biodiversity and conservation has benefited from the South African River Health Programme as well as more than a decade of research and application in the field of conservation planning directed at riverine ecosystems. The resulting national-scale information is generally regarded as scientifically sound and tested. Of South Africa's river length, 22% has been identified as spatial priorities for conservation (FEPAs). The occurrence of these priority areas in the various NPs are summarised in *Section 4.2*. Two significant realities are that (a) only 84 of the 223 river ecosystem types are found within the 19 NPs, and (b) even when inside an NP a river FEPA are not necessarily enjoying full protection because of external and sometimes internal threats. South Africa can only achieve its conservation targets for rivers when relevant government departments, agencies and land owners work together and achieve integrated planning and management across whole catchments.

- The NSBA reported that **wetlands** are the most threatened of all South Africa's ecosystems. Although only making up 2.4% of South Africa's area, wetlands provide critical ecosystem services such as water purification and flood regulation. Of the total wetland area in the country, 38% has been identified as FEPAs. The occurrence of these wetland FEPAs in NPs are outlined in *Section 4.3*. However, it must be noted that the national-scale wetland information is based on a GIS desktop procedure for classifying wetlands that has been applied for the first time during the mentioned national assessments. It is reasonable to expect that both the underlying data layers and the classification procedure will be refined in future. In terms of SANParks' responsibility to contribute to wetland conservation, mapping and classification of wetlands per park should be a high priority. Such an exercise will provide valuable feedback to contribute to the revision and improvement of national-scale wetland information.

- **Estuaries** face multiple pressures from human activities, often resulting from development too close to the estuary as well as the cumulative impacts of land uses throughout the catchment that feeds the estuary. Only 71 of the approximately 250 estuaries or estuarine systems in South Africa enjoy some form of formal protection. Of these only 14 estuaries have full no-take protection. Sixteen estuaries or estuarine systems occur in four of the 19 national parks, of which 11 are in the Garden Route NP. Several of the estuaries that are contained within NPs are being subject to anthropogenic changes such as reductions in freshwater inflows, moderate pollution, consumptive resource utilization (fishing, bait collection), recreational utilisation, and artificial breaching. Important conclusions are that (a) the degree to which SANParks can contribute to national conservation targets for estuaries is relatively limited, and (b) the degree of protection extended to estuaries even within NPs is limited because of catchment-based impacts and recreational and developmental pressures around these systems.

- In **marine** ecosystems, the contribution by SANParks is very much limited to the coastal and inshore zones. In terms of the role that SANParks plays, four of the six coastal NPs have a total of eight associated MPAs – out of 22 MPAs around South Africa's coast. These eight MPs contribute a total area of 1 447 km^2 of which only 365 km^2 enjoys no-take protection. Similarly to the identification of FEPAs for rivers, wetlands and estuaries (Nel et al., 2011), priority marine ecosystems for future protection have been identified through various national (Sink and Attwood, 2008, Sink et al., 2012) and regional plans (Majiedt et al., 2012). Of these, the offshore marine ecosystems are the most poorly protected of any in South Africas, with only 4% of offshore ecosystem types well protected. It is unlikely that SANParks will or can help address this, due to the multi-agency governance and mandate model applicable to these systems. In practical terms, SANParks's only feasible contribution to marine conservation goals is by way of access control, coastal monitoring and fisheries compliance, but it lacks the organisational and logistical capacity (e.g. seagoing vessels) to improve this contribution farther from the shore. Offshore ecosystems play a vital role in sustaining fisheries, and spatial management measures including marine protected areas are a key tool in the ecosystem approach to fisheries management, but this function is probably marginal to the common interpretation of SANParks' mandate.

A main aim of this report was to develop some understanding of how SANParks should respond to the findings of the mentioned national-scale biodiversity assessments. The following three recommendations provide some direction in terms of immediate next steps:

- The "enabling conditions" listed in *Section 3.2* should be developed in more detail and implemented as part of a parallel initiative to build leadership in aquatic conservation within SANParks.
- Most of the data presented in *Section 4* of this report should be verified against reality on the ground and associated actions and management plans should be developed for each NP. Workshops to ground-truth and apply the information in this report should be held with staff from Biodiversity Social Projects (responsible for management of invasive alien plants and associated restoration) and the respective NPs, either by park or cluster of parks.
- Lessons from the NFEPA and NBA 2011 projects, as well as park-specific applications discussed in the previous sub-section, should be used to formulate policy objectives specifically related to aquatic conservation through a NP system.

LIST OF ACRONYMS

CBD	Convention on Biodiversity
COP	Conference of the Parties (governing body of CBD)
CR	critically endangered
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWA	Department of Water Affairs
EEZ	Exclusive Economic Zone
EN	endangered
FEPA	Freshwater Ecosystem Priority Area
GIS	Geographic Information System
LT	least threatened
MCM	Marine and Coastal Management Branch under the former Department of Environmental Affairs and Tourism, before this ministry was restructured into DEA: Branch Oceans and Coast and DAFF Fisheries Branch
MPA	Marine Protected Area
NBA 2011	National Biodiversity Assessment of 2011
NSBA 2004	National Spatial Biodiversity Assessment of 2004
NP	National Park
O&C	Oceans and Coasts Branch: DEA
VU	vulnerable

GLOSSARY OF TERMS

Conservation targets: A 20% biodiversity target was used for representing freshwater and estuarine ecosystems, as recommended in the cross-sectoral policy document for conserving freshwater ecosystems (Roux et al., 2006). To be considered protected in this assessment, river and wetland ecosystems had to be in formal protected areas AND be in a good condition (A or B ecological category for rivers and wetlands; excellent or good health category for estuaries). The latter requirement acknowledges the problems that rivers have with upstream impacts outside protected areas. Thus, a river ecosystem with a total length of 100 km in South Africa would have a biodiversity target of 20 km against which its length in good condition within formal protected areas was assessed. Similarly, a wetland ecosystem with a total area of 100 ha in South Africa, would have a biodiversity target of 20 ha against which its area in good condition within formal protected areas was assessed.

Currently targets for coastal conservation are measured in kilometres of coastline, with 21.75% of the South African coastline falling within protected areas, although only 9.26% of this is fully protected (i.e. occurs in MPAs where no resource exploitation is permitted, or “no-take”) and 12.49% partial protection (Sink et al., 2012). However this 21% is unequally distributed, with no protection in the Namaqua ecoregion on the west coast, whereas the Delagoa ecoregion on the Mozambique border enjoys over 20% protection in no-take MPAs. The marine conservation target set by the Convention on Biodiversity (CBD) and its governing body the Conference of the Parties (COP) are also measured in percentage length of coastline and is set at 15% no take by 2020. Moving offshore, less than 1% of South Africa’s EEZ falls within MPAs, and of this, less than 0.2% is no-take.

Ecosystem condition describes the extent to which a river, wetland, estuary or marine ecosystem has been modified by human activity.

Ecosystem protection level is used as a measure of how well SANParks’ NPs are contributing to meeting national targets for conserving the full variety of ecosystem types across the country. This indicator measures how much of the biodiversity target for each ecosystem type has been included in the NPs, thus helping to focus protected area expansion on the least protected ecosystem types.

Ecosystem threat status is a key indicator of the degree to which South Africa’s ecosystems are still intact, or alternatively losing vital aspects of their structures and functioning. Ecosystems can be categorised as critically endangered (CR), endangered (EN), vulnerable (VU) or least threatened (LT), with CR, EN and VU ecosystem types collectively referred to as threatened.

Ecosystem types are landscape-level surrogates that have been delineated to represent the diversity of aquatic ecosystems, including their habitats and biota. Using ecosystem types allows us to advance freshwater conservation beyond species as the only measure of biodiversity, to examine the conservation of habitats and ecosystems on a systematic basis. Different approaches were followed in delineating ecosystem types for rivers, wetlands, estuaries and marine ecosystems. Following are brief descriptions of the respective approaches:

- Rivers – Level 1 ecoregions (31 regions delineated based on topography, altitude, slope, rainfall, temperature, geology and potential natural vegetation), flow variability (permanent and not permanent) and channel slope (mountain streams, upper foothills, lower foothills and lowland rivers) were overlaid to produce 223 distinct combinations of river ecosystem types for South Africa (Nel and Driver, 2012).
- Wetlands – The national wetland classification system provides a hierarchical classification framework consisting of six levels, with each level requiring increasing levels of detail about the wetland. Level 1 separates wetlands into inland, marine and estuarine systems. Levels 2 to 4 identify broad groups of wetlands sharing similar regional context, landform and broad hydrology. Levels 5 and 6 describe site characteristics such as hydroperiod, geology, vegetation, substratum, salinity, pH and naturalness (Nel and Driver, 2012).
- Estuaries – Four main physical features of South Africa's estuaries – size, mouth state, salinity structure and catchment type (given in ecosystem name as colour or clarity, i.e. turbid, black, clear) – were combined into 46 ecosystem types comprising permutations of the features for each of the three main biogeographical regions
- Marine ecosystems – Marine and coastal habitats were classified based on key drivers of marine biodiversity pattern: terrestrial and benthic-pelagic connectivity, substrate, depth and slope, geology, grain size, wave exposure and biogeography. The habitat classification identifies and maps a total of 136 habitat types including 37 coast types, 17 inshore (5-30 m) habitat types and 62 offshore (deeper than 30 m) benthic habitat types. In addition, a separate classification was undertaken to define 16 different offshore pelagic habitat types based on differences in sea surface temperature, productivity, chlorophyll, depth and the frequency of eddies, temperature fronts and chlorophyll fronts.

A **pressure** refers to an influence or action that could affect the condition of an ecosystem.

1. INTRODUCTION AND OBJECTIVES

The impact of human actions on natural ecosystems has reached alarming proportions over the past 50 years. While economic development and human survival depend on a multitude of services derived from ecosystems, unsustainable use of these systems erodes their ability to produce services. This inter-dependence between human use and ecosystem function prompts the need for wise stewardship and at least partial conservation of ecosystems.

A central principle of conservation science is to set aside representative samples of ecosystems to act as biodiversity banks or proactive protection against future modifications. Systematic conservation planning has, over the last 30 years, evolved into a widely accepted framework for identifying and prioritising ecosystems for protection in order to minimize the loss of biodiversity and ecosystem services (Pressey and Bottrill, 2009).

Systematic conservation planning has developed around terrestrial conservation objectives (Nel et al., 2009a). Traditionally, freshwater, estuarine and marine ecosystems have received much less attention from systematic conservation planning exercises, often relying on incidental inclusion within a protected or conservation area of which the design has been driven by terrestrial features (Abell et al., 2007, Roux et al., 2008). However, since the early 2000s systematic conservation planning for freshwater ecosystems and species has emerged and grown purposefully to become a new and applied branch of conservation biology (Nel et al., 2009b, Linke et al., 2011). To date, South Africa has featured as one of a few growth centres for freshwater conservation planning (Roux and Nel, 2013). Marine and estuarine conservation planning has also taken off in the last decade with several national (Driver et al., 2004, Turpie et al., 2012), regional (Clark and Lombard, 2007, Lagabrielle et al., 2010, Majiedt et al., 2012) and fine scale plans (Turpie and Clark, 2007) being completed.

While the adoption of a systematic approach for different ecosystem types presents a major opportunity for integrated conservation planning, these systems are often still examined in relative isolation. This isolation is rooted in the academic separation of disciplines (e.g. freshwater ecologists and marine biologists work in separate departments) and governance structures (e.g. dealing with freshwater, biodiversity and marine issues in different departments and policies). This situation may mask the underlying connectivity between such systems and thus confound more coordinated management approaches. For example, the causal link between freshwater flow and the productivity of fisheries in estuarine and coastal systems has been clearly demonstrated but is a fact probably under-appreciated in management and policy contexts (Lamberth et al., 2008). Conservation planning and management need to recognise the interrelated nature of terrestrial, aquatic and marine ecosystems, as it relates to the hydrological cycle, but also ecosystem services (e.g. fishery production) (Gillson, 2011).

Spatial and temporal distribution of water (especially freshwater) across the surface of Earth is a key determinant of biodiversity patterns as well as of social developmental potential. At the same time freshwater and estuarine ecosystems are more endangered than their marine and terrestrial counterparts. The ecological functionality of these already stressed ecosystems is vulnerable to changes in climate (e.g. evaporation and precipitation), expanding human populations and changes in societal values and governance systems (Carpenter et al., 1992).

Complemented by numerous method developments and several conservation planning exercises, two recent developments have in particular advanced our understanding of the status of aquatic ecosystems across South Africa. These developments are:

- Identification of Freshwater Ecosystem Priority Areas (FEPAs) for South Africa (Driver et al., 2011, Nel et al., 2011). FEPA's constitute strategic areas for conserving rivers, wetlands and estuaries and comprise 22% of South Africa's river length, 38% of wetland area and 41% of estuaries.
- Publication of a second National Biodiversity Assessment (NBA) for South Africa (Driver et al., 2012). The freshwater, estuarine and marine components of NBA 2011 build on work that has been undertaken since NSBA 2004 and addresses several of the limitations highlighted in NSBA 2004.

Data associated with the above national assessments and aquatic priority areas allow us to answer a few questions that are of particular relevance to SANParks: (a) To what degree does the national park system of SANParks – henceforth referred to as National Parks (NPs) – contribute to aquatic conservation targets in South Africa? (b) What is the contribution of each of the 19 NPs to aquatic conservation? (c) What can SANParks do to promote effective conservation of aquatic ecosystems?

In view of the above, the objectives of this report are to:

- Provide an overview of the:
    - ecological state of, and main pressures on, aquatic ecosystems in South Africa; and
    - conservation status and protection levels (through the national park system) of aquatic ecosystems in South Africa;
- Assess the contribution of each national park to the achievement of national conservation targets for aquatic ecosystems;
- Propose general management/response guidelines for SANParks in context of its mandate to conserve aquatic ecosystems;
- Propose a process for effectively incorporating aquatic conservation priorities into the management plans of each NP.

2. KEY NATIONAL-SCALE FINDINGS

The results presented in this section are largely excerpts from the products of the FEPA (Nel et al., 2011) and NBA-2011 (Driver et al., 2012, Nel and Driver, 2012, Sink et al., 2012, Van Niekerk and Turpie, 2012) projects.

2.1 Rivers

2.1.1. National statistics from NBA 2011

In South Africa, freshwater condition is often described in six "present ecological state or PES" categories ranging from natural (A) to critically-modified (F). Following from the 2011 NBA (Nel and Driver, 2012), rivers and wetlands in an A and B category were regarded as being in "good condition", with the ability to contribute towards biodiversity targets. Category C-F rivers were grouped as "not in good condition". According to this classification, 35% of the length of main river stems, 57% of tributaries and 47% of the length of all rivers in South Africa are in a good condition.

River ecosystem types are components of rivers with similar physical features (such as climate, flow and geomorphology) that can be used to represent the diversity of river ecosystems across the country. There are 223 river ecosystem types in South Africa (Nel and Driver, 2012). Of these, 26% are critically endangered, 18% are endangered, 11% are vulnerable, and 46% are least threatened. Higher ecosystem threat levels are prevalent in mainstem rivers compared to tributaries. Lowland river types are also more threatened than mountain streams, which is arguably a reflection of multiple pressures accumulating from river source to sea (Nel and Driver, 2012).

Only 7% of the country's river length occurs in formal protected areas – as recognised in terms of the National Environmental Management: Protected Areas Act (Act 57 of 2003). Of the rivers in formal protected areas, 57% are in good condition (A or B ecological category), 29% are in a moderately modified condition (C ecological category), and 14% are in a largely to heavily modified condition (D, E or F ecological category). These results show that inclusion in protected areas does not guarantee conservation. However, the higher proportion of good condition rivers inside protected areas, compared to outside, emphasises the positive role protected areas can have, through appropriate land management strategies. Further to the ecological condition of rivers in South Africa, the 2011 NBA also found that only 14% of river ecosystem types are well protected, 7% moderately protected, 29% poorly protected and 50% not protected at all. It is important to realise that formal protected areas in South Africa render good protection to only 14% of river ecosystem types. Disaggregating these results to slope categories reveals that mountain streams have the highest proportion of moderately to well protected river ecosystem types, while lowland rivers have the highest proportion of river ecosystem types not protected. Consistent to a worldwide trend for lowland productive areas (Pressey, 1994), this makes lowland rivers the most threatened of the slope categories and also the least protected.

2.1.2. Ecosystem types and their threat status in NPs

There are 84 of the 223 river ecosystem types (38%) found within the 19 NPs, 34 of which are considered threatened (Figure 1). Almost a third of the threatened river ecosystem types (i.e. those classified as CR, EN and VU in the NBA 2011) are protected in NPs (Figure 1).

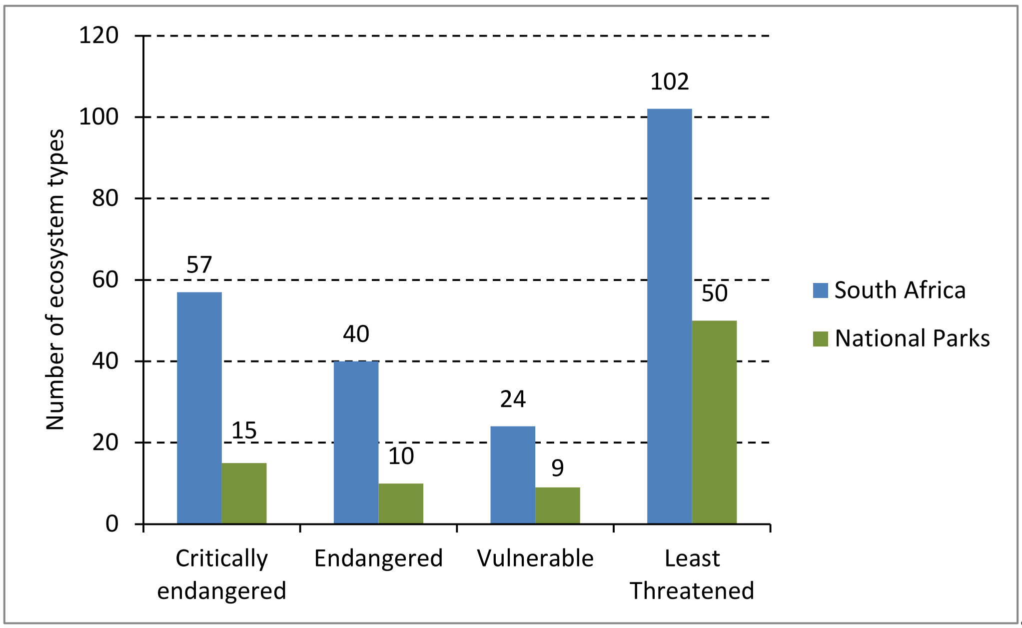

Figure 1

Ecosystem threat status for river ecosystems types in South Africa and National Parks. Ecosystem threat status is an indicator used in the National Biodiversity Assessment that assesses the state of different ecosystem types. Statistics in this figure were drawn from the recently completed National Biodiversity Assessment 2011 (Driver et al., 2012, Nel and Driver, 2012).

Six river ecosystem types have the majority of their length (> 50%) in the NPs, and effective SANParks management of these river ecosystem types is particularly important (Table 1). Of significance are the river ecosystem types Great Karoo and Limpopo Plain (Level 1 ecoregions), which have respectively 96% and 73% of their length within NPs, but are considered “not protected” in the recent National Biodiversity Assessment (Table 1). This is because the rivers within NPs containing these ecosystems are not in a good condition and were therefore not considered to be protected.

Table 1

River ecosystem types that have the majority of their length (> 50%) in National Parks, together with their ecosystem threat status (ETS) and protection levels (EPL) according to the National Biodiversity Assessment 2011 (Nel and Driver 2011). Heading abbreviations ETS, EPL, SA, and NPs refer respectively to, Ecosystem Threat Status and Ecosystem Protection Levels, South Africa and National Parks. How many river ecosystem types have < 50% of their length in National Parks? It would be really cool if we can identify the names of these rivers and the parks in which they occur?

River type code	**Level 1 ecoregion**	***Flow variability**	**Slope category**	****ETS**	*****EPL**	**Total length in SA (km)**	**Total length in NPs (km)**	**% length in NPs**
21_P_F	Great Karoo	P/S	Lowland river	CR	NP	2.80	2.70	96
1_N_M	Limpopo Plain	E	Mountain stream	CR	NP	6.97	5.11	73
12_N_L	Lebombo Uplands	E	Lower foothill	LT	WP	185.80	136.11	73
20_N_F	South Eastern Coastal Belt	E	Lowland river	VU	WP	30.17	20.33	67
1_P_M	Limpopo Plain	P/S	Mountain stream	LT	WP	4.78	3.16	66
19_N_F	Southern Folded Mountains	E	Lowland river	LT	WP	7.55	3.79	50

*P/S = Permanent or seasonal rivers; E = ephemeral flow

**CR = Critically endangered; EN = endangered; VU = Vulnerable; LT = Least Threatened

***Well protected (WP) ecosystem types have ≥ 100% of their national biodiversity target formally protected; moderately protected (MP) and poorly protected (PP) river ecosystem types have respectively at least 50% and 5% of their target in protected areas and in good condition; while not protected (NP) have < 5%

2.1.3. Ecosystem condition and ecosystem protection levels in NPs

Generally, rivers flowing through NPs are in better condition than those outside protected areas – 76% of the river length in NPs is considered to be in a good ecological condition (AB category) compared to only 47% of the river length outside of NPs (Figure 2). However, being in a NP does not necessarily guarantee maintenance of ecological condition because upstream activities influence downstream condition – this is evidenced by 24% of all rivers in NPs being in a moderately to heavily modified ecological condition (Figure 2).

To determine protection levels, no distinction was made between rivers that are protected on both sides of their river bank and ones that form the boundary of the protected area (which are therefore protected on one side only). However the river had to be in a good condition (A or B ecological category) to be considered protected, irrespective of whether it was on a protected area boundary or not. For each river ecosystem type, the length in good condition and under formal protection was expressed as a percentage of the length required by the biodiversity target (calculated as 20% of the total length for each ecosystem type). An ecosystem protection level category was thus assigned, where well protected river ecosystem types were defined as those with 100% of their biodiversity target in protected areas and in good condition. Similarly, moderately protected and poorly protected river ecosystem types have respectively at least 50% and 5% of their target in protected areas and in good condition; while not protected have < 5%.

