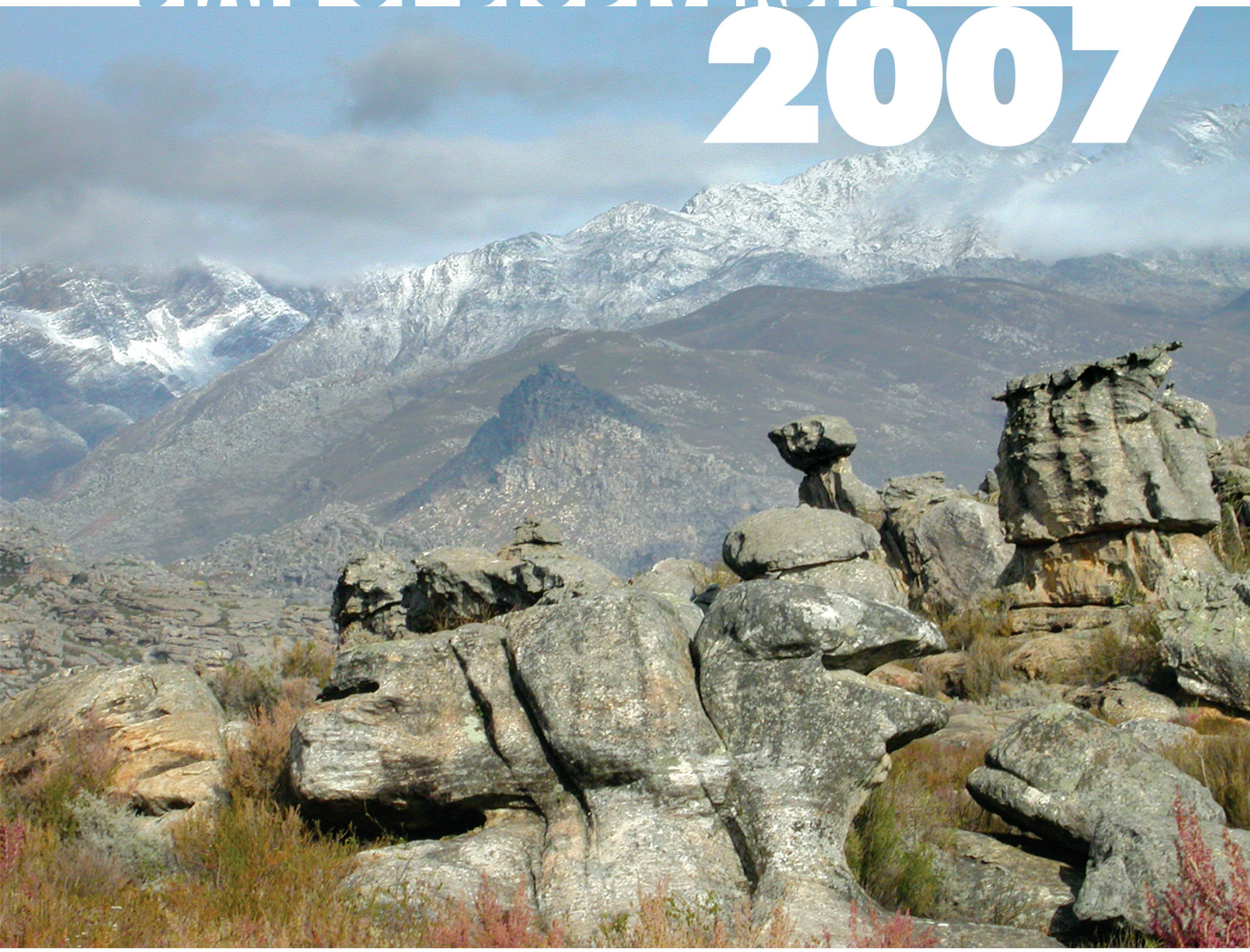
WESTERN CAPE PROVINCE STATE OF BIODIVERSITY 2007



CapeNature

SCIENTIFIC SERVICES

WESTERN CAPE PROVINCE STATE OF BIODIVERSITY 2007

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Cover page photographs by Andrew Turner (CapeNature), Roger Bills (SAIAB) & Wicus Leeuwner.

ISBN 978-0-620-39289-1

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SCIENTIFIC SERVICES

CHAPTER 1
INTRODUCTION

Andrew Turner
aaturner@cncjnk.pgwc.gov.za

> *"We live at a historic moment, a time in which the world's biological diversity is being rapidly destroyed. The present geological period has more species than any other, yet the current rate of extinction of species is greater now than at any time in the past. Ecosystems and communities are being degraded and destroyed, and species are being driven to extinction. The species that persist are losing genetic variation as the number of individuals in populations shrinks, unique populations and subspecies are destroyed, and remaining populations become increasingly isolated from one another.*
>
> *The cause of this loss of biological diversity at all levels is the range of human activity that alters and destroys natural habitats to suit human needs."*
>
> (Primack, 2002).

CapeNature launched its State of Biodiversity Programme (SoBP) to assess and monitor the state of biodiversity in the Western Cape in 1999. This programme delivered its first report in 2002 and these reports are updated every five years. The current report (2007) reports on the changes to the state of vertebrate biodiversity and land under conservation usage. In addition, the current report is expanded to include an initial assessment of plant biodiversity in the province and has a broader look at land utilization and ecosystem health. This report differs from typical State of the Environment (SoE) reports in that it is primarily focused on biodiversity and natural ecosystems.

Within the current reporting period several other "state" reports were produced that have direct relevance to this report:

1. A National Spatial Biodiversity Assessment (NSBA) was published (Driver *et al.* 2004) as part of the National Biodiversity Strategy and Action Plan (NBSAP) which will outline a strategy for the protection of biodiversity nationally (see Chapter 9 for more detail);
2. The City of Cape Town continued its annual State of the Environment reporting;
3. The Department of Water Affairs and Forestry produced a pilot report on the national State of Forests (Institute of Natural Resources (INR) 2005);
4. The DWAF in collaboration with CapeNature produced five River Health reports and three technical reports on river health in the Western Cape Province (see Chapter 10).

The report covers birds, mammals, reptiles, amphibians