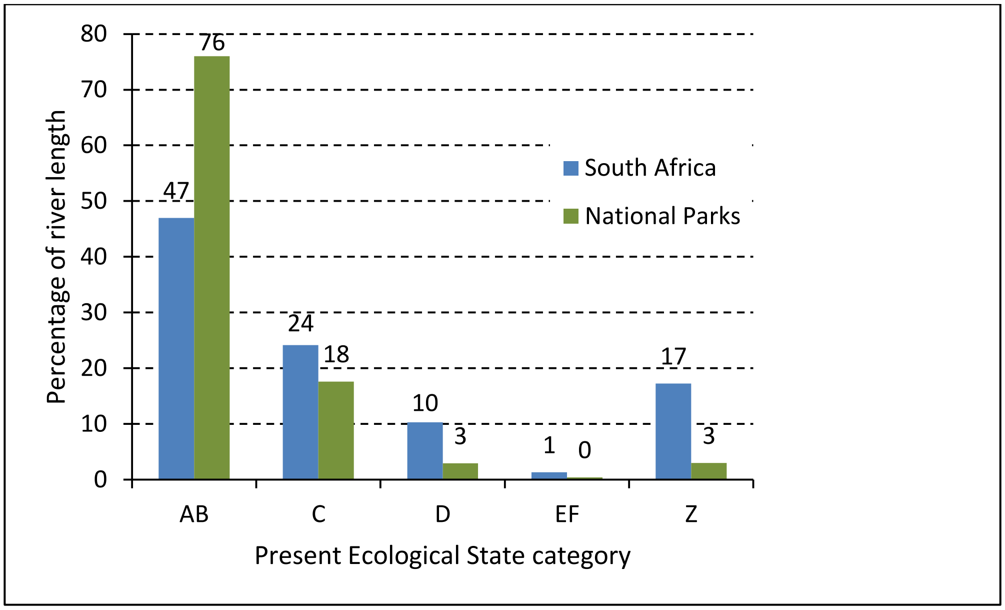

Figure 2

River condition inside and outside of National Parks. Present Ecological Categories are where AB, C, D, and EF refer respectively to rivers in natural or good ecological condition, moderate ecological condition, heavily modified ecological condition, unacceptably modified ecological condition (Kleynhans, 2000). Rivers in Z category have been modelled as "not intact"(Nel et al., 2011) using national land cover data (Van den Berg et al., 2008).

Figure 3 shows that 67% of the moderately- to well-protected river ecosystem types in South Africa are contained within NPs. It also shows that NPs protect less than 1% of the river ecosystem types that are not protected, and it is here where a strategic effort should be made with regards to protected area expansion.

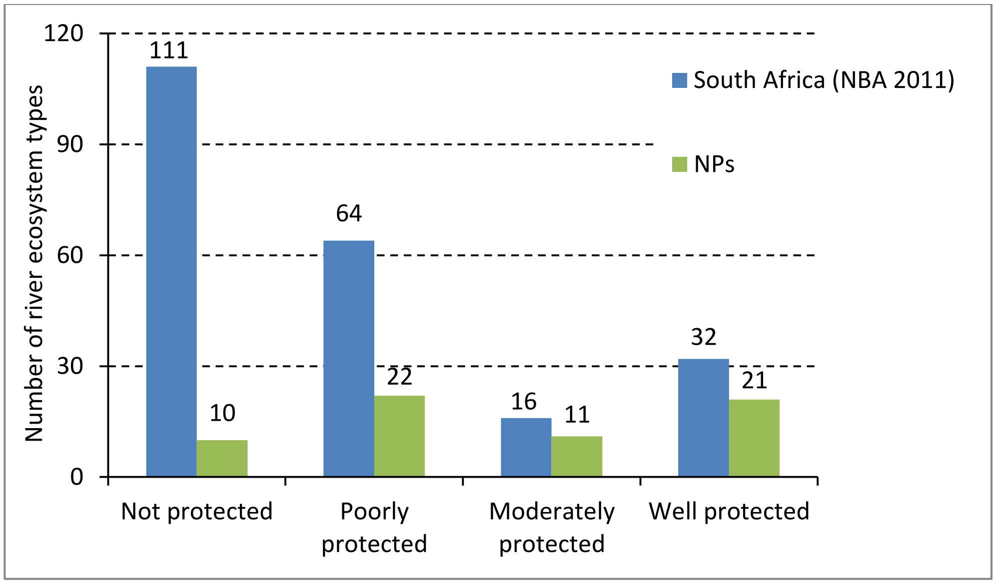

Figure 3

Summary of ecosystem protection level for the 223 river ecosystem types in all formal protected areas of South Africa and in the 19 NPs.

2.1.4. Freshwater Ecosystem Priority Areas in NPs

Over 50% of the river length in NPs has been identified as a Freshwater Ecosystem Priority Area (FEPA) or Fish Support Area (Nel et al., 2011), contributing to national conservation goals for conserving freshwater ecosystem types (Roux et al., 2006) and protecting threatened fish species (Table 2). A further 5% of the river length in NPs has been identified as a Phase 2 FEPA, which if rehabilitated from their current moderately modified ecological condition (C category) to a good ecological condition (A or B category) could contribute further to national conservation targets. In addition, there are rivers in NPs (25% of the river length) that support downstream FEPAs.

Table 2

Rivers that have been identified as Freshwater Ecosystem Priority Areas (Nel et al., 2011). FEPAs refer to Freshwater Ecosystem Priority Areas and NPs refer to National Parks.

FEPA Map Category	Length in NPs	% of total river length in NPs
FEPA	2253.43	44
Fish Support Area	134.55	9
Phase2 FEPA	309.16	5
Upstream	253.45	25
No category assigned	1268.45	17

2.2 Wetlands

What is a wetland?

Wetlands represent a very diverse range of ecological systems, and are defined in the South African National Water Act (Act 36 of 1998) as “land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support vegetation adapted to life in saturated soil.” A national wetland classification system has been proposed (Dini et al., 1998) based on the well-known system of Cowardin (Cowardin, 1979) with six types of natural wetlands recognised (riverine, estuarine, marine, endorheic, lacustrine and palustrine) in additional to artificial wetlands. Within this study marine and estuarine systems, and the river component (perennial, intermittent, and ephemeral watercourses) of riverine wetlands are dealt with under separate sections. The remaining wetland types are collectively considered under the heading “Wetlands” and include endorheic systems (closed drainage pans), lacustrine systems (permanent, relatively fresh water, lake-like systems), palustrine systems (marsh, vlei, seep), riparian zones of rivers and floodplains.

2.2.1. National statistics from the NBA 2011

The NBA 2011 found 47% of the total wetlands area in South Africa to be in a good condition (Nel and Driver, 2012).

There are 791 wetland ecosystem types (Nel and Driver, 2012), of which 48% are critically endangered, 12% are endangered, 5% are vulnerable, and 35% are least threatened. There is also variability within the overall picture for wetland ecosystem types, with floodplain wetland ecosystem types being the most critically endangered, followed closely by valleyhead seeps and valley-bottom wetlands. These wetland types are often associated with highly productive land, and are the ones that are often dammed, drained or bulldozed for agricultural purposes (Nel and Driver, 2012).

Only 9% of the country's wetland area occurs in formal protected areas. Of the wetlands in protected areas, 32% are in good condition (A or B ecological category), 7% are in moderately modified, and 54% are considered to be heavily to critically modified. An alarming proportion of wetlands in protected areas are regarded as being in heavily to critically-modified condition, which stem mostly from those wetlands that are associated with rivers that are not in a good condition (although in some instances, for example in Kruger NP, riparian wetlands are categorised differently from the rivers i.e. most rivers are A or B, whereas their riparian areas are D and lower), or from wetlands that were mapped as artificial waterbodies (e.g. waterholes) by DLA-CDSM (2005-2007). Less than 20% of wetland ecosystem types are considered moderately to well protected, and almost three-quarters of the wetland ecosystem types of South Africa are not protected at all.

2.2.2. Ecosystem types and their threat status in NPs

Of the 791 wetland ecosystem types, 220 (28%) are found within the 19 NPs, 134 of which are considered threatened (Figure 4). Thirteen wetland ecosystem types are completely contained within NPs, and a further 11 have the majority of their area (> 50%) in NPs – effective SANParks management of these wetland ecosystem types is particularly important (Table 3).

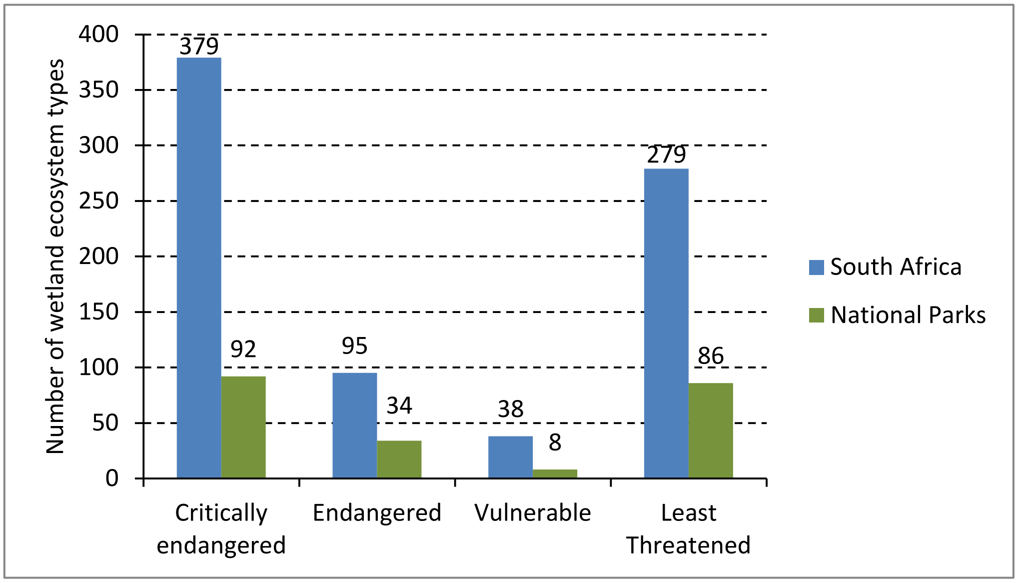

Figure 4

Ecosystem threat status for wetland ecosystems types in South Africa and National Parks. Ecosystem threat status is an indicator used in the National Biodiversity Assessment that assesses the state of different ecosystem types. Statistics in this figure were drawn from the recently completed National Biodiversity Assessment 2011 (Driver et al. 2011; Nel and Driver 2011).

Of concern are the nine wetland ecosystem types listed in Table 3 that are well represented in NPs but yet are considered to be “not protected” in the recent National Biodiversity Assessment 2011 (Nel and Driver, 2012). This is because they have been modelled as having a poor ecological condition – restoration of wetlands representing these wetland ecosystem types in National Parks should urgently be considered.

Table 3

Wetland ecosystem types that have the majority of their area (> 50%) in National Parks, together with their ecosystem threat status (ETS) and protection levels (EPL) according to the National Biodiversity Assessment 2011 (Nel and Driver 2011). Heading abbreviations ETS, EPL, SA, and NPs refer respectively to Ecosystem Threat Status, Ecosystem Protection Levels, South Africa and National Parks. How many wetland types have < 50% of their area in NPs?

Wetveg group	**HGM_txt**	**ETS**	**EPL**	**Area SA (ha)**	**Area in NPs (ha)**	**%area in NPs**
Lowveld Group 8	Depression	LT	WP	0.35	0.35	100
Lowveld Group 5	Seep	CR	PP	8.97	8.97	100
Mopane Group 3	Floodplain wetland	EN	WP	1585.64	1585.64	100
Mopane Group 3	Valleyhead seep	VU	WP	197.17	197.17	100
Lowveld Group 1	Depression	LT	NP	9.84	9.84	100
Namaqualand Cape Shrublands Quartzite Fynbos	Flat	CR	NP	1.31	1.31	100
Lowveld Group 5	Unchannelled valley-bottom wetland	CR	NP	0.30	0.30	100
Mopane Group 3	Depression	LT	WP	187.92	187.92	100
Mopane Group 2	Depression	LT	WP	48.17	48.17	100
Mopane Group 3	Flat	LT	WP	27.46	27.46	100
Mopane Group 3	Unchannelled valley-bottom wetland	CR	NP	15.00	15.00	100
Mopane Group 3	Seep	LT	WP	3.86	3.86	100
Mopane Group 3	Channelled valley-bottom wetland	LT	WP	907.99	906.60	100
Lowveld Group 2	Depression	LT	WP	39.09	38.41	98
Southern Silcrete Fynbos	Valleyhead seep	LT	WP	83.72	79.03	94
Mopane Group 4	Depression	LT	WP	144.01	131.71	91
Lowveld Group 5	Channelled valley-bottom wetland	CR	NP	28.85	23.38	81
Albany Thicket Valley	Valleyhead seep	CR	NP	1478.73	1154.80	78
Lowveld Group 4	Depression	LT	WP	26.52	18.93	71
Lowveld Group 4	Channelled valley-bottom wetland	CR	NP	2994.08	1886.72	63
Lowveld Group 8	Channelled valley-	CR	NP	568.1	345.64	61

	bottom wetland			7		
Mesic Highveld Grassland Group 11	Flat	CR	NP	1.29	0.75	58
South Strandveld Western Strandveld	Valleyhead seep	LT	WP	28.40	15.80	56
Mopane Group 4	Seep	CR	PP	373.01	206.57	55

**CR = Critically endangered; EN = endangered; VU = Vulnerable; LT = Least Threatened

***Well protected (WP) ecosystem types have ≥ 100% of their national biodiversity target formally protected; moderately protected (MP) and poorly protected (PP) river ecosystem types have respectively at least 50% and 5% of their target in protected areas and in good condition; while not protected have < 5%

2.2.3. Ecosystem condition and ecosystem protection levels in NPs

Wetlands within National Parks are in no better condition than those outside protected areas – only 44% of the wetland area in both South Africa and NPs, is considered to be in a good condition (Figure 5). These are lower-than-expected trends in condition within NPs and this could be due to several reasons. First, there is more uncertainty in the wetland condition data, than for rivers, as it was based purely on modelled data using national land cover combined with river ecological condition in the case of riverine wetlands (channelled valley-bottom wetlands and floodplains). National land cover is inherently poor at detecting land degradation, which is a particular issue in the semi-arid and arid interior of the country where over-stocking livestock has led to substantial degradation that goes undetected. As a consequence, most of the wetlands in the semi-arid and arid interior (a high proportion of total wetland area) are modelled as intact possibly giving an overly-optimistic view to the national trend in wetland condition. Apart from the modelling uncertainties, the trends may reflect some reality in NPs because the condition of riverine wetlands often reflects the condition of its associated river. Thus, wetlands associated with rivers that are modified from natural or good condition will be considered modified even if the landscape directly surrounding the wetland is fairly natural (although some inconsistencies between river and wetland condition in especially Kruger NP is concerning and needs to be investigated). In addition, waterholes were classified as artificial wetlands and have been included in the assessment as being in a critically modified condition. Further investigation on the condition of wetlands within NPs is needed to explain trends in condition within South Africa and NPs.

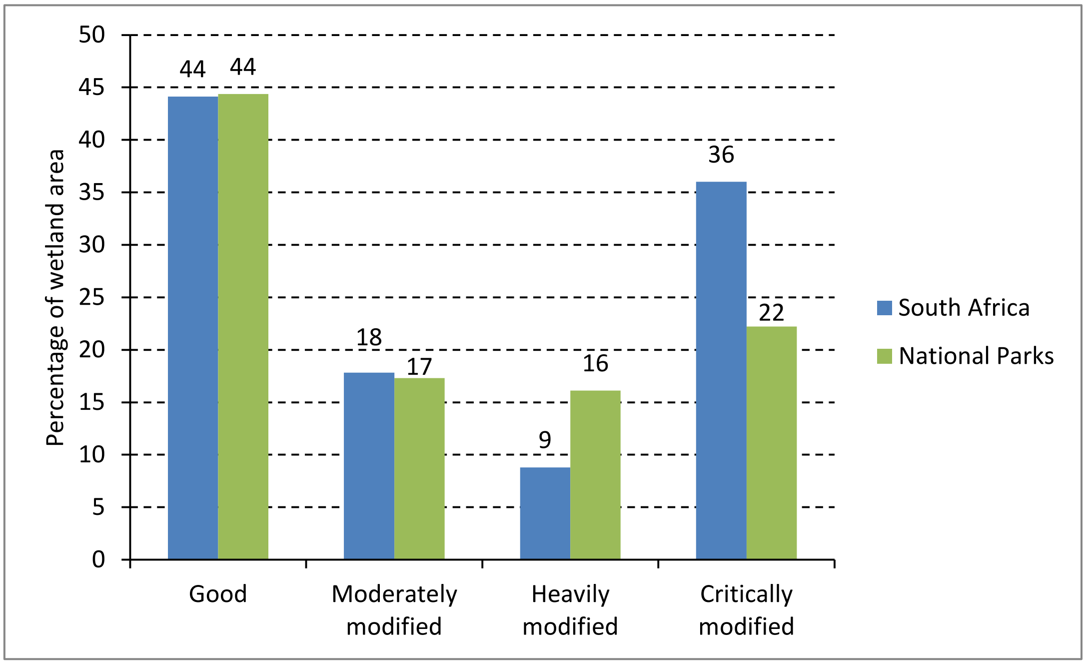

Figure 5

Wetland condition inside and outside of National Parks. Wetland condition was modelled according to Nel et al. (2011) using national land cover data (Van den Berg et al., 2008) and river ecological condition (in the case of riverine wetlands).

As with rivers, wetland ecosystem types and wetland condition were spatially combined with the protected areas GIS layer to calculate the area of each wetland ecosystem type within the 19 NPs and its associated condition. Only wetlands in good condition were used in the assessment of ecosystem protection levels. For each wetland ecosystem type, the area in good condition *AND* under formal protection was expressed as a percentage of the area required by the biodiversity target (calculated as 20% the total area for each ecosystem type). An ecosystem protection level category was thus assigned, where well protected wetland ecosystem types were defined as those with ≥ 100% of their biodiversity target in protected areas and in good condition. Similarly, moderately protected and poorly protected wetland ecosystem types have respectively at least 50% and 5% of their target in protected areas and in good condition; while not protected have < 5%.

Figure 6 shows that approximately 38% of the moderately- to well-protected wetland ecosystem types occur in NPs, while NPs contain less than 1% of the wetland ecosystem types that are not protected. Protected area expansion should focus on securing representation of the under-protected wetland ecosystem types.

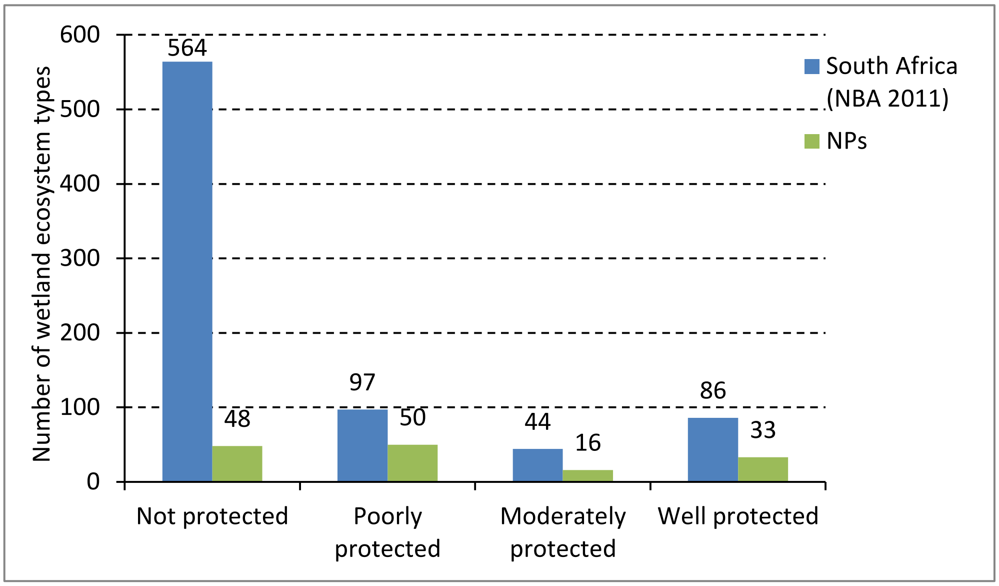

Figure 6

Summary of ecosystem protection levels for wetland ecosystem types. The % of ecosystem types is calculated as the number of ecosystems in the ecosystem threat status category expressed as a percentage of the total number of ecosystem types (= 791). Well protected, moderately protected, poorly protected wetland ecosystem types have at least 100%, 50%, 5% of their biodiversity target in protected areas and in good condition; not protected wetland ecosystem types have <5%.

2.2.4. Freshwater Ecosystem Priority Areas in NPs

Some 25% of the wetland area in NPs has been identified as a FEPA (Nel et al., 2011), contributing to national conservation goals for conserving freshwater ecosystem types (Roux et al., 2006) – see Table 4.

Table 4

Wetlands that have been identified as Freshwater Ecosystem Priority Areas (Nel et al. 2011). FEPAs refer to Freshwater Ecosystem Priority Areas and NPs refer to National Parks.

FEPA Map Category	**Area in NPs (ha)**	**% of total wetland area within NPs**
Wetland FEPA	10503.06	25
No category assigned	31926.15	75

2.3 Estuaries

What is an estuary?

In international literature, an estuary is defined as a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with freshwater derived from land drainage (Elliott and McLusky 2002; Cameron & Pritchard 1963; Pritchard 1967). A number of different definitions for South African estuaries recognise that these systems may not necessarily have a 'free connection with the sea' but are 'either permanently or periodically open to the sea' (Day 1980). The NBA 2011 (Van Niekerk & Turpie, 2012) defined an estuary as ''a partially enclosed permanent water body, either continuously or periodically open to the sea on decadal time scales, extending as far as the upper limit of tidal action or salinity penetration. During floods an estuary can become a river mouth with no seawater entering the formerly estuarine area or when there is little or no fluvial input an estuary can be isolated from the sea by a sandbar and become a lagoon or lake which may become fresh or hypersaline".

Langebaan Lagoon has many of the characteristics of an estuary, including calm coastal waters that are protected from marine wave action (see photograph) and a biota that reflects many of the species usually found in estuaries. However, the system lacks a conventional estuarine salinity gradient due to the absence of any inflowing river, although there is groundwater that feeds into certain sections of the system. Because Langebaan does receive a freshwater inflow from land drainage (aquifer input), and also has typical estuarine biota, Whitfield (2005) suggested that the term "coastal embayment" type of estuary be used to describe the system. Whether viewed as an estuary or as a marine ecosystem, Langebaan Lagoon separates out as a unique coastal ecosystem type. The 2011 NBA recognised the "transitional" nature of Langebaan Lagoon and assessed it as part of the Marine Component for consistency reasons.

2.3.1. Ecosystem condition and pressures

Estuarine health has been classified according to *excellent (A)*, *good (B)*, *fair (C&D)* and *poor* (E&F) classes (Van Niekerk and Turpie, 2012). It was found that only 1% of the total estuarine habitat area in South Africa is in an *excellent* condition, with about 14% in a *good* condition, 31% in a *fair* condition, and 54% in a *poor* condition. While a large number of South Africa's estuaries are still in an *excellent* to good condition, they mostly represent very small systems, while the larger systems which are important fish nursery areas are predominantly in a *fair* to *poor* condition. Approximately 83% of the estuarine area that falls within Ramsar sites (57 000 ha) is in a *poor* state, while none is in an *excellent* condition. Collectively 72% of estuaries in Marine or other Protected Areas (65 900 ha) are in a *poor* condition (Van Niekerk and Turpie, 2012).

Pressures that contribute to the degradation of estuarine ecosystems include (Van Niekerk and Turpie, 2012):

- Freshwater inflow modifications: Nearly 4% of all estuaries, and particularly the large permanently-open systems, are under significant flow modification pressure. An additional 18% of estuaries have experienced a moderate degree of flow modification.
- Water quality modifications (e.g. increased nutrient loading and turbidity resulting from effluent discharges and agricultural activities): About 15% of estuaries are under significant pollution pressure and 40% under a moderate degree of pollution pressure. Less than 1% of all estuaries have no pollution pressures on them.
- Artificial breaching and habitat modification: Thirteen percent of South Africa's estuaries are under significant habitat modification or development pressure. The mouths of about 16% of estuaries, which account for 62% of the total estuarine habitat, are artificially managed, with in particular inappropriate low-lying developments necessitating artificial mouth manipulations.
- Exploitation of natural resources (referring mostly to harvesting of marine living resources such as fish and bait species): About 1% of South Africa's estuaries are under tremendous fishing pressure resulting in a significant decline in fish stocks in these systems. Another 13% are under major fishing pressure, with approximately 2 000 tonnes of fish (comprising 80 species) caught in South African estuaries each year. About 84% of all estuaries are influenced by bait collection activities.
- Alien biota: There are 13 invasive alien plant species, ranging from trees to water weeds which have been identified in South Africa's estuaries. At present 11 invasive alien and 7 extra-limital fish species have been identified in the 130 estuaries for which data exist. Including invertebrates there are at least 86 introduced marine species established in estuaries, bays or along the coast, and another 39 of uncertain origin (='cryptogenic') (Robinson et al., 2005, Griffiths et al., 2009, Mead et al., 2011).
- Climate change: Climate change pressures on estuaries include flow modification, sea-level rise, increased temperatures and coastal storminess. These can lead to changes in physical processes and biological responses with an ultimate impact on ecosystem services.

It should be noted that pressures such as flow reduction, habitat modification, fishing and pollution are cumulative, and have been highlighted as being in particular need of management interventions. Invasive alien species, aquaculture and desalination are emerging pressures that could pose a significant threat to estuarine biodiversity in the future.

2.3.2. Ecosystem types and their threat status

There are 46 estuary ecosystem types (Van Niekerk and Turpie, 2012) in South Africa. Approximately 39% (18 types) of these are classified as critically endangered, 2% (1 type) as endangered, 2% (1 type) as vulnerable, and 57% (26 types) as least threatened. In terms of estuarine area 79% of South Africa's estuarine area falls within estuary types classified as critically endangered, compared with less than 1% in types that are endangered or vulnerable and 21% in types that are least threatened (Van Niekerk and Turpie, 2012).

Note on modification of national database for estuaries

It came to our attention that a large section of the Wilderness lake system (Serpentine, Eilandvlei, Langvlei, Rondevlei) which make up a significant component of the estuarine area in NPs, were excluded from the national database used in NBA 2011. This area (1,007.23 Ha) was included to recalculate the values for estuaries in national parks. The recalculated values are reflected in the remainder of this section as well as in Figures 7 and 8. Recalculation has not changed the overall trends shown by these figures but has changed individual values marginally. Moreover, the national database indicates that no fishing occurs in both Swartvlei and Wilderness systems. This is not accurate – fishing does occur in these systems – and the calculations in this section reflect a correction of this statement.

Approximately 5% of estuarine area occurring in NPs are classified as critically endangered, 1% as endangered, 1% as vulnerable, and 93% as least threatened (Van Niekerk and Turpie, 2012)

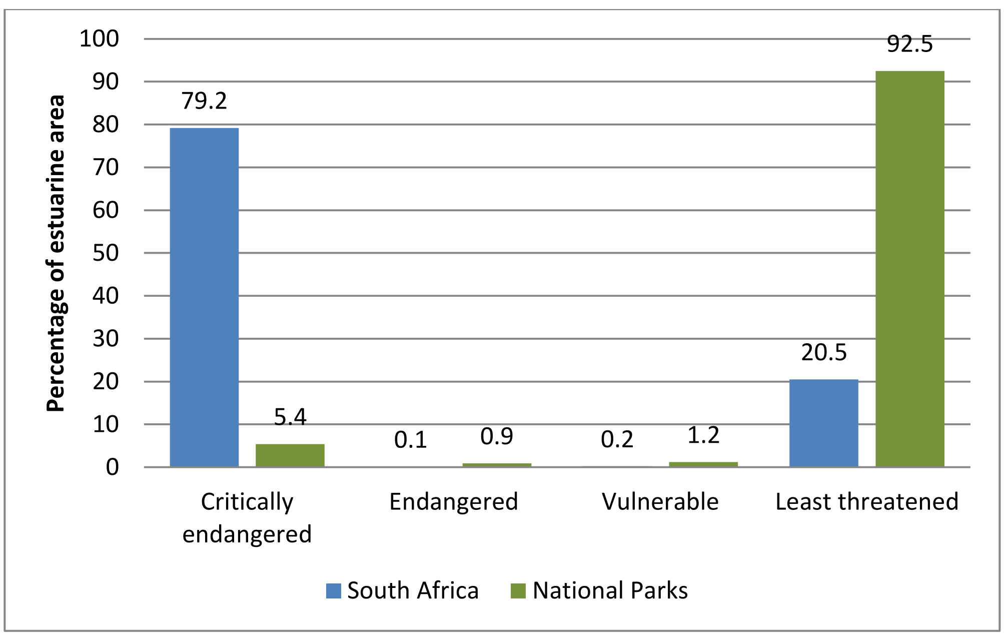

Figure 7

Ecosystem threat status inside and outside of National Parks. Estuary condition was modelled according to Van Niekerk and Turpie (2012).

A pressure assessment (based on habitat area) of estuaries occurring in NPs highlight the following issues in need of management intervention:

- *Flow alterations*: Nearly 5% (Wildevoëlvlei, Ratel and Groot East) of the estuarine habitat occurring in SANParks are under moderate flow modification pressure and an additional 95% under low flow modification pressure.

- *Habitat modification*: About 55% (Wildevoëlvlei, Swartvlei and Wilderness System) of estuarine habitat are under moderate habitat modification or development pressure. While an additional 45% (10 estuaries) of the habitat are under low development pressures. Of special significance is that the mouths of two estuarine lakes systems (Swartvlei and Wilderness System) as well as a temporary open-closed estuary (Groot West) are being artificially managed as a result of inappropriate low-lying developments necessitating artificial mouth manipulations.

- *Resource utilization*: About 42% (Knysna) of SANParks estuarine habitat are under significant fishing pressure resulting in some decline in fish stocks in this system. Another 58% (14 systems) are under low fishing pressure. All, but two systems (Krom, Storms), are influenced by bait collection activities (both permitted and illegal).

- *Pollution*: About 5% (Wildevoëlvlei) of estuarine area are under significant pollution pressure and 64% (Ratel, Wilderness System, Knysna and Groot East) under a moderate degree of pollution pressure. All SANParks estuaries had some pollution pressures on them.

- *Estuary Integrity:* Only about 1% (Krom, Sout, Bloukrans, Lottering, Elandsbos, Storms) of SANParks estuarine area is in an excellent state and 94% (Spoeg, Groen, Wilderness System, Swartvlei, Knysna, Groot (west), Elands, Groot (East) in a good state, represented by systems in an A or B category. About 5% (Wildevoëlvlei) of estuarine area is in a heavily modified condition, represented by systems in a D category.

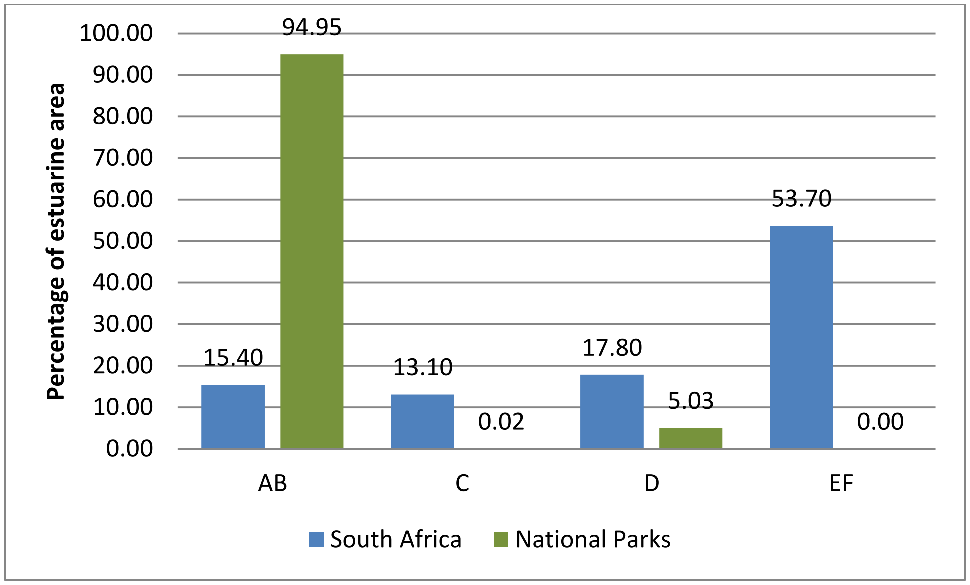

Figure 8

Estuary condition inside and outside of National Parks. Estuary condition was modelled according to Van Niekerk and Turpie (2012).

Regarding ecosystem threat status, approximately 7% of estuarine area occurring in NPs are classified as critically endangered, 1% as endangered, 91% as vulnerable, and 1% as least threatened (Van Niekerk and Turpie, 2012).

2.3.3. Ecosystem protection levels

Regarding ecosystem protection levels, approximately 33% of South Africa's estuary ecosystem types (15 types) are considered to be well protected, while 4% (2 types) are moderately protected, 4% (2 types) are poorly protected, and 59% have no formal protection (Figure 8). The unprotected types make up 83% of the total estuarine area. Only 71 estuaries in South Africa enjoy some form of formal protection. Of these only 14 estuaries have full no-take protection. The National Estuary Biodiversity Plan identified 61 estuaries that require full protection and 72 estuaries that require partial protection. This amounts to about 46% of estuaries and 79% of estuarine area (Van Niekerk and Turpie, 2012).

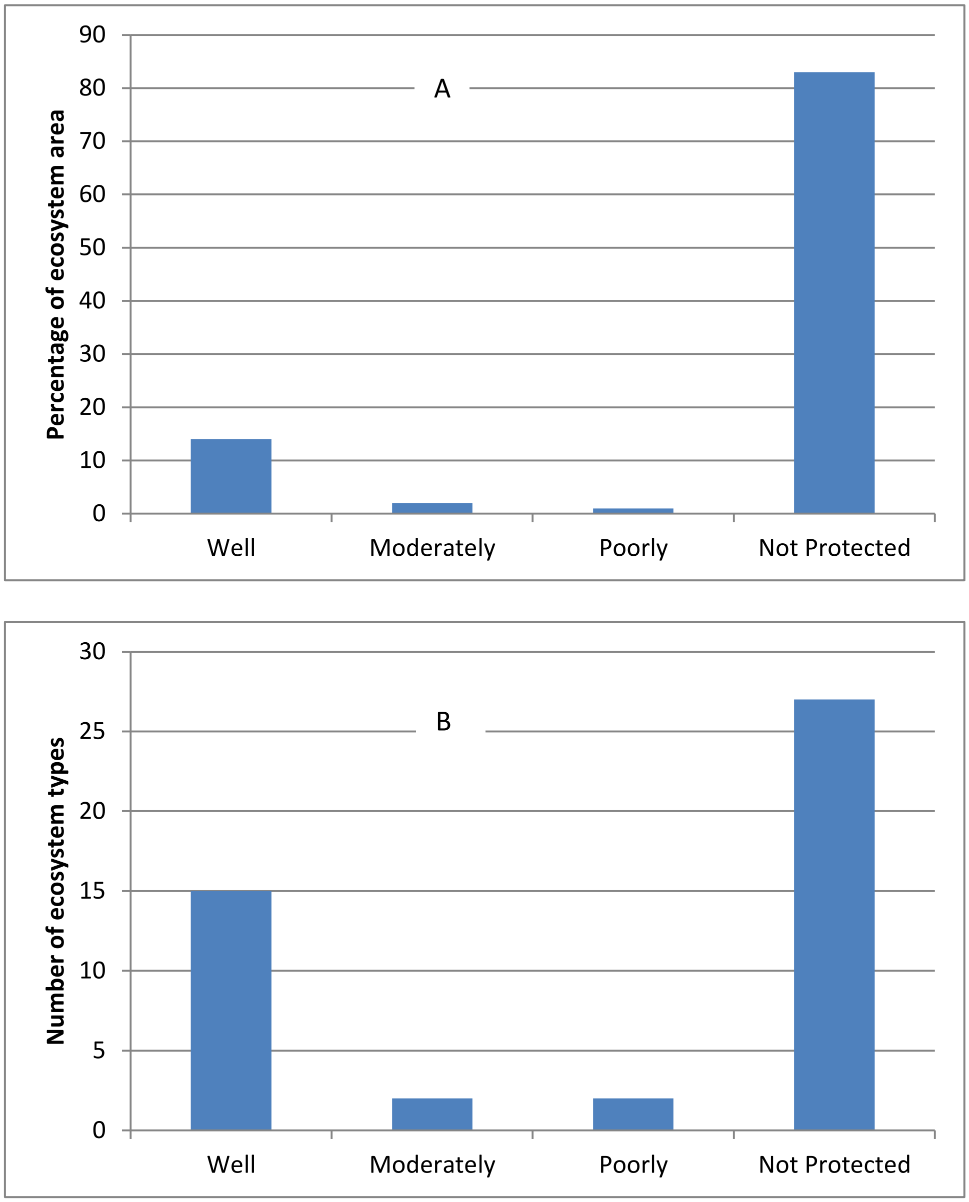

Figure 9

Protection levels of estuarine ecosystem types by (A) percentage types and (B) percentage area in well, moderately, poorly or not protected categories.

2.4 Marine ecosystems

2.4.1. Ecosystem condition and pressures

Maps of human use were the main indicators used for assessing ecosystem pressures and condition in the marine environment. A total of 27 pressures on marine and coastal biodiversity were reviewed (Sink et al., 2012). Extractive use has the biggest impact and accounts for 18 out of the 27 pressures. Fishing was scored as the greatest driver of ecosystem change in most broad ecosystem groups and remains the greatest pressure on marine biodiversity in South Africa. Most of the assessed marine resources along the South African coastline are overexploited and several marine and coastal species are threatened (DAFF, 2012). More than 630 species are caught by commercial, subsistence and recreational fisheries in South Africa. Marine alien and invasive species are an emerging pressure. Coastal development is considered the greatest pressure on coastal biodiversity, with 17% of South Africa's coastline having some form of development within 100 m of the shoreline. A comprehensive overview of literature on each threat was compiled (Sink et al., 2012), but is not repeated in this report. Ecosystem condition was not derived from direct measurements, but inferred from the cumulative pressures mentioned above. Most coastal and inshore areas are in poor condition, as is the shelf edge, where commercial fishing pressure is the highest.

Another emerging issue in Large Marine Ecosystems is that of oceanographic and biological regime shifts that may not only impact fishery production but also endangered species (e.g. African penguins) (Cury and Shannon, 2004, Roy et al., 2007). This issue becomes more important in the light of global climatic change and how this may impact on species abundance and distribution (relative to MPAs for example) (Soto, 2001).

Most Marine Protected Areas (MPAs) along the South African coast are zoned into "take" (extractive use allowed) or "no-take" (no extractive use allowed) zones. Thus in some parts of MPAs the pressures in the MPA are equal to pressure outside MPAs. For example in Table Mountain National Park MPA, only 4 small inshore areas (<5%) are closed to fishing (no-take zones), with the rest of the MPA subjected to commercial fishing, recreational fishing, recreational activities as well as sewage and stormwater discharge from the city. Thus, this may create an "illusion of protection" (Agardy et al., 2011), when habitat condition cannot always be assumed to be better within an MPA than in other parts of the ocean (see Figure 12).

2.4.2. Ecosystem types

Marine habitat and ecosystem data are limited when compared to terrestrial systems. The first national classification of marine ecosystems took place during the 2004

National Spatial Biodiversity Assessment (Driver et al., 2004), while the first terrestrial mapping was already done in 1937. The 2004 NSBA was a very coarse first attempt at classifying the marine environment of South Africa and mapped marine biodiversity at the scale of biozones rather than habitats. The National Biodiversity Assessment 2011 was the first data driven mapping and assessment at the habitat level (Sink et al., 2012). The area assessed stretched from 500 m above the low water line to 200 nautical miles offshore (EEZ – Exclusive Economic Zone), with some 136 coastal and marine habitat types and 27 pressures on marine and coastal biodiversity mapped (Sink et al., 2011). The habitat classification identified and mapped 37 coast types, 17 inshore (5-30 m) habitat types and 62 offshore (deeper than 30 m) benthic habitat types. Of these 136 habitats, 35 are represented within the SANParks conservation estate, spanning three ecoregions. Currently there are 4 coastal marine ecoregions starting with the Southern Benguela (which includes the Namaqua and Southern Cape inshore regions) on the west coast down to Cape Point, the Agulhas region from Cape Point till the Mbashe on the Transkei coast, the Natal ecoregion up to Cape Vidal and the Delagoa region stretching into Mozambique (Griffiths et al., 2010, Sink et al., 2012). The six coastal parks of the SANParks estate fall within the Agulhas ecoregion (Table Mountain, Agulhas, Garden Route and Addo Elephant National Parks), the South Western Cape region (Table Mountain & West Coast National Park), and the Namaqua region (Namaqua National Park). Table Mountain is split between two ecoregions as these are separated by Cape Point. Of these coastal Parks only four have associated Marine Protected Areas (MPAs) (see Table 5). There are 22 MPAs around the South African coast.

Table 5

Distribution of MPAs per NP across the SANParks estate.

National Park	**Associated MPA**	**Take area (km^2)**	**No-take area (km^2)**	**Total area (km^2)**
Namaqua National Park	-			
West Coast National Park	Langebaan lagoon MPA Malgas lsand MPA Marcus Island MPA Jutten Island MPA 16 Mile beach MPA	145	11	156
Table Mountain National Park	Table Mountain National Park MPA	936	20	956
Agulhas National Park	-			
Garden Route National Park	Tsitsikamma MPA		264	264
Addo Elephant National Park	Bird Island MPA		71	71
SANParks total MPA area		**1081**	**365**	**1447**

In terms of area SANParks protects 0.15% of the total EEZ, and about 2% of the inshore, coastal and island habitats (Table 5). For the purpose of this analysis none of the pelagic zones as identified by Sink *et al*. (2012) were used. Reasons for this is that the definition of the pelagic 'zones' was fairly controversial and not widely supported, secondly when the area is calculated for each park, the pelagic zone would artificially double the value. Furthermore "inshore" was defined as all 37 coastal types (500 m above high water mark to 3-5 m depth), including island habitat, 17 inshore (5-30 m) habitat types and 25 of the inner-shelf benthic habitat types (offshore deeper than 30 m).

Table 6

SANParks estate (in area and %), in relation to the South African EEZ, and total available inshore shelf, coastal and island habitat.

Area	Number of habitats (excluding pelagic)	Area in hectares	%
Total EEZ	121	1073575	100.0
Total deep water habitat	43	994608	92.6
Total inshore shelf, coastal and island habitat	73	78967	7.4
Total SANParks estate of EEZ (of total inshore)	35	1557.5*	0.1 (1.97)
Total SANParks no-take area of total inshore		365	0.46

*This full area consists of inshore habitats, as defined in the paragraph above.

2.4.3. Ecosystem threat status

Of the 136 marine and coastal habitat types (including pelagic habitat types) assessed (Sink et al 2011a), a greater proportion of the coastal habitats are threatened, because most anthropogenic impacts are on or close to the coast (Figure 10).

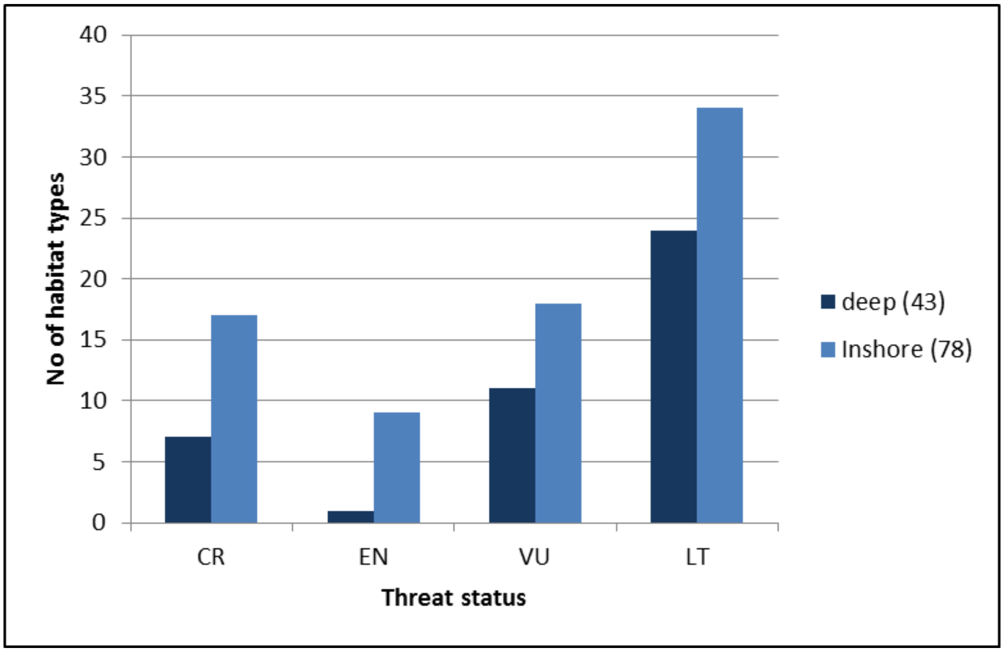

Figure 10

Threat status of deep habitats vs. inshore and coastal habitat types. Numbers indicate the number of habitat types in each classification (Pelagic habitats not included).

SANParks only have conservation areas within the inshore and coastal habitats. This is due to SANParks traditionally being a terrestrial conservation body, and the mandate for offshore/oceans presently falling within the mandates of DAFF: Fisheries and DEA: Oceans and Coasts Branch. Furthermore, SANParks do not have the infrastructure or operational capacity to deal with oceanic conditions where large ships are required to fulfil such a mandate. Figure 11 indicates threat status as covered by the SANParks conservation estate. SANParks conserves about 5% of the target of vulnerable habitats. The table below express these values in percentages.

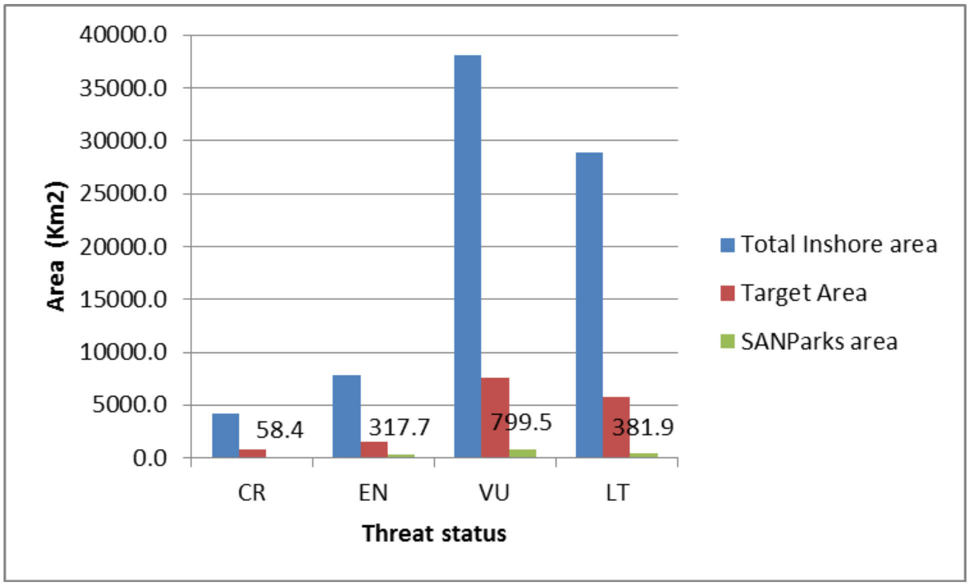

Figure 11

Threat status of inshore and coastal habitat types (total area), target area and SANParks estate area. Numbers on graph indicate SANParks area in km2.

Table 7

SANParks inshore conservation estate as a percentage of the inshore area, and as a percentage of the target area for each threat status.

Threat status	SANParks % of Inshore area	SANParks % of 20 % Target
CR	1.39	6.95
EN	4.08	20.41
VU	2.10	10.50
LT	1.32	6.60

2.4.4. Ecosystem protection levels

The need for conservation action to increase protection of coastal and marine biodiversity was identified in several earlier studies (Attwood et al., 1997, Lombard et al., 2004, RSA., 2010). According to Sink et al., 2012 only 6% of marine and coastal habitat types have full protection, with most of these falling in the Agulhas and Delagoa ecoregions. Forty percent have zero protection, which includes the entire Namaqua inshore and inner shelf ecozones (Sink et al., 2012). When comparing coastal versus offshore habitats, coastal habitats are far better protected (9% versus 0%). Offshore ecosystems are the least protected ecosystems across all environments in South Africa (Driver et al., 2012). It is only the Prince Edwards Islands MPA (proclaimed on 5 April 2013, Government Gazette No. 36307). Progress is being made in planning towards a network of offshore spatial management measures across the mainland Exclusive Economic Zone of South Africa (Sink *et al.* 2011).

Figure 11 shows the protection levels of marine and coastal habitats represented in SANParks and other Conservation agencies versus the total inshore habitat. SANParks protects 44% of the number of inshore and coastal habitats, however when this is converted to area of habitat, SANParks conserves less than 2% (Figure 12).

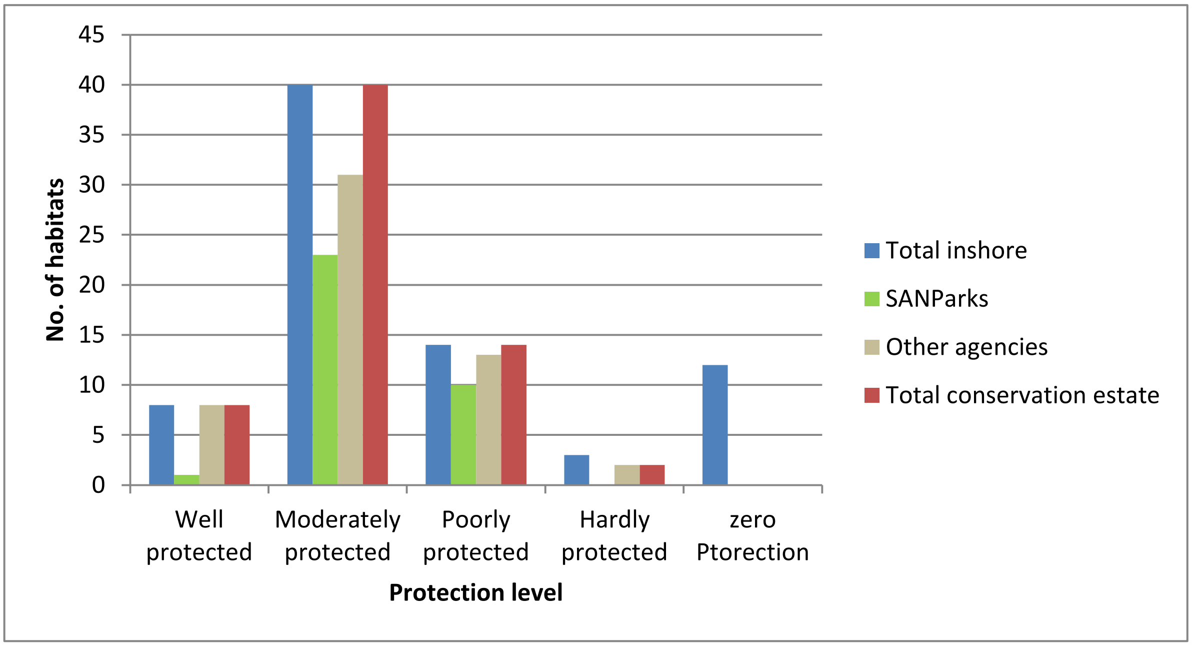

Figure 12

Protection levels of marine and coastal habitats represented in SANParks and other Conservation agencies vs. the whole of South Africa (total number of inshore habitats)

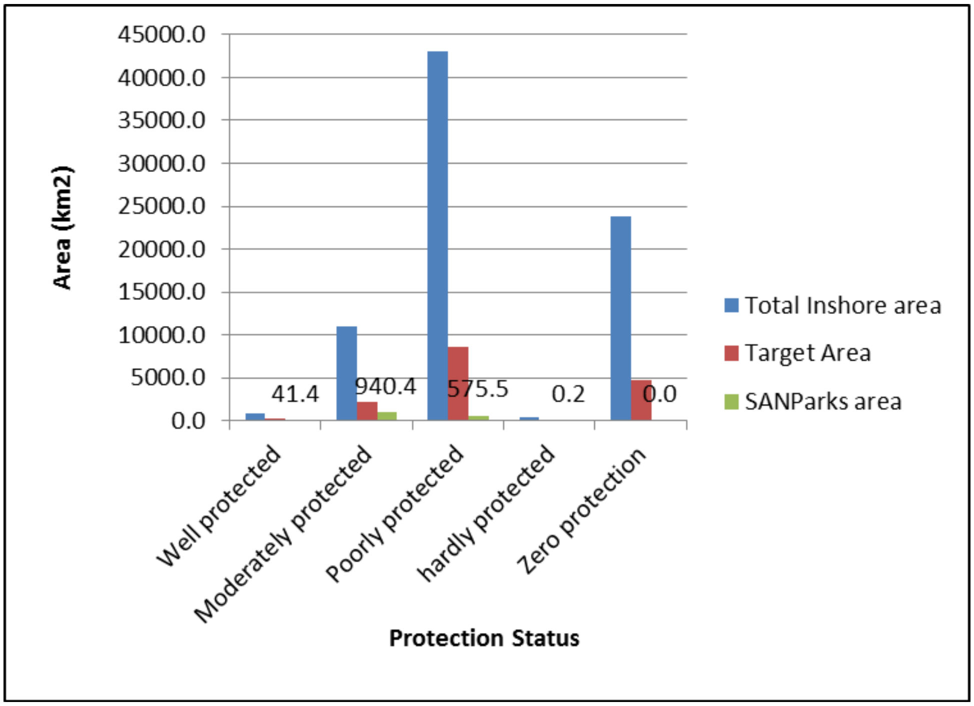

Figure 13

Protection status of the SANParks inshore and coastal estate vs. the total inshore and coastal area, and target area.

Table 8

SANParks inshore conservation estate as a percentage of the inshore area, and as a percentage of the target area for each protection status.

	SANParks % of total Inshore area	SANParks % of 20 %Target
Well protected	4.67	0.26
Moderately protected	8.61	43.03
Poorly protected	1.34	6.68
hardly protected	0.06	0.31
Zero protection	0.00	0.00

3. MANAGEMENT IMPLICATIONS AND RECOMMENDATIONS

3.1. Key messages

3.1.1. Rivers and wetlands

Many pressures contribute to the degradation of freshwater ecosystems and it is often difficult to identify a single cause. The main pressures impacting on rivers and wetlands include (Nel et al., 2011):

- Flow alteration: Altering the flow regime of rivers is regarded as the single biggest pressure on South Africa's freshwater ecosystems.
- Water pollution: Sources of pollution include industrial and mining effluent, agricultural pesticides and fertilizers, and domestic effluent including sewage.
- Destruction or degradation of natural habitat: Modification of riparian zones and wetlands, for example by ploughing or building infrastructure, results in often irreversible damage to freshwater ecosystems and their ability to provide ecosystem services.
- Invasive alien species: Invasive alien plants impact on river habitats and water yield. Invasive alien or translocated fish species pose a considerable threat to indigenous ones through trophic level impacts (e.g. bass and trout), or disruption of ecosystem functioning (e.g. carp and catfish).
- Climate change: Flow and water temperature are being regarded as "master variables" that influence many fundamental ecological processes in freshwater ecosystems. Therefore, changes in rainfall and temperature as a result of climate change are likely to have a significant impact on freshwater ecosystems.

Given the high levels of threat shown for both rivers and wetlands, it is concerning that the NSBA 2004 and NBA 2011 have highlighted significant gaps in protected area systems for freshwater ecosystems, both in terms of their representation and their ecological viability and integrity. To address these gaps, South Africa has recently developed a strategy to guide the expansion of the country's land-based protected area system – including both the establishment of new protected areas and expansion of existing ones. As input into the strategy, a spatial assessment of both terrestrial and freshwater biodiversity was undertaken to identify 42 focus areas for land-based protected area expansion. These are large, intact and unfragmented areas suitable for the creation or expansion of large protected areas that benefit both terrestrial and freshwater biodiversity. Several objectives were used to guide identification of freshwater focus areas, including: improving the overall representation of natural examples of river ecosystem types in protected areas with a focus on threatened river ecosystem types; promoting the establishment of new protected areas for conserving free-flowing rivers; and identifying ecologically functional river reaches that could be fully incorporated into a protected area with only minor expansion (Nel et al., 2009a).

> *Free-flowing rivers*
>
> Free-flowing rivers are rivers without dams. These rivers flow undisturbed from their source to the confluence with a larger river or to the sea. Dams prevent water from flowing down a river and disrupt ecological functioning, with serious knock-on effects for downstream river reaches and users. Free-flowing rivers are a rare feature in the South African landscape and part of the country's natural heritage. Nineteen flagship free-flowing rivers were identified based on their representativeness of free-flowing rivers across the country, as well as their importance for ecosystem processes and biodiversity value (Nel and Driver, 2012). These flagship rivers should receive top priority for retaining their free-flowing character.

Using the focus areas identified by the National Protected Area Expansion Strategy (Government South Africa 2010) in planning for protected area expansion, together with maps of FEPAs and free-flowing rivers (completed after this strategy) will help to address the gaps in the protected area system for freshwater ecosystems. In addition, the National Protected Area Expansion Strategy recommends some simple changes to the way protected areas are designed that could help to make protected areas work better for both freshwater and terrestrial ecosystems, for example:

- Avoid using a river as the boundary of a protected area.
- Encourage expansion of existing protected areas to incorporate whole river reaches that are currently only partially protected. Sometimes this is possible with a relatively modest adjustment to an existing protected area boundary.
- Incorporate natural large-scale catchment processes into protected areas where possible.
- Ensure that rivers are well managed within protected areas, enabling them to recover from the impact of activities upstream as they flow through the protected area.
- Avoid development of visitor infrastructure on priority freshwater ecosystems in protected areas.
- Promote new protected areas for the last remaining free-flowing rivers.

Strategic Water Source Areas

Strategic Water Source Areas (SWSAs) were considered to be those sub-quaternary catchments[1] (Nel et al., 2011) where mean annual run-off (mm per year) is at least three times more than the average for the related primary catchment. Mean annual run-off is the amount of water on the surface of the land that can be utilised in a year, which is calculated as an average (or mean) over several years. SWSAs are important because they contribute significantly to the overall water supply of the country. They can be regarded as South Africa's 'water factories', supporting growth and development needs that are often a far distance away. Deterioration of water quantity and quality in these SWSAs can have a disproportionately large adverse effect on the functioning of downstream ecosystems and the overall sustainability of growth and development in the regions they support. The 2011 NBA reported that (Nel and Driver, 2012):

- Almost 60% of the country's rivers in SWSAs are in a good ecological condition (A or B ecological category), representing a significant opportunity for managing water security in the country.
- Most of the remaining rivers in high water yield sub-quaternary catchments (nearly a third) are in a heavily-modified condition (D, E, F or Z ecological condition). The potential of rehabilitating these rivers and their associated sub-quaternary catchments should be investigated as this will contribute to the sustainability of downstream activities.
- Only 18% of SWSAs are formally protected, providing a substantial opportunity for park expansion directed at protecting water-based ecosystem services.

The effective protection of freshwater ecosystems requires close coordination and cooperation among the sectors responsible for protection and management of water resources, biodiversity conservation, land-use management (including agricultural resources) and integrated development planning. It is important that all role players in these sectors adopt and implement the lessons and recommendations that emerged from the NFEPA and NBA 2011 projects. Following are **four guiding principles** that should become "common currency" in decision making and policy development among these role players (Nel et al., 2011):

Freshwater, estuarine and marine environments are connected systems that require a source-to-sea approach: Rivers form ecological corridors from source areas all the way down to the sea, connected along many environmental gradients (e.g. land-water, altitudinal, nutrient, temperature, flow, salinity and habitat gradients). A loss of natural connectivity along freshwater systems fundamentally alters ecosystem processes and associated services, and negatively effects biodiversity. For example, fresh water

[1] Sub-quaternary catchments are watersheds that are approximately nested in the Department of Water Affairs quaternary catchments (Midgley et al. 1994). The watershed of a sub-quaternary catchment is delineated around each river reach, where a river reach is defined as the portion of river between river confluences on the Department of Water Affairs 1:500 000 river network GIS layer.

provides an important environmental cue that helps fish and other marine animals find their way to estuary mouths to breed; nutrients in fresh water form the foundation of marine food webs; freshwater inflows are required to scour the mouth of most estuaries – without this scouring effect, sediments build up at the mouth and the risk of back-flooding during storms increases.

Healthy tributaries and wetlands support the sustainability of hard-working rivers: Freshwater ecosystems in a catchment can be managed on a continuum of use, so that minimally-used rivers and wetlands support the sustainability of hard-working rivers that often form the economic hub of the catchment. To ensure that some tributaries and wetlands stay healthy, a catchment can be zoned for varying degrees of use and impact. While FEPAs should be zoned for low-impact activities only, surrounding secondary zones can allow moderate impact activities. Heavily impacting activities such as high-intensity agriculture, plantation forestry and mining should be restricted to high impact zones.

Healthy riparian, wetland and estuary buffers reduce the impact of land-use activities: Rivers, wetlands and estuaries are susceptible to impacts from receiving wastes, sediments and pollutants from upstream and upland runoff. Buffers of natural vegetation around these ecosystems will go a long way in reducing negative impacts by, for example, filtering out sediments and pollutants. The effective width of a buffer zone should be determined on a site-specific basis, as a wider buffer might be required for a floodplain than for a mountain stream.

Groundwater sustains river flows, particularly in dry seasons: Groundwater forms a critical component of the hydrological cycle and plays an important role in the environment. Groundwater sustains river flows ("base flows") and supports refuge pools in the dry season. Refuge pools are critical in seasonal rivers, as they support water-dependent ecosystems that would otherwise not survive when the rivers dry up. Groundwater further supports a wide a variety of groundwater dependent ecosystems such as wetlands, springs, estuarine and coastal systems (Colvin et al., 2007). Groundwater resources are under increasing pressure caused by the intensification of human activities and other factors such as climate change. Reductions in groundwater stores as a result of abstraction particularly from river beds, close to streams, and from shallow alluvial aquifers will have a direct influence on river flow and consequences for water quality because the salinity of the extracted water frequently increases as the volume of the reservoir decreases. Groundwater resources need to be carefully protected because in many regions, withdrawal rates exceed recharge rates and once modified or contaminated, groundwater can be very costly and difficult to restore.

Knowledge gaps and research requirements include:

- Descriptions and lists of dominant aquatic species should be developed for each river ecosystem type, and ideally published in a way similar to the vegetation map of South Africa, Lesotho and Swaziland (Mucina and Rutherford, 2006).
- Distinguish between the contributions of external impacts versus internal impacts to the fact that not all rivers in parks are ecologically intact.
- Wetland classification and the modelling of wetland condition require extensive ground trothing, across the country and especially in NPs.
- Nearly 50% of the total river length in NPs contributes to national targets (FEPAs). 26% of river length in NPs are upstream management areas and contribute to ecosystem service delivery to downstream users. This delivery has not been quantified yet.

3.1.2. Estuaries

A number of management processes have been developed in terms of national legislation to manage pressures on estuaries and assist with biodiversity conservation, e.g. ecological flow requirements under the National Water Act (Act 36 of 1998) and Estuary Management Plans under the Integrated Coastal Management (Act 24 of 2008). Estuaries play a critical role in linking terrestrial, freshwater and marine ecosystems. The multiple pressures of flow reduction, development and overfishing call for integrated estuarine management and strong collaboration between key government departments from local to national level that deal with water, coastal development and fisheries management. Estuary Management Plans are developed, or in progress, for 9% of South Africa's estuaries. Flow-related measures are starting to lag behind other planning processes. Ecological water requirement studies have been undertaken for only about 12% of all estuaries. Other issues highlighted by the NBA as requiring management consideration include the loss of mangroves from a number of estuaries along the South African coast, and that a number of overexploited fish species that should be listed as Red Data Species. In general, fish species with both an estuarine and marine phase to their lifecycle are being severely depleted, and those with freshwater, estuarine and marine components to their lifecycle being are even worse off due to being exposed to cumulative pressures in these different environments.

Priority actions for estuarine biodiversity management and conservation, of which some are national responsibilities and some SANParks responsibilities (with some overlap), include:

- Increase protection levels through the implementation of the National Estuary Biodiversity Plan, which provide the list of Priority Estuaries in need of protection (Van Niekerk and Turpie 2012).

- Develop a programme for early detection, monitoring, and where possible eradication of invasive species.
- Develop a National Coastal Biodiversity Plan that includes estuaries as a focal point. This would assist with ensure along-shore connectivity between estuaries.
- Determine ecological water requirements for all estuaries within 10 years and implement flow requirements within 5 years of their classification.
- Ensure resilience to climate change and other global change pressure through the appropriate management of the estuarine functional zone, sound management of our freshwater resources and restricting consumptive uses of living resources.
- Integrate the SANParks Estuary Monitoring programme with the National Estuary Monitoring Programme currently being developed by DWA. This has already commenced with pilot projects in Knysna and Swartvlei.
- Development of a cross sectorial National Sustainability Plan for Estuarine Resources. Such a resource strategy would require high level support from DWA, DEA, DAFF, SANBI, SANParks, national and provincial conservation agencies.

Knowledge gaps and research requirements include:

- Quantification of the modification (reduction/increase) in freshwater flow to the NP estuaries and what affect this have on the overall estuary condition.
- Developing a catchment-scale understanding of pollution (and its sources) and the resultant impacts on the NP estuaries. This includes developing an understanding of the biodiversity responses to pollution pressures (e.g. algal bloom resulting from nutrient enrichment).
- Conducting detail taxonomic surveys of the invertebrates and plants occurring in the NP estuaries to assist with biodiversity planning and protection.
- Regular assessment of the extent and effect of estuarine invasive species (plants, invertebrates, fish and birds) in the parks. This will facilitate with the early detection of new introductions and range expansion of already present alien invasive species.
- A quantification of the role that estuaries in NPs play in providing nursery function for exploited and collapsed fish species.
- Determining the vulnerability of estuaries, including those within NPs, to climate change and predicting the possible consequences on the associated biodiversity.
- Implement sediment monitoring programmes (e.g. regular topographical/bathymetric studies) to prove insights in long-term sediment processes that shape the habitat of NP estuaries.
- Develop an understanding (e.g. conceptual or numerical modelling) of hydrodynamic processes in estuaries, with emphasis on systems where water movement has been significantly altered through the construction of road and bridges, where artificial breaching is undertaken, or changes in freshwater inflows have been significant.
- Effect of climate change in estuaries, particularly with regard to altered inundation regimes, altered breaching patterns of temporarily open/closed estuaries, and habitat loss.

- Disturbance effects of recreational utilization of estuaries, and determination of environmental and social carrying capacities.

3.1.3. Marine ecosystems

The governance and management of the marine environment could be described as fragmented because it is governed by several different ministries with somewhat different mandates; the most important being DAFF, DMR and DEA. Extractive living resource use is managed by DAFF: Fisheries, while marine biodiversity (and MPAs) is managed by DEA: Oceans and Coasts and DEA: Biodiversity and Conservation. The implementation of marine biodiversity conservation however falls within the National, provincial and municipal agencies. Conservation efforts, particularly expansion of new MPAs, have been hampered due to lack of an overarching national MPA framework strategy, undefined and ambiguous MPA objectives, and conflicting government departmental objectives. For examples, DAFF: Fisheries need to create jobs and increase access to marine resources, while DEA: O&C need to conserve overexploited species and biodiversity. However, the existence of a SANBI-led national MPA Expansion Working Group that co-ordinate and prioritise marine conservation expansion brings about much needed support and championing.

Knowledge gaps and research requirements include:

- Data used in the NSBA 2004 and NBA 2011 were collected from various sources , with most data based on commercial fisheries data, mining and petroleum exploration, and other human use data. Although the 2011 assessment was a significant improvement on the previous data set, there are several concerns (Sink et al., 2012): some data are outdated (e.g. recreational and subsistence fisheries), some data are too coarse (commercial fisheries), and several fisheries are not included (net and experimental fisheries). Of major importance is an updated assessment of the national recreational line fishery effort, since this is a key threat to coastal marine biodiversity (Lombard et al., 2004, Sink et al., 2012).
- Lack of multidisciplinary research to help inform the establishment of MPAs and management in general.
- Lack of baseline studies on the abundance and distribution of fish and invertebrate species abundance and distribution prior to MPA proclamation.
- Lack of a plan to conduct regular surveys to fish and invertebrate species abundance and distribution in MPA subsequent to proclamation to assess effect of the protection
- Lack of baseline studies on the abundance and distribution for each of the marine alien species.
- Lack of a plan to conduct regular surveys to assess the abundance and distribution of marine alien species and their impact on native biota.

3.2. Systemic strategy guidelines

***Systemic** refers to something that is spread throughout, system-wide, and affecting a whole group.*

The NFEPA and NBA 2011 projects were characterised by collaboration across many organisations as well as the water and biodiversity sectors. The products of these projects provide a platform for cooperative action. Yet, each organisation with the mandate to contribute to this conservation action should ensure that they understand their responsibilities and develop their capacity to ensure an effective response. Following are seven systemic strategy guidelines that, if properly enabled, would strengthen SANParks' ability to, according to its national mandate within the broader conservation and water sectors, effectively conserve freshwater ecosystems. For the purposes of this report, each of the enabling conditions is presented in terms of a brief rationale for its inclusion; a principle or ideal that states what is strived for by the particular condition; a brief description of the current reality as well as a desired state regarding the condition; and actions that may lead to better enablement of each condition within SANParks.

3.2.1 Nurture strategic relationships

Rationale: Aquatic ecosystems (such as rivers, groundwater aquifers and marine ecosystems) do not adhere to administrative or institutional boundaries, including park boundaries. For example, most main rivers flow through parks as opposed to being contained within parks. Because of the importance of longitudinal and lateral connectivity to the overall condition of aquatic ecosystems, and the accumulation of impacts along these gradients, all the mandated organizations and stakeholders that use or are responsible for managing these systems need to work together to ensure effective conservation of aquatic ecosystems as a whole. Furthermore, aquatic ecosystems are complex systems with many interrelated components. To understand these systems in a systemic way requires input from various disciplines, for example groundwater science, limnology, geomorphology, hydrology, entomology, ichthyology, marine biology and increasingly also the social sciences. Few organizations (if any in South Africa) have the breadth of expertise to cover all these fields. To assemble multi-disciplinary projects teams, it is common to have to draw experts from various organizations. Working across organisational boundaries also helps to ensure access to the best possible mentors.

Principle: Strategic relationships strive to facilitate cooperation, knowledge sharing and resource mobilisation to advance effective conservation of aquatic ecosystems.

Current reality: SANParks has a strong culture of cooperation, primarily built around informal arrangements and personal relationships. There are also several formal arrangements in place to promote collaboration, especially with researchers (e.g. subsidised accommodation in parks and other forms of logistical support). Some SANParks researchers have professional associations with universities, providing access to additional research networks, funding and students. Furthermore, SANParks scientists make active contributions to many international and national forums, committees and reference groups – presumably where there is an expectation of mutual benefit. While the informal nature of current "relationship management" can be viewed as a strength, it also presents a vulnerability in that many network links (and their metadata) may disappear should the individuals responsible for them leave the organisation. Relationships that are important for aquatic conservation include Ramsar, IUCN, Cites, Water Research Commission, South African National Biodiversity Institute, CSIR, South African Institute for Aquatic Biodiversity, inter-departmental liaison committee on freshwater ecosystems, catchment management agencies, and various NGOs, government departments, local municipalities and provincial conservation agencies.

Desired state: Key network partners and links become explicit knowledge within CSD and are dynamically managed. SANParks leverage partnerships to deal with complex situations that would otherwise have been intractable.

Actions:

- Acknowledge "relationship management" as a critically important skill. A key "signal" of this happening would be when the "grooming" of relationships emerge spontaneously and frequently in conversations.
- From time to time, map strategic partners at various scales (international, national, regional and intra-organisational), identify current relationship managers and gaps in the desired network, and prioritise network links that are currently underdeveloped.

3.2.2 Lead appropriate depth and breadth of research

Rationale: Adaptive management and conservation of natural resources requires a firm and reliable foundation of knowledge to provide appropriate, evidence-based information for decision making. Social-ecological systems, including aquatic ecosystems, are characterised by swift change and multiple feedbacks, and researchers have to increasingly work across knowledge boundaries to make sense of emerging issues. In a conservation agency context, research is needed to better understand:

- The fauna, flora, habitats and ecological processes under our stewardship;

- The relative conservation significance of different ecosystems (e.g. in terms of irreplaceability and vulnerability) to inform prioritization of actions and strategic expansion;
- Cooperative (across vertical, horizontal and functional boundaries) governance for aquatic ecosystems at the landscape scale;
- The resilience of aquatic ecosystems in the context of resource use and cumulative pressures in NPs;
- The value of ecological infrastructure within NPs and of the ecosystem services "exported" from NPs.

Principle: Depth and breadth of research strives to produce new scientific information that is reliable and relevant and that can inform contemporary management dilemmas, policy processes and public debates regarding the conservation of aquatic ecosystems.

Current reality: A relatively small group of both full-time and part-time aquatic scientists (< 10 researchers) study a wide variety of issues related to aquatic ecosystems across the 19 NPs. These researchers collaborate in various research networks related to their fields of study and interest.

Desired state: A group of aquatic scientists that represents competence in key areas of aquatic conservation science have a common understanding of the knowledge needs of SANParks regarding the management and conservation of aquatic ecosystems and work in synergy with each other and with strategic research partners to continuously and systematically renew the available knowledge base.

Actions:

- Investigate possibility of consolidating research needs from Park Management Plans and to scope out national-level research needs.
- Influence research at park/regional level with every review of a park Management Plan.
- Allocate internal resources to implement priority research and "market" priority themes amongst external research collaborators.
- Critically assess external projects against identified knowledge needs and research priorities.

3.2.3. Maintain dynamic/adaptive monitoring

Rationale: Monitoring is a way of keeping a finger on the pulse of ecosystems and to detect trends over time and space. An adaptive monitoring approach has been defined as "a monitoring programme in which the development of conceptual models, question setting, experimental design, data collection, data analysis, and data interpretation are linked as iterative steps. An adaptive monitoring program is one that can evolve in response to new questions, new information, situations or conditions, or the development of new protocols but this must not distort or breach the integrity of the data record"(Lindenmayer et al., 2011).

Principle: Maintaining adaptive monitoring strives to collect primary data that can serve research, help to improve understanding and ultimately lead to better decisions regarding the conservation of aquatic ecosystems.

Current reality: Different monitoring approaches are applied for aquatic systems in different parks, with efforts varying in intensity and types of variables measured. This is to be expected given the diversity of aquatic systems and monitoring histories, and having some diversity in approaches may be good for providing learning opportunities. In general, there appears to be more monitoring associated with rivers and estuaries and very little if any with wetlands and groundwater. A recent report, compiled as part of a SANParks initiative to develop an integrated biodiversity monitoring system (McGeoch et al., 2011), proposes a park-wide monitoring programme with minimum standards for the monitoring of estuaries, rivers, wetlands and groundwater (Russell et al., 2012). Marine monitoring is haphazard across SANParks marine areas, but is also a national issue (MPA forum minutes). Currently a 20 year fish monitoring project in Tsitsikamma SANParks' and South Africa's oldest MPA was discontinued because of lack of funding from SANParks.

Desired state: The SANParks monitoring programme for freshwater and estuarine ecosystems (Russell et al., 2012) is implemented across all parks; the resulting data are rapidly processed to provide managers, stakeholders and researchers with useful feedbacks; and the programme itself is adapted and expanded to include additional physical attributes, biota and use where relevant. A similar programme is developed and implemented for marine ecosystems.

Actions:

- Implement the SANParks monitoring programme for freshwater and estuarine ecosystems at a pilot scale
- Develop a strategy to resource park-wide implementation of the monitoring programme
- Implement and dynamically update/revise the programme over time
- Secure long term monitoring projects to avoid data loss

3.2.4. Influence public understanding

Rationale: The products of scientists' research efforts do not lead directly to effective policy change. Rather, societal values generally dictate the goals of conservation policy. Therefore, a degree of public interest and social consensus on an issue's importance is needed. Scientists are increasingly expected to participate in processes of knowledge engagement with society. One extension activity is simply to actively communicate research findings in new ways and to new audiences with the aim of influencing public discourse. The media can be a useful conduit for connecting science with society. Another activity is to collaborate with individuals and groups who shape resource management and conservation policy.

Principle: Influencing public understanding strives to facilitate processes whereby scientific information contributes to the evolution of public understanding regarding the conservation of aquatic ecosystems.

Current reality: Broader communication of scientific information is recognised as an important activity and examples of good practice are emerging. However, SANParks personnel not directly involved in conservation need to internalise conservation messages from scientific output.

Desired state: Aquatic scientists have a good grasp of what is required to influence public discourse regarding the conservation of aquatic ecosystems and are purposefully improving their skills towards making a meaningful contribution in this arena. We work in collaboration with appropriate and carefully selected communications professionals including the exploration of social media.

Actions:

- Publish regularly in both scientific and popular media.
- Develop learning events to raise internal awareness of, and skill in, science communication.
- Actively link reporting on state of aquatic ecosystems (also online) to monitoring results. For example, develop a web platform that disseminate monitoring information on a short turnaround time and within a context (e.g. measured against "threshold of concerns")

3.2.5 Mainstreaming aquatic conservation throughout SANParks

Rationale: An organisation allocates attention and resources to what it perceives to be important. In a conservation agency, many issues compete for attention and new issues (e.g. rhino poaching) can emerge at any time. For aquatic conservation to continue getting its share of priority attention and resources, it has to be "mainstreamed" throughout the organisation. In this context, mainstreaming refers to integrating aquatic conservation into all the main planning and management functions of SANParks, including strategic and financial planning, human resource management, and park expansion strategies and management plans.

Principle: Mainstreaming strives to incorporate the responsibility of SANParks to conserve aquatic ecosystem, and its associated implications, into planning, budgeting, management and policy processes at all relevant levels throughout the organisation.

Current reality: Aquatic conservation has enjoyed relatively good general visibility and leadership support in SANParks, partly to do with the high-profile KNP Rivers Research Programme (1988-1999) and also to several staff members who have tirelessly advocated the relevance of freshwater ecosystems in the overall conservation objective. However, the external and internal drivers determining management priorities are highly dynamic, and so are the many threatening processes that impact the integrity and conservation of aquatic ecosystems. Moreover, results from research and national initiatives such as highlighted in this report continue to provide new information and perspectives relevant to aquatic conservation. In this dynamic environment, there can be no complacency regarding efforts to mainstream aquatic conservation in SANParks, including at the level of park management and financial and HR departments.

Desired state: Key decision makers at relevant levels in the organisation are "aquatic aware" and the conservation of aquatic ecosystems are reflected in their KPAs and budgets.

Actions:

- Actively seek and use opportunities to present aquatic conservation perspectives to relevant leaders, managers and staff at all levels throughout the organisation.
- Encourage interaction between relevant external projects and a range of park staff.

3.2.6. Attract key competencies and skills and maintain functional capacity

Rationale: Aquatic science is a very broad field with many component disciplines. Moreover, the differences between having expertise in, for example, water quality, ichthyology and geomorphology (to mention only a few aquatic specialisations) can be as distinct as the difference between large mammal ecology and botany. Similarly, aquatic scientists focussing on rivers, wetlands or estuaries are generally not exchangeable; not to mention groundwater and marine ecosystems. Few organisations in South Africa, including universities, have amongst their employees a full suite of disciplinary competencies that would typically be required in a comprehensive aquatic study. In addition to the disciplinary composition amongst staff, the spread of career stages and availability of skills in leadership, integration and social facilitation all determine the effectiveness of a research group.

Principle: Attracting key competencies and skills strives to maintain a basic functional capacity required for leadership in the conservation of aquatic ecosystems in the context of a contemporary conservation agency.

Current reality: Aquatic science has a long history in SANParks, for example the pioneering work by Dr. U. de V. Pienaar on fishes and amphibians in Kruger NP during the 1960s and 1970s and the previously mentioned KNP Rivers Research programme in the 1990s. Through its aquatic scientists, the organisation continues to be involved in many national and even international aquatic forums. There is also a growing realisation that aquatic ecosystems and biodiversity are more threatened than their terrestrial counterparts. Moreover, because of hydrological connectivity, aquatic conservation efforts that are restricted to the insides of park fences are unlikely to effectively contribute to national conservation targets. The challenge of achieving effective aquatic conservation across river, wetland, estuarine, marine and groundwater components are severe. Within this context, there is also a realisation that a handful of scientists, no matter how dedicated, might not be enough to cover all the strategic areas outlined in this section.

Desired state: A group of aquatic scientists, complementary in disciplines, career stages and skills, demonstrate leadership in applied aquatic research in the context of a national conservation agency.

Actions:

- Develop a matrix of human capital needs, reflecting particular skills, range of disciplinary knowledge and experience levels (e.g. restoration ecologist, wetland specialist, regional ecologists)
- Create space for minimum number of additional staff
- Explore creative options for increasing and supplementing in-house capacity, for example through appointing Research Fellows, Post-doctoral fellows and making use of university partnerships.
- Solicit and effectively manage (enable project and harvest useful information) key projects by external researchers

3.2.7. Be a learning unit

Rationale: Our capacities to extract lessons from past experiences, selectively unlearn out-dated habits, consider options for the most appropriate future direction, anticipate change, and strategically acquire new knowledge, are a function of learning proficiency. An organisation learns through its individual members. Therefore, the degree to which organisational learning takes place is determined by the quantity, quality, focus and coherence of learning that is practiced by its members. A learning organisation is "*an organisation skilled at creating, acquiring, and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights"* (Garvin, 1985). These organisations actively manage the learning process to ensure that it occurs by design rather than by chance.

Principle: Being a learning unit strives to create an environment where people are consciously learning how to learn together and continually expanding their capacity to create the results that they truly desire (Senge, 1990).

Current reality: SANParks's Conservation Services Department has a relatively well-developed learning culture, where learning through experimentation, peer engagement and knowledge sharing comes naturally. However, scientists are geographically distributed across the country and may sometime have little or no contact with each other for extended periods of time. There are many instances where we do not optimally learn from each other's' experiences.

Desired state: Scientists involved in aquatic research develop a cohesive learning community who, through regular interaction, learn how to better conserve aquatic ecosystem.

Actions:

- Have an aquatic conservation meeting at least once in two years.
- Encourage circulation of informative emails to update colleagues on events attended, papers published and in general lessons learned.
- Design projects that would foster learning inter-dependence amongst nodes.

4. PARK-SPECIFIC ASSESSMENT

4.1 Introduction

The information presented in this section provides a "desktop" overview of the occurrence and the conservation status of the aquatic ecosystems in the various NPs. A necessary next step (see conclusion) is to validate this information through park-specific assessments. The latter may require field visits and collection of data.

4.2 Rivers

Detail for the length of each river type and its condition within each of the 19 National Parks is provided in Appendix 1. This information is further summarised in Table 5, showing the number of river ecosystem types within each park, as well as the overall ecological condition of rivers in the park. Some interesting findings are:

- Kruger, Addo Elephant and Augrabies National Parks have over ten river ecosystem types.
- There are no river ecosystem types in the West Coast National Park because this protected area has no rivers. The Park is however a Ramsar site because of the Langebaan lagoon, in addition to which it contains several important wetlands.
- Six National Parks have a high proportion (> 70%) of rivers in natural or good condition: Kalahari Gemsbok, Richtersveld, Kruger, Garden Route, Table Mountain National Park, Augrabies.
- Eight National Parks have less than half their rivers are no longer considered in good or natural ecological condition: Agulhas, Bontebok, Mapungubwe, Marakele, Mokala, Mountain Zebra, Namaqua and Tankwa Karoo. For five of these, the majority of the length is in a moderately modified ecological condition (C ecological category) and the feasibility of rehabilitation should be explored: Agulhas, Marakele, Mokala, Namaqua and Tankwa Karoo.
- Addo Elephant and Camdeboo National Parks have the highest proportion of rivers in a heavily modified condition (D ecological category). Attention should be given to improving this condition through management within the Park as well as engaging with the management of land use activities in upstream catchments, which are undoubtedly impinging on the ecological integrity of rivers in these protected areas.
- Mountain Zebra National Park has 71% of its river length modelled as not in good condition (Z ecological category). Attention should be given to verifying these data in the field and intervening if this is the case.

Table 6 shows the proportion of each FEPA map category (according to Nel et al. 2011) within each National Park. Some interesting findings are:

- A substantial proportion of the river length in the Garden Route and Kruger National Parks (almost 75% and 50% respectively) have been selected as FEPAs, making these protected areas very important in achieving national freshwater ecosystem conservation goals (Roux et al. 2006).
- Four other National Parks also have more than a third of their rivers identified as FEPAs: Golden Gate Highlands, Kalahari Gemsbok, Table Mountain and Karoo National Park.
- Despite most of the rivers of Agulhas National Park being moderately modified, the Park contributes a substantial proportion of its river length towards the conservation of threatened indigenous freshwater fish. Management plans for these fish should be developed, as the rivers of this park represent some of the last sanctuaries for these threatened species.
- More than half the rivers in Marakele National Park have been identified as Phase 2 FEPAs that could contribute to national biodiversity targets for freshwater ecosystems if the condition was improved from a moderately modified condition to a natural or good condition. Management plans in this park should explore this feasibility.

Table 9

The number of river ecosystem types within each of the 19 National Parks, together with the overall ecological condition of rivers in each park. AB, C, D, and EF refer respectively to rivers in natural or good ecological condition, moderate ecological condition, heavily modified ecological condition, unacceptably modified ecological condition. Rivers in Z category have been modelled as "not intact" by Nel et al. (2011) using national land cover data (Van den Berg et al., 2008).

National Park	**No. river ecosystem types**	**% length AB**	**% length C**	**% length D**	**% length EF**	**% length Z**
Addo Elephant National Park	16	54	12	24	7	3
Agulhas National Park	6	0	76	0	0	24
Augrabies Falls National Park	11	70	30	0	0	0
Bontebok National Park	3	5	95	0	0	0
Camdeboo National Park	6	68	0	32	0	0
Garden Route National Park	7	74	12	0	0	14
Golden Gate Highlands National Park	5	52	48	0	0	0
Kalahari Gemsbok National Park	1	100	0	0	0	0
Karoo National Park	5	68	32	0	0	0
Kruger National Park	19	82	15	3	0	0

Mapungubwe National Park	4	34	39	0	0	27
Marakele National Park	9	27	73	0	0	0
Mokala National Park	1	0	100	0	0	0
Mountain Zebra National Park	2	29	0	0	0	71
Namaqua National Park	6	22	78	0	0	0
Richtersveld National Park	8	97	3	0	0	0
Table Mountain National Park	4	74	18	0	8	0
Tankwa Karoo National Park	6	25	48	0	0	26
West Coast National Park	0	0	0	0	0	0

Table 10

Proportion of rivers within National Parks that have been allocated a FEPA map category Nel et al. (2011). FEPAs refer to Freshwater Ecosystem Priority Areas and NPs refer to National Parks.

National Park	**FEPA**	**Fish Corridor**	**Fish Support Area**	**Phase2 FEPA**	**Upstream areas**	**No category assigned**
Addo Elephant National Park	29	0	11	5	17	38
Agulhas National Park	0	0	96	4	0	0
Augrabies Falls National Park	18	0	0	0	1	81
Bontebok National Park	0	0	0	0	5	95
Camdeboo National Park	58	0	0	0	27	14
Garden Route National Park	74	0	6	5	8	8
Golden Gate Highlands National Park	47	0	0	0	0	53
Kalahari Gemsbok National Park	55	0	0	0	45	0
Karoo National Park	37	0	0	5	58	0
Kruger National Park	49	0	8	4	24	15
Mapungubwe National Park	0	0	0	27	0	73
Marakele National Park	27	0	11	62	0	0
Mokala National Park	0	0	0	0	0	100
Mountain Zebra National Park	0	0	0	0	0	100
Namaqua National Park	22	0	0	20	27	31
Richtersveld National Park	18	35	0	0	28	19
Table Mountain National Park	43	0	21	0	0	35
Tankwa Karoo National Park	16	0	0	22	55	7
West Coast National Park	0	0	0	0	0	0

4.3 Wetlands

Detail for the area of each wetland ecosystem type and its condition within each of the 19 National Parks is provided in Table 11, showing the number of wetland ecosystem types within each park, as well as the overall ecological condition of wetlands in the park. Some interesting findings are:

- Based on modelled wetland condition data, six National Parks have a substantial proportion of their wetlands (> 75%) in a good condition: Garden Route, Golden Gate Highlands, Grasspan (formally Vaalbos, now managed in conjunction with Mokala NP), Kalahari Gemsbok, Namaqua, Table Mountain, and West Coast. Mokala National Park has more than half of its wetlands (59%) in good condition. The wetlands in remaining National Parks have less than half their proportion considered to be in a good condition.
- Of particular concern are the wetlands of Addo, Camdeboo, Marakele, and Mokala. These National Parks have a very high proportion of their wetland area in a heavily to critically modified condition.

Table 12 shows the proportion of wetlands selected as FEPAs (according to Nel et al. 2011) within each National Park. Five National Parks have more than half the proportion of their wetlands selected as FEPAs: Agulhas, Garden, Grasspan, Table Mountain, Garden Route, and Mapungubwe.

Table 11

The number of wetland ecosystem types within each of the 19 National Parks, together with the overall ecological condition of rivers in each park.

Park Name	**No. wetland ecosystem types**	**% Good**	**% Moderately modified**	**% Heavily to critically modified**
Addo Elephant National Park	17	1	2	97
Agulhas National Park	23	40	60	0
Augrabies Falls National Park	7	22	73	5
Bontebok National Park	7	49	51	0
Camdeboo National Park	10	0	0	100
Garden Route National Park	19	90	7	3
Golden Gate Highlands National Park	8	86	3	11
Grasspan	5	97	0	3
Kalahari Gemsbok National Park	10	99	1	0
Karoo National Park	7	48	13	39
Kruger National Park	59	15	18	68
Mapungubwe National Park	8	42	9	49
Marakele National Park	11	1	3	96

Mokala National Park	11	59	11	30
Mountain Zebra National Park	10	0	4	96
Namaqua National Park	13	98	1	0
Richtersveld National Park	4	4	96	0
Table Mountain National Park	13	89	3	9
Tankwa Karoo National Park	10	41	19	40
West Coast National Park	4	85	15	0

Table 12

Proportion of wetlands within National Parks that have been allocated a FEPA map category Nel et al. (2011). FEPAs refer to Freshwater Ecosystem Priority Areas.

Park name	**Wetland area allocated as FEPA (%)**	**No category assigned**
Addo Elephant National Park	1	99
Agulhas National Park	86	14
Augrabies Falls National Park	0	100
Bontebok National Park	31	69
Camdeboo National Park	0	100
Garden Route National Park	64	36
Golden Gate Highlands National Park	12	88
Grasspan	83	17
Kalahari Gemsbok National Park	19	81
Karoo National Park	27	73
Kruger National Park	23	77
Mapungubwe National Park	52	48
Marakele National Park	3	97
Mokala National Park	0	100
Mountain Zebra National Park	0	100
Namaqua National Park	0	100
Richtersveld National Park	0	100
Table Mountain National Park	72	28
Tankwa Karoo National Park	26	74
West Coast National Park	15	85

4.4 Estuaries

Sixteen estuaries or estuarine systems occur in four of the 19 national parks. Two occur in Namaqua NP, two In Table Mountain NP, one in Agulhas NP, and 11 in Garden Route NP. The four estuaries in Namaqua and Table Mountain NPs occur in the Cool Temperate biogeographical region, whereas those in Agulhas and Garden Route NPs are in the Warm Temperate biogeographical region. No estuaries in national parks are in the Subtropical ecoregion. There are numerous small river outlets in coastal parks, some of which may at times perform an estuarine function though this is likely to be temporary and minor.

Eight different NBA estuarine types occur within national parks (17%), with one type occurring in each of Namaqua and Agulhas NPs, two in Table Mountain NP and six in Garden Route NP. Examples of all five different estuarine types defined in the classification system of Whitfield (Whitfield, 1992) occur in Garden Route NP.

Table 13

Summary of the estuaries that occur in National Parks, showing their type, area, protection levels, ecological category and threat status.

Estuary name	National Park name	Type (Whitfield 1992)	NBA 2011 Type	Area (ha)	NBA Protection Levels	Ecological Category	NBA Ecosystem Threat Status
Spoeg	Namaqua	Temporarily closed	MediumClosedMixedTurbid	9	Well	B	Vulnerable
Groen	Namaqua	Temporarily closed	MediumClosedMixedTurbid	44	Well	B	Vulnerable
Wildevoëlvlei	Table Mountain	Temporarily closed	LargeClosedMixedBlack	231	Not protected	D	Critically endangered
Krom	Table Mountain	Temporarily closed	SmallClosedMixedBlack	9	Well	A	Critically endangered
Ratel	Agulhas	Temporarily closed	SmallClosedFreshBlack	1	Well	C	Critically endangered
Wilderness	Garden Route	Estuarine lake	MediumClosedMixedBlack*	53**	Well	B	Least threatened
Swartvlei	Garden Route	Estuarine lake	LargeClosedMixedBlack	1286	Well	B	Least threatened
Knysna	Garden Route	Estuarine bay	LargeOpenMarineBlack	1926	Well	B	Least threatened
Sout (Oos)	Garden Route	Permanently open	SmallOpenMixedBlack	5	Well	A	Critically endangered
Groot (Wes)	Garden Route	Temporarily closed	MediumClosedMixedBlack	39	Well	B	Least threatened
Bloukrans	Garden Route	River mouth	SmallOpenFreshBlack	4	Well	A	Endangered
Lottering	Garden Route	River mouth	SmallOpenFreshBlack	2	Well	A	Endangered
Elandsbos	Garden Route	River mouth	SmallOpenFreshBlack	5	Well	A	Endangered
Storms	Garden Route	River mouth	SmallOpenFreshBlack	12	Well	A	Endangered
Elands	Garden Route	River mouth	SmallOpenFreshBlack	7	Well	B	Endangered
Groot (Oos)	Garden Route	River mouth	SmallClosedMixedBlack	10	Well	B	Endangered

* NBA Type likely considered only the Touw Estuary but excluded the lakes (Eilandvlei, Langvlei, Rondevlei). Had the lakes been included Wilderness would have been categorised as a LargeClosedMixedBlack system

** This area is for the Touw Estuary alone. If the Wilderness Lakes were included the total area for the systems would be approximately 1007ha

The total area of estuarine habitat within national parks is 4597 ha, the majority of which (94%) occurs within Garden Route NP.

All estuarine systems in both Table Mountain NP and Agulhas NP are considered to be Critically Endangered and thus require concerted conservation effort. Particularly problematic is Wildervoëlvlei which has a low ecological category (D) and occurs only partially within the Table Mountain NP and hence is also considered to have a low protection level. While larger systems in Garden Route NP (Knysna, Wilderness, Swartvlei, Groot (West) are considered to be the least threatened, it should be noted that these systems are subject to several anthropogenic changes including reductions in freshwater inflows, moderate pollution, consumptive resource utilization (fishing, bait collection), intensive recreational utilisation, and with the exception of Knysna, artificial breaching.

The most pristine estuaries based on their ecological categorization are the Krom Estuary (Table Mountain NP) and the Salt, Bloukrans, Elandsbos, Lottering, and Storms estuaries along the Tsitsikamma coastline in Garden Route NP.

Ten of the sixteen estuaries occur fully within park boundaries. The Groen and Groot (East) occur on the boundaries of the Namaqua and Garden Route parks respectively, and hence are only partially incorporated. Portions of the Swartvlei, Wilderness, Knysna and Wildevoëlvlei estuaries occur outside of national parks.

4.5 Marine ecosystems

Six out of SANParks 19 parks are coastal and marine parks, and as mentioned earlier all these fall within only 3 ecoregions. SANParks does not have parks in the Natal or Delagoa ecoregions, as this province has traditionally been conserved under the Ezemvelo KZN Wildlife provincial conservation body.

Table 14

The number of habitats in each Park is indicated, as per threat status, including total area covered by each park.

Protection status	Addo Elephant National Park	Agulhas National Park	Garden Route National Park	Namaqua National Park	Table Mountain National Park	West Coast National Park
CR	-	-	1	-	7	-
EN	-	-	1	1	3	2
VU	3	2	5	1	9	3
LT	2	4	5	5	10	5
Total no of habitats	5	6	12	7	29	10
Total area	102.8	7.9	310.3	24.9	923.8	187.8

The South Western Cape ecoregion is well protected, due to the size of Table Mountain National Park MPA. Most of the conservation targets for the habitats have been exceeded. However, about half of the habitat area in this MPA is in poor condition. This is due to the zonation of Table Mountain MPA, which allows for commercial fisheries.

The Agulhas bioregion represented in SANParks MPAs are in good condition because of the no-take zonation of the Tsitsikamma (Garden Route National Park) and Bird Island (Addo Elephant National Park) MPAs (See Figure 14).

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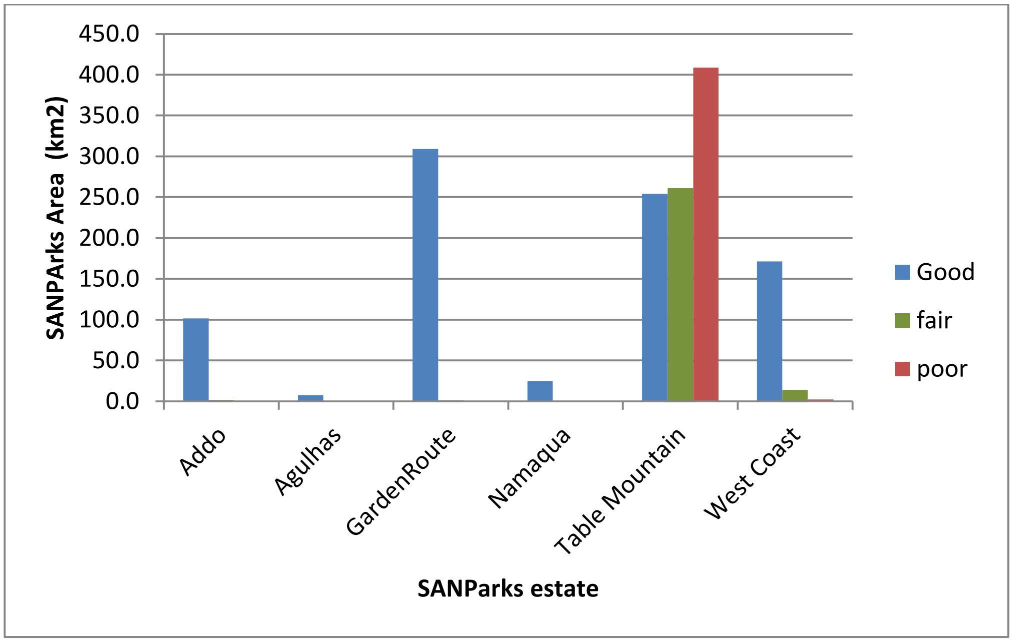

Figure 14

Condition of SANParks inshore and coastal estate.

Important to take note of is even if a habitat is in good condition, the associated exploited marine resources (fish, abalone) might not be. E.g. the Agulhas inshore reef habitat is considered to be in good condition. However the associated fish assemblages have been heavily over-exploited to the point that the Minister of DEAT declared a 'State of emergency" for the line fish resource in 2000. The Tsitsikamma, Bird Island and other no-take MPAs have become the sole supporters of the line fisheries' continued existence.

MPA expansion has been identified for the Greater Addo Elephant National Park MPA and the Namaqua National Parks MPA. The Namaqua MPA will address a major gap in the protection status of this ecoregion, were currently no MPA exist. The expansion of Bird Island MPA will contribute to increasing the total area conserved, as well as increasing the number of habitat types.

5. CONCLUSION

Two important national developments have informed the analysis presented in this report: (a) identification of Freshwater Ecosystem Priority Areas (FEPAs) for South Africa (Nel et al., 2011) and (b) publication of the second National Biodiversity Assessment (NBA) for South Africa (Driver et al., 2012). Both of these initiatives were characterised by highly participatory processes involving many government departments and agencies, universities and research councils, NGOs as well as experts working in the private sector. As a result of their inclusive processes, the products of these initiatives (for example national-scale datasets, statistics on ecological condition and ecosystem treat status, and spatially explicit priority areas for conservation) enjoy considerable institutional buy-in.

The availability of national-scale spatial information on biodiversity and species is most useful for highlighting problem areas as well as relative threats and future priorities for South Africa. Such information can and should influence policy processes, national-level decision making and the public discourse on conservation issues. During the course of preparing this report, we have also seen that this information can be extremely useful to deriving conservation insights at smaller scales, but that substantial additional analysis and local-scale fieldwork might be required. While it was relatively straight-forward to extract information that is informative at the level of the SANParks estate (all 19 NPs), more work is required to translate the national assessments into park-specific priorities and management plans.

National-scale information on **river** biodiversity and conservation has benefited from the South African River Health Programme as well as more than a decade of research and application in the field of conservation planning directed at riverine ecosystems. The resulting national-scale information is generally regarded as scientifically sound and tested. Of South Africa's river length, 22% has been identified as spatial priorities for conservation (FEPAs). The occurrence of these priority areas in the various NPs are summarised in *Section 4.2*. Two significant realities are that (a) only 84 of the 223 river ecosystem types are found within the 19 NPs, and (b) even when inside an NP a river FEPA are not necessarily enjoying full protection because of external and sometimes internal threats. South Africa can only achieve its conservation targets for rivers when relevant government departments, agencies and land owners work together and achieve integrated planning and management across whole catchments.

The NSBA reported that **wetlands** are the most threatened of all South Africa's ecosystems. Although only making up 2.4% of South Africa's area, wetlands provide critical ecosystem services such as water purification and flood regulation. Of the total wetland area in the country, 38% has been identified as FEPAs. The occurrence of these wetland FEPAs in NPs are outlined in *Section 4.3*. However, it must be noted that the national-scale wetland information is based on a GIS desktop procedure for classifying wetlands that has been applied for the first time during the mentioned national assessments. It is reasonable to expect that both the underlying data layers and the classification procedure will be refined in future. In terms of SANParks' responsibility to contribute to wetland conservation, mapping and classification of wetlands per park should be a high priority. Such an exercise will provide valuable feedback to contribute to the revision and improvement of national-scale wetland information.

Estuaries face multiple pressures from human activities, often resulting from development too close to the estuary as well as the cumulative impacts of land uses throughout the catchment that feeds the estuary. Only 71 of the approximately 250 estuaries or estuarine systems in South Africa enjoy some form of formal protection. Of these only 14 estuaries have full no-take protection. Sixteen estuaries or estuarine systems occur in four of the 19 national parks, of which 11 are in the Garden Route NP. Several of the estuaries that are contained within NPs are being subject to anthropogenic changes such as reductions in freshwater inflows, moderate pollution, consumptive resource utilization (fishing, bait collection), recreational utilisation, and artificial breaching. Important conclusions are that (a) the degree to which SANParks can contribute to national conservation targets for estuaries is relatively limited, and (b) the degree of protection extended to estuaries even within NPs is limited because of catchment-based impacts and recreational and developmental pressures around these systems.

In **marine** ecosystems, the contribution by SANParks is very much limited to the coastal and inshore zones. In terms of the role that SANParks plays, four of the six coastal NPs have a total of eight associated MPAs – out of 22 MPAs around South Africa's coast. These eight MPs contribute a total area of 1 447 km^2 of which only 365 km^2 enjoys no-take protection. Similarly to the identification of FEPAs for rivers, wetlands and estuaries (Nel et al., 2011), priority marine ecosystems for future protection have been identified through various national (Sink and Attwood, 2008, Sink et al., 2012) and regional plans (Majiedt et al., 2012). Of these, the offshore marine ecosystems are the most poorly protected of any in South Africas, with only 4% of offshore ecosystem types well protected. It is unlikely that SANParks will or can help address this, due to the multi-agency governance and mandate model applicable to these systems. In practical terms, SANParks's only feasible contribution to marine conservation goals is by way of access control, coastal monitoring and fisheries compliance, but it lacks the organisational and logistical capacity (e.g. seagoing vessels) to improve this contribution farther from the shore. Offshore ecosystems play a vital role in sustaining fisheries, and spatial management measures including marine protected areas are a key tool in the ecosystem approach to fisheries management, but this function is probably marginal to the common interpretation of SANParks' mandate.

A main aim of this report was to develop some understanding of how SANParks should respond to the findings of the mentioned national-scale biodiversity assessments. The following three recommendations provide some direction in terms of immediate next steps:

- The "enabling conditions" listed in *Section 3.2* should be developed in more detail and implemented as part of a parallel initiative to build leadership in aquatic conservation within SANParks.
- Most of the data presented in *Section 4* of this report should be verified against reality on the ground and associated actions and management plans should be developed for each NP. Workshops to ground-truth and apply the information in this report should be held with staff from Biodiversity Social Projects (responsible for management of invasive alien plants and associated restoration) and the respective NPs, either by park or cluster of parks.
- Lessons from the NFEPA and NBA 2011 projects, as well as park-specific applications discussed in the previous sub-section, should be used to formulate policy objectives specifically related to aquatic conservation through a NP system.

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Appendix 1 – River data

River ecosystem types protected within each of the 19 National Parks, together with their total length and the percentage of the length that is in a natural or good (AB), moderately modified (C), heavily to unacceptably modified condition (DEF) or modelled as not in good condition (Z). Numbers in bold print in the row of the park's name represent totals for each park. AB, C, D, and EF refer respectively to rivers in natural or good ecological condition, moderate ecological condition, heavily modified ecological condition, unacceptably modified ecological condition. Rivers in Z category have been modelled as "not intact" by Nel et al. (2011) using national land cover data (Van Den Berg et al. 2008).

River ecosystem type	Level 1 ecoregion (after Kleynhans et al. 2005)	Flow variability (after CDSM 1:50K maps 2005-7)	Slope category (after Rowntree and Wadeson 1999)	Length (km)	Length AB (km)	% AB	% C	%D EF	% Z
Addo Elephant National Park				**289.68**	**156.17**	**54**	**12**	**31**	**3**
19_N_F	Southern Folded Mountains	Ephemeral	Lowland river	3.79	3.79	100	0	0	0
19_N_L	Southern Folded Mountains	Ephemeral	Lower foothill	5.25	5.25	100	0	0	0
19_N_M	Southern Folded Mountains	Ephemeral	Mountain stream	1.07	1.07	100	0	0	0
19_N_U	Southern Folded Mountains	Ephemeral	Upper foothill	70.44	70.44	100	0	0	0
19_P_L	Southern Folded Mountains	Permanent/Seasonal	Lower foothill	48.55	0.00	0	0	100	0
19_P_M	Southern Folded Mountains	Permanent/Seasonal	Mountain stream	0.47	0.47	100	0	0	0
19_P_U	Southern Folded Mountains	Permanent/Seasonal	Upper foothill	44.39	44.39	100	0	0	0
20_N_L	South Eastern Coastal Belt	Ephemeral	Lower foothill	10.78	10.01	93	7	0	0
20_N_M	South Eastern Coastal Belt	Ephemeral	Mountain stream	1.72	0.00	0	8	0	92
20_N_U	South Eastern Coastal Belt	Ephemeral	Upper foothill	45.58	17.47	38	46	0	16
20_P_F	South Eastern Coastal Belt	Permanent/Seasonal	Lowland river	0.13	0.00	0	0	100	0
20_P_L	South Eastern Coastal Belt	Permanent/Seasonal	Lower foothill	16.21	0.00	0	76	24	0
21_N_L	Great Karoo	Ephemeral	Lower foothill	3.82	2.49	65	0	35	0
21_N_U	Great Karoo	Ephemeral	Upper foothill	0.78	0.78	100	0	0	0
21_P_F	Great Karoo	Permanent/Seasonal	Lowland river	2.70	0.00	0	0	100	0
21_P_L	Great Karoo	Permanent/Seasonal	Lower foothill	34.01	0.00	0	4	96	0
Agulhas National Park				**25.77**	**0.00**	**0**	**76**	**0**	**24**
19_P_L	Southern Folded Mountains	Permanent/Seasonal	Lower foothill	4.76	0.00	0	100	0	0
19_P_M	Southern Folded Mountains	Permanent/Seasonal	Mountain stream	1.30	0.00	0	0	0	100
19_P_U	Southern Folded Mountains	Permanent/Seasonal	Upper foothill	4.91	0.00	0	0	0	100

River ecosystem type	Level 1 ecoregion (after Kleynhans et al. 2005)	Flow variability (after CDSM 1:50K maps 2005-7)	Slope category (after Rowntree and Wadeson 1999)	Length (km)	Length AB (km)	% AB	% C	%DEF	% Z
22_N_L	Southern Coastal Belt	Ephemeral	Lower foothill	5.20	0.00	0	100	0	0
22_N_U	Southern Coastal Belt	Ephemeral	Upper foothill	3.71	0.00	0	100	0	0
22_P_L	Southern Coastal Belt	Permanent/Seasonal	Lower foothill	5.89	0.00	0	100	0	0
Augrabies Falls National Park				**64.88**	**45.25**	**70**	**30**	**0**	**0**
26_N_L	Nama Karoo	Ephemeral	Lower foothill	3.12	3.12	100	0	0	0
26_N_M	Nama Karoo	Ephemeral	Mountain stream	1.49	1.49	100	0	0	0
26_N_U	Nama Karoo	Ephemeral	Upper foothill	22.79	22.79	100	0	0	0
26_P_L	Nama Karoo	Permanent/Seasonal	Lower foothill	2.68	0.00	0	100	0	0
26_P_M	Nama Karoo	Permanent/Seasonal	Mountain stream	1.16	0.00	0	100	0	0
26_P_U	Nama Karoo	Permanent/Seasonal	Upper foothill	1.19	0.00	0	100	0	0
28_N_L	Orange River Gorge	Ephemeral	Lower foothill	6.10	6.10	100	0	0	0
28_N_M	Orange River Gorge	Ephemeral	Mountain stream	0.44	0.44	100	0	0	0
28_N_U	Orange River Gorge	Ephemeral	Upper foothill	11.31	11.31	100	0	0	0
28_P_F	Orange River Gorge	Permanent/Seasonal	Lowland river	9.54	0.00	0	100	0	0
28_P_U	Orange River Gorge	Permanent/Seasonal	Upper foothill	5.06	0.00	0	100	0	0
Bontebok National Park				**9.64**	**0.45**	**5**	**95**	**0**	**0**
16_N_M	South Eastern Uplands	Ephemeral	Mountain stream	0.45	0.45	100	0	0	0
22_P_F	Southern Coastal Belt	Permanent/Seasonal	Lowland river	0.35	0.00	0	100	0	0
22_P_L	Southern Coastal Belt	Permanent/Seasonal	Lower foothill	8.84	0.00	0	100	0	0
Camdeboo National Park				**20.76**	**14.02**	**68**	**0**	**32**	**0**
18_N_L	Drought Corridor	Ephemeral	Lower foothill	3.17	3.17	100	0	0	0
18_N_U	Drought Corridor	Ephemeral	Upper foothill	9.39	9.39	100	0	0	0

River ecosystem type	Level 1 ecoregion (after Kleynhans et al. 2005)	Flow variability (after CDSM 1:50K maps 2005-7)	Slope category (after Rowntree and Wadeson 1999)	Length (km)	Length AB (km)	% AB	% C	%D EF	% Z
18_P_L	Drought Corridor	Permanent/Seasonal	Lower foothill	5.22	0.00	0	0	100	0
21_N_L	Great Karoo	Ephemeral	Lower foothill	1.52	0.00	0	0	100	0
21_N_M	Great Karoo	Ephemeral	Mountain stream	1.07	1.07	100	0	0	0
21_N_U	Great Karoo	Ephemeral	Upper foothill	0.39	0.39	100	0	0	0
Garden Route National Park				**352.49**	**261.76**	**74**	**12**	**0**	**14**
20_N_F	South Eastern Coastal Belt	Ephemeral	Lowland river	20.33	13.75	68	0	0	32
20_N_L	South Eastern Coastal Belt	Ephemeral	Lower foothill	4.91	4.27	87	13	0	0
20_N_U	South Eastern Coastal Belt	Ephemeral	Upper foothill	14.55	1.67	11	89	0	0
20_P_F	South Eastern Coastal Belt	Permanent/Seasonal	Lowland river	17.21	17.21	100	0	0	0
20_P_L	South Eastern Coastal Belt	Permanent/Seasonal	Lower foothill	14.16	7.67	54	0	0	46
20_P_M	South Eastern Coastal Belt	Permanent/Seasonal	Mountain stream	51.47	40.99	80	2	0	19
20_P_U	South Eastern Coastal Belt	Permanent/Seasonal	Upper foothill	229.86	176.19	77	12	0	12
Golden Gate Highlands National Park				**62.31**	**32.61**	**52**	**48**	**0**	**0**
15_N_M	Eastern Escarpment Mountains	Ephemeral	Mountain stream	2.46	2.46	100	0	0	0
15_N_U	Eastern Escarpment Mountains	Ephemeral	Upper foothill	3.67	3.67	100	0	0	0
15_P_L	Eastern Escarpment Mountains	Permanent/Seasonal	Lower foothill	6.35	0.00	0	100	0	0
15_P_M	Eastern Escarpment Mountains	Permanent/Seasonal	Mountain stream	12.49	7.95	64	36	0	0
15_P_U	Eastern Escarpment Mountains	Permanent/Seasonal	Upper foothill	37.33	18.53	50	50	0	0
Kalahari Gemsbok National Park				**416.03**	**416.03**	**100**	**0**	**0**	**0**
29_N_F	Southern Kalahari	Ephemeral	Lowland river	416.03	416.03	100	0	0	0
Karoo National Park				**144.84**	**97.78**	**68**	**32**	**0**	**0**
21_N_L	Great Karoo	Ephemeral	Lower foothill	4.20	0.00	0	100	0	0
21_N_M	Great Karoo	Ephemeral	Mountain stream	16.82	13.12	78	22	0	0
21_N_U	Great Karoo	Ephemeral	Upper foothill	123.21	84.64	69	31	0	0
21_P_M	Great Karoo	Permanent/Seasonal	Mountain stream	0.03	0.03	100	0	0	0
26_N_U	Nama Karoo	Ephemeral	Upper foothill	0.58	0.00	0	100	0	0
Kruger National Park				**2796.07**	**2298.03**	**82**	**15**	**3**	**0**
1_P_F	Limpopo Plain	Permanent/Seasonal	Lowland river	51.35	21.61	42	58	0	0
1_P_L	Limpopo Plain	Permanent/Seasonal	Lower foothill	1.95	1.95	100	0	0	0

River ecosystem type	Level 1 ecoregion (after Kleynhans et al. 2005)	Flow variability (after CDSM 1:50K maps 2005-7)	Slope category (after Rowntree and Wadeson 1999)	Length (km)	Length AB (km)	% AB	% C	%D EF	% Z
12_N_L	Lebombo Uplands	Ephemeral	Lower foothill	136.11	136.11	100	0	0	0
12_N_M	Lebombo Uplands	Ephemeral	Mountain stream	1.12	1.12	100	0	0	0
12_N_U	Lebombo Uplands	Ephemeral	Upper foothill	80.75	80.75	100	0	0	0
12_P_L	Lebombo Uplands	Permanent/Seasonal	Lower foothill	55.88	30.87	55	7	38	0
12_P_U	Lebombo Uplands	Permanent/Seasonal	Upper foothill	0.48	0.48	100	0	0	0
2_N_L	Soutpansberg	Ephemeral	Lower foothill	20.47	20.47	100	0	0	0
2_N_U	Soutpansberg	Ephemeral	Upper foothill	10.29	10.29	100	0	0	0
2_P_L	Soutpansberg	Permanent/Seasonal	Lower foothill	24.87	24.87	100	0	0	0
2_P_U	Soutpansberg	Permanent/Seasonal	Upper foothill	2.08	2.08	100	0	0	0
3_N_F	Lowveld	Ephemeral	Lowland river	4.89	4.89	100	0	0	0
3_N_L	Lowveld	Ephemeral	Lower foothill	798.43	763.80	96	4	1	0
3_N_M	Lowveld	Ephemeral	Mountain stream	6.90	6.90	100	0	0	0
3_N_U	Lowveld	Ephemeral	Upper foothill	398.18	398.04	100	0	0	0
3_P_F	Lowveld	Permanent/Seasonal	Lowland river	41.52	6.09	15	85	0	0
3_P_L	Lowveld	Permanent/Seasonal	Lower foothill	1087.15	726.55	67	30	4	0
3_P_M	Lowveld	Permanent/Seasonal	Mountain stream	0.47	0.47	100	0	0	0
3_P_U	Lowveld	Permanent/Seasonal	Upper foothill	73.18	60.69	83	7	10	0
Mapungubwe National Park				**35.45**	**11.91**	**34**	**39**	**0**	**27**
1_N_F	Limpopo Plain	Ephemeral	Lowland river	9.02	0.00	0	0	0	100
1_N_L	Limpopo Plain	Ephemeral	Lower foothill	12.28	11.70	95	0	0	5
1_N_U	Limpopo Plain	Ephemeral	Upper foothill	0.22	0.22	100	0	0	0
1_P_F	Limpopo Plain	Permanent/Seasonal	Lowland river	13.94	0.00	0	100	0	0
Marakele National Park				**67.00**	**18.10**	**27**	**73**	**0**	**0**
1_N_L	Limpopo Plain	Ephemeral	Lower foothill	19.88	0.00	0	100	0	0
1_N_M	Limpopo Plain	Ephemeral	Mountain stream	5.11	0.00	0	100	0	0
1_N_U	Limpopo Plain	Ephemeral	Upper foothill	16.65	0.00	0	100	0	0
1_P_M	Limpopo Plain	Permanent/Seasonal	Mountain stream	3.16	3.16	100	0	0	0

River ecosystem type	Level 1 ecoregion (after Kleynhans et al. 2005)	Flow variability (after CDSM 1:50K maps 2005-7)	Slope category (after Rowntree and Wadeson 1999)	Length (km)	Length AB (km)	% AB	% C	%DEF	% Z
1_P_U	Limpopo Plain	Permanent/Seasonal	Upper foothill	4.43	4.43	100	0	0	0
6_N_M	Waterberg	Ephemeral	Mountain stream	1.79	0.00	0	100	0	0
6_N_U	Waterberg	Ephemeral	Upper foothill	5.47	0.00	0	100	0	0
6_P_M	Waterberg	Permanent/Seasonal	Mountain stream	3.60	3.60	100	0	0	0
6_P_U	Waterberg	Permanent/Seasonal	Upper foothill	6.91	6.91	100	0	0	0
Mokala National Park				**8.41**	**0.00**	**0**	**100**	**0**	**0**
29_P_L	Southern Kalahari	Permanent/Seasonal	Lower foothill	8.41	0.00	0	100	0	0
Mountain Zebra National Park				**49.84**	**14.39**	**29**	**0**	**0**	**71**
18_N_M	Drought Corridor	Ephemeral	Mountain stream	6.06	2.43	40	0	0	60
18_N_U	Drought Corridor	Ephemeral	Upper foothill	43.78	11.95	27	0	0	73
Namaqua National Park				**144.27**	**32.16**	**22**	**78**	**0**	**0**
25_N_F	Western Coastal Belt	Ephemeral	Lowland river	6.39	0.00	0	100	0	0
25_N_L	Western Coastal Belt	Ephemeral	Lower foothill	86.20	8.59	10	90	0	0
25_N_U	Western Coastal Belt	Ephemeral	Upper foothill	18.76	1.08	6	94	0	0
27_N_L	Namaqua Highlands	Ephemeral	Lower foothill	13.99	3.56	25	75	0	0
27_N_M	Namaqua Highlands	Ephemeral	Mountain stream	0.95	0.95	100	0	0	0
27_N_U	Namaqua Highlands	Ephemeral	Upper foothill	17.98	17.98	100	0	0	0
Richtersveld National Park				**376.40**	**369.19**	**98**	**2**	**0**	**0**
25_N_L	Western Coastal Belt	Ephemeral	Lower foothill	12.44	12.44	100	0	0	0
27_N_M	Namaqua Highlands	Ephemeral	Mountain stream	11.84	11.84	100	0	0	0
27_N_U	Namaqua Highlands	Ephemeral	Upper foothill	50.25	50.25	100	0	0	0
28_N_L	Orange River Gorge	Ephemeral	Lower foothill	7.53	7.53	100	0	0	0
28_N_M	Orange River Gorge	Ephemeral	Mountain stream	20.92	20.92	100	0	0	0
28_N_U	Orange River Gorge	Ephemeral	Upper foothill	158.31	158.31	100	0	0	0
28_P_F	Orange River Gorge	Permanent/Seasonal	Lowland river	101.93	96.79	95	5	0	0
28_P_L	Orange River Gorge	Permanent/Seasonal	Lower foothill	13.17	11.11	84	16	0	0
Table Mountain National Park				**30.93**	**22.88**	**74**	**18**	**8**	**0**

River ecosystem type	Level 1 ecoregion (after Kleynhans et al. 2005)	Flow variability (after CDSM 1:50K maps 2005-7)	Slope category (after Rowntree and Wadeson 1999)	Length (km)	Length AB (km)	% AB	% C	%DEF	% Z
19_N_L	Southern Folded Mountains	Ephemeral	Lower foothill	1.32	0.91	69	0	31	0
19_N_U	Southern Folded Mountains	Ephemeral	Upper foothill	12.69	11.86	93	0	7	0
19_P_M	Southern Folded Mountains	Permanent/Seasonal	Mountain stream	11.63	6.66	57	32	11	0
19_P_U	Southern Folded Mountains	Permanent/Seasonal	Upper foothill	5.29	3.45	65	35	0	0
Tankwa Karoo National Park				**144.30**	**36.33**	**25**	**48**	**0**	**26**
21_N_L	Great Karoo	Ephemeral	Lower foothill	19.52	0.00	0	71	0	29
21_N_M	Great Karoo	Ephemeral	Mountain stream	9.21	0.00	0	0	0	100
21_N_U	Great Karoo	Ephemeral	Upper foothill	75.81	29.03	38	31	0	31
21_P_L	Great Karoo	Permanent/Seasonal	Lower foothill	23.41	0.00	0	100	0	0
26_N_M	Nama Karoo	Ephemeral	Mountain stream	3.62	1.78	49	51	0	0
26_N_U	Nama Karoo	Ephemeral	Upper foothill	12.74	5.52	43	57	0	0

Appendix 2 – Wetland data

Wetland ecosystem types protected within each of the 19 National Parks, together with their total area and the percentage of the area that is in a good, moderately modified, heavily modified or critically modified condition. Numbers in bold print in the row of the park's name represent totals for each park. Wetland condition was modelled by Nel et al. (2011) using national land cover data (Van Den Berg et al. 2008) and, for riverine wetlands, condition of its associated river.

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
Addo Elephant National Park	**5274.75**	**1**	**2**	**97**
Albany Thicket Bontveld_Depression	0.60	100	0	0
Albany Thicket Bontveld_Flat	0.31	100	0	0
Albany Thicket Valley_Channelled valley-bottom wetland	799.66	1	9	89
Albany Thicket Valley_Depression	2.89	83	0	17
Albany Thicket Valley_Flat	793.43	0	1	99
Albany Thicket Valley_Floodplain wetland	2434.88	0	0	100
Albany Thicket Valley_Seep	29.61	0	0	100
Albany Thicket Valley_Unchannelled valley-bottom wetland	40.72	31	42	26
Albany Thicket Valley_Valleyhead seep	1154.80	0	1	99
Eastern Fynbos-Renosterveld Quartzite Fynbos_Channelled valley-bottom wetland	1.80	0	100	0
Eastern Fynbos-Renosterveld Quartzite Fynbos_Unchannelled valley-bottom wetland	1.14	0	100	0
Eastern Fynbos-Renosterveld Shale Fynbos_Channelled valley-bottom wetland	1.07	100	0	0
Eastern Fynbos-Renosterveld Shale Fynbos_Unchannelled valley-bottom wetland	0.13	100	0	0
Lower Nama Karoo_Channelled valley-bottom wetland	9.51	0	0	100
Lower Nama Karoo_Flat	1.97	0	0	100
Lower Nama Karoo_Seep	1.27	0	0	100
Lower Nama Karoo_Unchannelled valley-bottom wetland	0.95	0	0	100
Agulhas National Park	**4035.74**	**40**	**60**	**0**
East Coast Shale Renosterveld_Valleyhead seep	0.72	0	2	98
South Coast Limestone Fynbos_Channelled valley-bottom wetland	58.36	100	0	0

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
South Coast Limestone Fynbos_Depression	0.99	0	100	0
South Coast Limestone Fynbos_Flat	10.41	100	0	0
South Coast Limestone Fynbos_Seep	43.10	100	0	0
South Coast Limestone Fynbos_Unchannelled valley-bottom wetland	61.84	0	100	0
South Coast Limestone Fynbos_Valleyhead seep	0.11	0	0	100
South Coast Sand Fynbos_Depression	21.11	100	0	0
South Coast Sand Fynbos_Flat	0.07	0	0	100
South Coast Sand Fynbos_Unchannelled valley-bottom wetland	20.71	100	0	0
South Strandveld Western Strandveld_Unchannelled valley-bottom wetland	2.09	100	0	0
South Strandveld Western Strandveld_Valleyhead seep	15.80	100	0	0
Southwest Ferricrete Fynbos_Channelled valley-bottom wetland	449.45	0	100	0
Southwest Ferricrete Fynbos_Depression	957.03	58	42	0
Southwest Ferricrete Fynbos_Flat	373.68	43	57	0
Southwest Ferricrete Fynbos_Floodplain wetland	980.25	0	100	0
Southwest Ferricrete Fynbos_Seep	180.93	19	79	2
Southwest Ferricrete Fynbos_Unchannelled valley-bottom wetland	103.44	100	0	0
Southwest Ferricrete Fynbos_Valleyhead seep	672.78	82	18	0
Southwest Sandstone Fynbos_Channelled valley-bottom wetland	61.54	0	100	0
Southwest Sandstone Fynbos_Flat	2.26	100	0	0
Southwest Sandstone Fynbos_Seep	13.78	44	11	45
Southwest Sandstone Fynbos_Unchannelled valley-bottom wetland	5.28	100	0	0
Augrabies Falls National Park	**780.19**	**22**	**73**	**5**
Nama Karoo Bushmanland_Channelled valley-bottom wetland	87.62	85	15	1
Nama Karoo Bushmanland_Depression	0.25	0	0	100
Nama Karoo Bushmanland_Flat	97.60	68	6	26
Nama Karoo Bushmanland_Floodplain wetland	544.41	0	100	0
Nama Karoo Bushmanland_Seep	5.40	65	2	34

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
Nama Karoo Bushmanland_Unchannelled valley-bottom wetland	5.62	52	19	29
Nama Karoo Bushmanland_Valleyhead seep	39.28	61	23	16
Bontebok National Park	**498.62**	**49**	**51**	**0**
East Coast Shale Renosterveld_Flat	1.56	3	96	1
East Coast Shale Renosterveld_Floodplain wetland	154.01	0	100	0
East Coast Shale Renosterveld_Valleyhead seep	0.83	44	52	4
Southern Silcrete Fynbos_Channelled valley-bottom wetland	23.45	8	92	0
Southern Silcrete Fynbos_Flat	178.73	91	8	1
Southern Silcrete Fynbos_Unchannelled valley-bottom wetland	61.02	0	100	0
Southern Silcrete Fynbos_Valleyhead seep	79.03	100	0	0
Camdeboo National Park	**1498.21**	**0**	**0**	**100**
Albany Thicket Escarpment_Flat	0.43	0	0	100
Albany Thicket Escarpment_Unchannelled valley-bottom wetland	1.13	0	0	100
Albany Thicket Escarpment_Valleyhead seep	0.59	0	0	100
Dry Highveld Grassland Group 1_Channelled valley-bottom wetland	1291.20	0	0	100
Dry Highveld Grassland Group 1_Flat	166.72	0	0	100
Dry Highveld Grassland Group 1_Unchannelled valley-bottom wetland	2.71	0	0	100
Dry Highveld Grassland Group 1_Valleyhead seep	26.60	0	0	100
Upper Nama Karoo_Channelled valley-bottom wetland	0.24	0	0	100
Upper Nama Karoo_Flat	0.55	0	0	100
Upper Nama Karoo_Seep	8.04	0	0	100
Garden Route National Park	**106.22**	**90**	**7**	**3**
Eastern Fynbos-Renosterveld Granite Fynbos_Floodplain wetland	1.00	0	0	100
Eastern Fynbos-Renosterveld Granite Fynbos_Unchannelled valley-bottom wetland	0.07	0	0	100
Eastern Fynbos-Renosterveld Sand Fynbos_Flat	0.02	100	0	0
Eastern Fynbos-Renosterveld Sand Fynbos_Unchannelled valley-bottom wetland	0.04	100	0	0
Eastern Fynbos-Renosterveld Sandstone Fynbos_Channelled valley-bottom wetland	7.38	98	0	2

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
Eastern Fynbos-Renosterveld Sandstone Fynbos_Depression	0.11	0	100	0
Eastern Fynbos-Renosterveld Sandstone Fynbos_Flat	0.52	69	31	0
Eastern Fynbos-Renosterveld Sandstone Fynbos_Floodplain wetland	38.89	100	0	0
Eastern Fynbos-Renosterveld Sandstone Fynbos_Unchannelled valley-bottom wetland	8.08	85	0	15
Eastern Fynbos-Renosterveld Shale Fynbos_Channelled valley-bottom wetland	20.81	100	0	0
Eastern Fynbos-Renosterveld Shale Fynbos_Flat	0.14	0	0	100
Eastern Fynbos-Renosterveld Shale Fynbos_Floodplain wetland	0.56	0	100	0
Eastern Fynbos-Renosterveld Shale Fynbos_Unchannelled valley-bottom wetland	0.30	100	0	0
South Strandveld Sand Fynbos_Flat	10.06	100	0	0
South Strandveld Sand Fynbos_Floodplain wetland	1.82	8	70	22
South Strandveld Sand Fynbos_Unchannelled valley-bottom wetland	6.32	73	27	0
South Strandveld Western Strandveld_Channelled valley-bottom wetland	1.17	100	0	0
South Strandveld Western Strandveld_Floodplain wetland	4.40	7	92	1
South Strandveld Western Strandveld_Unchannelled valley-bottom wetland	4.52	98	2	0
Golden Gate Highlands National Park	**203.65**	**86**	**3**	**11**
Drakensberg Grassland Group 4_Channelled valley-bottom wetland	8.02	0	82	18
Drakensberg Grassland Group 5_Depression	2.54	100	0	0
Drakensberg Grassland Group 5_Flat	0.07	100	0	0
Mesic Highveld Grassland Group 1_Channelled valley-bottom wetland	142.97	92	0	8
Mesic Highveld Grassland Group 1_Depression	1.38	100	0	0
Mesic Highveld Grassland Group 1_Flat	12.30	41	0	59
Mesic Highveld Grassland Group 1_Seep	29.77	97	0	3
Mesic Highveld Grassland Group 1_Unchannelled valley-bottom wetland	6.61	82	0	18
Grasspan	**330.30**	**97**	**0**	**3**
Eastern Kalahari Bushveld Group 3_Depression	112.68	100	0	0
Eastern Kalahari Bushveld Group 3_Flat	0.20	0	0	100
Eastern Kalahari Bushveld Group 3_Seep	11.08	100	0	0

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
Eastern Kalahari Bushveld Group 5_Flat	5.33	100	0	0
Eastern Kalahari Bushveld Group 5_Seep	201.01	95	1	5
Kalahari Gemsbok National Park	**11049.91**	**99**	**1**	**0**
Eastern Kalahari Bushveld Group 6_Depression	17.69	100	0	0
Eastern Kalahari Bushveld Group 6_Unchannelled valley-bottom wetland	15.06	100	0	0
Eastern Kalahari Bushveld Group 6_Valleyhead seep	3.04	100	0	0
Kalahari Duneveld_Channelled valley-bottom wetland	91.88	98	2	0
Kalahari Duneveld_Depression	3573.25	100	0	0
Kalahari Duneveld_Flat	467.90	95	5	0
Kalahari Duneveld_Floodplain wetland	5065.52	100	0	0
Kalahari Duneveld_Seep	1151.78	97	3	0
Kalahari Duneveld_Unchannelled valley-bottom wetland	262.24	92	8	0
Kalahari Duneveld_Valleyhead seep	401.56	93	7	0
Karoo National Park	**94.75**	**48**	**13**	**39**
Lower Nama Karoo_Channelled valley-bottom wetland	23.23	41	0	59
Lower Nama Karoo_Depression	13.97	19	81	0
Lower Nama Karoo_Flat	15.48	9	7	84
Lower Nama Karoo_Unchannelled valley-bottom wetland	32.93	83	0	17
Upper Nama Karoo_Channelled valley-bottom wetland	1.92	85	0	15
Upper Nama Karoo_Flat	6.60	38	0	62
Upper Nama Karoo_Unchannelled valley-bottom wetland	0.63	0	0	100
Kruger National Park	**12335.07**	**15**	**18**	**68**
Lowveld Group 1_Channelled valley-bottom wetland	317.95	0	5	95
Lowveld Group 1_Depression	9.84	53	47	0
Lowveld Group 1_Seep	5.15	34	0	66
Lowveld Group 1_Unchannelled valley-bottom wetland	20.40	16	24	60
Lowveld Group 2_Channelled valley-bottom wetland	44.15	1	13	87

Ecosystem Type	**Total Area (ha)**	**%AB**	**%C**	**%DEFZ123**
Lowveld Group 2_Depression	38.41	100	0	0
Lowveld Group 2_Flat	4.41	78	0	22
Lowveld Group 2_Seep	1.84	66	0	34
Lowveld Group 2_Unchannelled valley-bottom wetland	1.56	95	0	5
Lowveld Group 3_Channelled valley-bottom wetland	1869.71	0	12	88
Lowveld Group 3_Depression	6.03	100	0	0
Lowveld Group 3_Flat	8.87	5	44	51
Lowveld Group 3_Seep	38.22	1	0	99
Lowveld Group 3_Unchannelled valley-bottom wetland	8.52	9	33	58
Lowveld Group 4_Channelled valley-bottom wetland	1886.72	0	3	97
Lowveld Group 4_Depression	18.93	100	0	0
Lowveld Group 4_Flat	13.67	12	61	28
Lowveld Group 4_Seep	9.14	0	0	100
Lowveld Group 4_Unchannelled valley-bottom wetland	27.22	0	5	95
Lowveld Group 4_Valleyhead seep	8.48	0	99	1
Lowveld Group 5_Channelled valley-bottom wetland	23.38	0	4	96
Lowveld Group 5_Seep	8.97	2	0	98
Lowveld Group 5_Unchannelled valley-bottom wetland	0.30	0	0	100
Lowveld Group 7_Channelled valley-bottom wetland	94.51	0	53	47
Lowveld Group 7_Flat	0.35	0	0	100
Lowveld Group 7_Seep	1.47	0	0	100
Lowveld Group 8_Channelled valley-bottom wetland	345.64	0	30	70
Lowveld Group 8_Depression	0.35	100	0	0
Lowveld Group 8_Unchannelled valley-bottom wetland	0.29	0	0	100
Lowveld Group 9_Channelled valley-bottom wetland	707.73	0	18	82
Lowveld Group 9_Depression	2.67	100	0	0
Lowveld Group 9_Flat	31.58	1	4	95

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
Lowveld Group 9_Unchannelled valley-bottom wetland	6.31	0	16	84
Lowveld Group 9_Valleyhead seep	10.44	0	1	99
Mopane Group 1_Channelled valley-bottom wetland	108.71	40	0	60
Mopane Group 1_Depression	110.67	88	12	0
Mopane Group 1_Flat	114.50	40	60	0
Mopane Group 1_Floodplain wetland	770.28	0	100	0
Mopane Group 1_Seep	0.35	0	0	100
Mopane Group 1_Unchannelled valley-bottom wetland	30.42	100	0	0
Mopane Group 1_Valleyhead seep	45.91	31	63	6
Mopane Group 2_Channelled valley-bottom wetland	88.02	0	1	99
Mopane Group 2_Depression	34.50	51	49	0
Mopane Group 2_Flat	3.56	12	0	88
Mopane Group 2_Unchannelled valley-bottom wetland	25.47	0	7	93
Mopane Group 3_Channelled valley-bottom wetland	906.60	71	1	28
Mopane Group 3_Depression	187.92	100	0	0
Mopane Group 3_Flat	27.46	63	8	29
Mopane Group 3_Floodplain wetland	1585.64	23	33	44
Mopane Group 3_Seep	3.86	100	0	0
Mopane Group 3_Unchannelled valley-bottom wetland	15.00	0	24	76
Mopane Group 3_Valleyhead seep	197.17	48	0	52
Mopane Group 4_Channelled valley-bottom wetland	2025.49	0	1	99
Mopane Group 4_Depression	131.71	100	0	0
Mopane Group 4_Flat	72.94	12	50	37
Mopane Group 4_Floodplain wetland	40.51	0	100	0
Mopane Group 4_Seep	206.57	2	1	97
Mopane Group 4_Unchannelled valley-bottom wetland	10.25	13	73	15
Mopane Group 4_Valleyhead seep	18.38	0	0	100

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
Mapungubwe National Park	**546.61**	**42**	**9**	**49**
Mopane Group 1_Channelled valley-bottom wetland	70.21	96	0	4
Mopane Group 1_Depression	1.86	100	0	0
Mopane Group 1_Unchannelled valley-bottom wetland	0.01	0	100	0
Mopane Group 2_Channelled valley-bottom wetland	2.40	0	0	100
Mopane Group 2_Depression	13.67	0	0	100
Mopane Group 2_Flat	29.77	90	10	0
Mopane Group 2_Floodplain wetland	345.04	37	2	61
Mopane Group 2_Valleyhead seep	83.64	11	47	42
Marakele National Park	**47.47**	**1**	**3**	**96**
Central Bushveld Group 1_Channelled valley-bottom wetland	0.25	0	0	100
Central Bushveld Group 1_Flat	1.49	0	100	0
Central Bushveld Group 1_Seep	19.56	0	0	100
Central Bushveld Group 3_Channelled valley-bottom wetland	18.38	0	0	100
Central Bushveld Group 3_Depression	0.62	100	0	0
Central Bushveld Group 3_Flat	0.29	0	0	100
Central Bushveld Group 3_Seep	0.39	0	0	100
Central Bushveld Group 3_Unchannelled valley-bottom wetland	3.99	0	0	100
Central Bushveld Group 3_Valleyhead seep	0.34	0	0	100
Mesic Highveld Grassland Group 11_Flat	0.75	0	0	100
Mesic Highveld Grassland Group 11_Seep	1.41	0	0	100
Mokala National Park	**136.93**	**59**	**11**	**30**
Eastern Kalahari Bushveld Group 3_Channelled valley-bottom wetland	21.95	0	71	29
Eastern Kalahari Bushveld Group 3_Depression	13.43	100	0	0
Eastern Kalahari Bushveld Group 3_Flat	13.11	90	0	10
Eastern Kalahari Bushveld Group 3_Seep	48.86	52	0	48
Eastern Kalahari Bushveld Group 3_Unchannelled valley-bottom wetland	6.35	10	0	90

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
Eastern Kalahari Bushveld Group 3_Valleyhead seep	19.44	100	0	0
Eastern Kalahari Bushveld Group 5_Flat	0.75	0	0	100
Eastern Kalahari Bushveld Group 5_Seep	2.09	0	0	100
Upper Nama Karoo_Flat	9.87	100	0	0
Upper Nama Karoo_Unchannelled valley-bottom wetland	0.34	0	0	100
Upper Nama Karoo_Valleyhead seep	0.76	0	0	100
Mountain Zebra National Park	**108.05**	**0**	**4**	**96**
Albany Thicket Escarpment_Channelled valley-bottom wetland	0.79	0	0	100
Albany Thicket Escarpment_Unchannelled valley-bottom wetland	0.52	0	0	100
Dry Highveld Grassland Group 1_Channelled valley-bottom wetland	1.25	0	0	100
Dry Highveld Grassland Group 1_Flat	4.75	0	0	100
Dry Highveld Grassland Group 1_Seep	2.52	0	0	100
Dry Highveld Grassland Group 1_Unchannelled valley-bottom wetland	0.21	0	0	100
Upper Nama Karoo_Channelled valley-bottom wetland	75.67	0	5	95
Upper Nama Karoo_Flat	0.16	0	0	100
Upper Nama Karoo_Seep	2.98	0	0	100
Upper Nama Karoo_Unchannelled valley-bottom wetland	19.18	0	5	95
Namaqua National Park	**1461.02**	**98**	**1**	**0**
Namaqualand Hardeveld (Skn)_Channelled valley-bottom wetland	1154.64	100	0	0
Namaqualand Hardeveld (Skn)_Flat	4.36	53	47	0
Namaqualand Hardeveld (Skn)_Floodplain wetland	118.10	100	0	0
Namaqualand Hardeveld (Skn)_Seep	31.44	95	0	5
Namaqualand Hardeveld (Skn)_Unchannelled valley-bottom wetland	0.06	77	0	23
Namaqualand Hardeveld (Skn)_Valleyhead seep	3.22	89	10	1
Namaqualand Sandveld (Sks)_Channelled valley-bottom wetland	64.61	100	0	0
Namaqualand Sandveld (Sks)_Flat	20.21	86	13	0
Namaqualand Sandveld (Sks)_Floodplain wetland	13.20	3	97	0

Ecosystem Type	Total Area (ha)	%AB	%C	%DEFZ123
Namaqualand Sandveld (Sks)_Seep	23.73	97	0	3
Namaqualand Sandveld (Sks)_Unchannelled valley-bottom wetland	9.99	64	34	2
Namaqualand Sandveld (Sks)_Valleyhead seep	8.05	99	0	1
Northwest Sand Fynbos_Seep	9.41	100	0	0
Richtersveld National Park	**1298.65**	**4**	**96**	**0**
Gariep Desert (Dg)_Floodplain wetland	1245.36	0	100	0
Gariep Desert (Dg)_Unchannelled valley-bottom wetland	1.27	100	0	0
Namaqualand Cape Shrublands Quartzite Fynbos_Flat	1.31	0	100	0
Richtersveld (Skr)_Depression	50.71	100	0	0
Table Mountain National Park	**1032.88**	**89**	**3**	**9**
Southwest Granite Fynbos_Flat	0.34	0	0	100
Southwest Sand Fynbos_Channelled valley-bottom wetland	61.68	100	0	0
Southwest Sand Fynbos_Flat	66.91	100	0	0
Southwest Sand Fynbos_Unchannelled valley-bottom wetland	66.48	70	30	0
Southwest Sandstone Fynbos_Channelled valley-bottom wetland	295.07	100	0	0
Southwest Sandstone Fynbos_Flat	356.98	77	0	23
Southwest Sandstone Fynbos_Seep	27.61	82	0	18
Southwest Sandstone Fynbos_Unchannelled valley-bottom wetland	53.68	100	0	0
Southwest Sandstone Fynbos_Valleyhead seep	2.05	100	0	0
Southwest Shale Fynbos_Unchannelled valley-bottom wetland	1.19	0	0	100
Western Strandveld_Channelled valley-bottom wetland	87.97	100	0	0
Western Strandveld_Depression	2.57	100	0	0
Western Strandveld_Unchannelled valley-bottom wetland	10.35	26	69	4
Tankwa Karoo National Park	**1466.08**	**41**	**19**	**40**
Karoo Dolerite Renosterveld_Flat	0.82	0	0	100
Karoo Shale Renosterveld_Flat	1.12	0	0	100
Karoo Shale Renosterveld_Seep	0.58	0	0	100

Ecosystem Type	**Total Area (ha)**	**%AB**	**%C**	**%DEFZ123**
Rainshadow Valley Karoo (Skv)_Channelled valley-bottom wetland	922.09	29	13	58
Rainshadow Valley Karoo (Skv)_Depression	291.93	62	38	0
Rainshadow Valley Karoo (Skv)_Flat	70.55	92	2	6
Rainshadow Valley Karoo (Skv)_Unchannelled valley-bottom wetland	127.92	42	35	23
Rainshadow Valley Karoo (Skv)_Valleyhead seep	41.08	57	11	32
Trans-Escarpment Succulent Karoo (Skt)_Flat	9.77	22	0	78
Trans-Escarpment Succulent Karoo (Skt)_Unchannelled valley-bottom wetland	0.23	0	0	100
West Coast National Park	**124.11**	**85**	**15**	**0**
Southwest Sand Fynbos_Floodplain wetland	18.60	0	100	0
Southwest Sand Fynbos_Seep	0.38	100	0	0
Western Strandveld_Depression	3.59	100	0	0
Western Strandveld_Unchannelled valley-bottom wetland	101.53	100	0	0

Appendix 3 – Marine data

Summary of coastal, inshore and inner-shelf habitats presenting their ecosystem threat status, protection levels, total area, conservation targets, occurrence in each NP, and SANParks' contribution to the achievement of targets.

					SANParks							Other Agencies	All agencies	SANParks as a % of PA estate	SANParks as a % of target
					Addo	Agulhas	Garden Route	Namaqua	Table Mountain	West Coast	Total	Other	Grand Total		
Habitat	**Ecosystem Threat Status**	**Protection Level**	**Total Habitat Area (km^2)**	**Target (km^2)**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**		**Total**			
Harbour	CR	(blank)	19.4	3.9					0.2		0.2		0.2	99.6	4.6
Namaqua Island	CR	Hardly protected	280.0	56.0								0.2	0.2		
Namaqua Sheltered Rocky Coast	CR	Hardly protected	9.3	1.9										100.0	2.1
Natal Shelf Edge Reef	LT	Hardly protected	17.6	3.5								0.1	0.1		
Agulhas Inshore Reef	CR	Moderately protected	42.9	8.6			0.8		12.0		12.7	1.6	14.3	89.1	148.4

Agulhas Sheltered Rocky Coast	CR	Moderately protected	20.5	4.1								2.9	2.9		
Southwestern Cape Boulder Shore	CR	Moderately protected	19.9	4.0					6.4	0.0	6.4	0.8	7.3	88.6	162.0
Southwestern Cape Inshore Hard Grounds	CR	Moderately protected	51.3	10.3					32.1		32.1		32.1	100.0	312.8
Southwestern Cape Inshore Reef	CR	Moderately protected	5.7	1.1					5.3		5.3		5.3	100.0	465.5
Southwestern Cape Sheltered Rocky Coast	CR	Moderately protected	1.1	0.2					0.2		0.2		0.2	100.0	87.7
Southwestern Cape Very Exposed Rocky Coast	CR	Moderately protected	1.4	0.3					1.4		1.4		1.4	100.0	500.0
Agulhas Inshore Gravel	EN	Moderately protected	46.5	9.3								9.5	9.5		
Natal Inshore Reef	EN	Moderately protected	245.3	49.1								70.5	70.5		
Natal Muddy Inshore	EN	Moderately protected	53.0	10.6								14.5	14.5		

Natal Muddy Shelf	EN	Moderately protected	501.9	100.4								90.8	90.8		
Southwestern Cape Exposed Rocky Coast	EN	Moderately protected	50.5	10.1					20.0	2.2	22.2	1.8	24.0	92.6	220.1
Southwestern Cape Hard Inner Shelf	EN	Moderately protected	1317.8	263.6					157.9		157.9		157.9	100.0	59.9
Agulhas Boulder Shore	LT	Moderately protected	49.0	9.8			7.2		3.5		10.7	8.4	19.1	56.1	109.2
Agulhas Dissipative-Intermediate Sandy Coast	LT	Moderately protected	350.3	70.1	23.9	0.7	3.6		0.7		28.9	43.8	72.8	39.8	41.3
Agulhas Estuarine Shore	LT	Moderately protected	43.1	8.6	0.1	0.1	1.7				1.8	5.7	7.6	24.7	21.7
Agulhas Intermediate Sandy Coast	LT	Moderately protected	71.8	14.4		0.5	0.1		0.3		0.9	5.8	6.7	13.7	6.4
Agulhas Reflective Sandy Coast	LT	Moderately protected	3.7	0.7		0.2	0.1		0.3		0.6	0.1	0.7	90.6	80.1
Delagoa Very Exposed Rocky Coast	LT	Moderately protected	0.1	0.0								0.1	0.1		

Natal Exposed Rocky Coast	LT	Moderately protected	75.0	15.0								19.2	19.2		
Natal Gravel Shelf	LT	Moderately protected	1097.2	219.4								194.6	194.6		
Natal Gravel Shelf Edge	LT	Moderately protected	773.5	154.7								126.9	126.9		
Natal Mixed Sediment Shelf	LT	Moderately protected	1.8	0.4								1.8	1.8		
Natal Muddy Shelf Edge	LT	Moderately protected	61.8	12.4								40.1	40.1		
Natal-Delagoa Dissipative Sandy Coast	LT	Moderately protected	4.0	0.8								1.1	1.1		
Southern Benguela Dissipative Sandy Coast	LT	Moderately protected	68.9	13.8					3.8	15.1	18.9	0.0	18.9	100.0	137.4
Southern Benguela Dissipative-Intermediate Sandy Coast	LT	Moderately protected	120.3	24.1				3.6	3.0	12.8	19.4	2.0	21.4	90.7	80.6
Southern Benguela Estuarine Shore	LT	Moderately protected	12.1	2.4				0.3	0.7		1.0	3.3	4.3	22.5	40.3

Southwestern Cape Sandy Inner Shelf	LT	Moderately protected	1652.1	330.4					264.8	21.7	286.5	0.0	286.5	100.0	86.7
Agulhas Dissipative Sandy Coast	VU	Moderately protected	98.9	19.8					0.9		0.9	13.6	14.5	6.0	4.4
Agulhas Inshore Hard Grounds	VU	Moderately protected	751.6	150.3			7.9				7.9	110.1	117.9	6.7	5.2
Agulhas Mixed Shore	VU	Moderately protected	478.5	95.7	5.7	6.1	10.9		1.9		24.6	73.4	98.0	25.1	25.7
Agulhas Sandy Inshore	VU	Moderately protected	1708.8	341.8			45.7		67.1		112.8	105.7	218.6	51.6	33.0
Agulhas Very Exposed Rocky Coast	VU	Moderately protected	31.8	6.4								4.7	4.8	0.5	0.4
Natal Canyon	VU	Moderately protected	483.1	96.6								66.2	66.2		
Natal-Delagoa Intermediate Sandy Coast	VU	Moderately protected	197.8	39.6								51.4	51.4		
Natal-Delagoa Reflective Sandy Coast	VU	Moderately protected	49.9	10.0								12.8	12.8		

Southwestern Cape Lagoon	VU	Moderately protected	129.1	25.8						64.7	64.7		64.7	100.0	250.5
Southwestern Cape Mixed Shore	VU	Moderately protected	49.0	9.8					17.6	1.5	19.1	1.7	20.8	91.9	195.0
Southwestern Cape Sandy Inshore	VU	Moderately protected	206.8	41.4					76.8	26.6	103.4		103.4	100.0	250.0
Agulhas Hard Inner Shelf	EN	Poorly protected	4279.1	855.8			37.8				37.8	80.9	118.8	31.9	4.4
Namaqua Mixed Shore	EN	Poorly protected	241.2	48.2				10.0			10.0	0.3	10.3	97.0	20.6
Southwestern Cape Island	EN	Poorly protected	1045.9	209.2					47.9	41.9	89.8	2.3	92.2	97.5	42.9
Agulhas Gravel Inner Shelf	LT	Poorly protected	1321.8	264.4								60.5	60.5		
Namaqua Exposed Rocky Coast	LT	Poorly protected	146.3	29.3				8.5			8.5	1.1	9.6	88.5	29.0
Natal Sandy Shelf Edge	LT	Poorly protected	2412.8	482.6								39.3	39.3		

Natal Very Exposed Rocky Coast	LT	Poorly protected	4.2	0.8								0.3	0.3		
Southern Benguela Intermediate Sandy Coast	LT	Poorly protected	123.8	24.8				1.2	0.6	1.0	2.8	2.5	5.4	52.8	11.5
Southern Benguela Reflective Sandy Coast	LT	Poorly protected	47.1	9.4				1.0	0.5	0.2	1.8	0.6	2.4	73.3	18.9
Agulhas Inner Shelf Reef	VU	Poorly protected	44.1	8.8					0.8		0.8	0.1	0.9	86.0	8.6
Agulhas Island	VU	Poorly protected	868.3	173.7	72.6				10.4		82.9	0.2	83.2	99.7	47.8
Agulhas Sandy Inner Shelf	VU	Poorly protected	26175.2	5235.0			164.9		175.8		340.7	269.6	610.3	55.8	6.5
Namaqua Very Exposed Rocky Coast	VU	Poorly protected	12.0	2.4				0.4			0.4		0.4	95.1	16.6
Natal Sandy Shelf	VU	Poorly protected	6348.2	1269.6								495.7	495.7		
Delagoa Inshore Reef	LT	Well protected	71.0	14.2								71.0	71.0		

Delagoa Mixed Shore	LT	Well protected	48.3	9.7								48.3	48.3		
Delagoa Sandy Inshore	LT	Well protected	104.3	20.9								104.3	104.3		
Delagoa Sandy Shelf	LT	Well protected	290.9	58.2								279.1	279.1		
Delagoa Shelf Reef	LT	Well protected	75.0	15.0								75.0	75.0		
Natal Estuarine Shore	LT	Well protected	0.5	0.1								0.5	0.5		
Natal Mixed Sediment Shelf Edge	LT	Well protected	29.2	5.8								29.2	29.2		
Agulhas Exposed Rocky Coast	VU	Well protected	266.3	53.3	0.5	0.3	29.6		11.0		41.4	29.0	70.4	58.8	77.7
Agulhas Muddy Inner Shelf	CR	Zero protection	2684.5	536.9											
Namaqua Boulder Shore	CR	Zero protection	0.6	0.1											

Namaqua Inner Shelf Reef	CR	Zero protection	0.9	0.2										
Namaqua Inshore Hard Grounds	CR	Zero protection	233.0	46.6										
Namaqua Inshore Reef	CR	Zero protection	3.4	0.7										
Namaqua Sandy Inshore	CR	Zero protection	823.9	164.8										
Natal Boulder Shore	CR	Zero protection	2.6	0.5										
Agulhas Mixed Sediment Inner Shelf	LT	Zero protection	627.5	125.5										
Namaqua Hard Inner Shelf	LT	Zero protection	2656.4	531.3										
Namaqua Muddy Inner Shelf	LT	Zero protection	11165.6	2233.1										
Namaqua Sandy Inner Shelf	LT	Zero protection	5394.5	1078.9										

Namaqua Muddy Inshore	VU	Zero protection	164.4	32.9											
Totals			78966.9	15793.4	102.8	7.9	310.3	24.9	923.8	187.8	1557.4	2675.3	4232.8	2726.1	3615.4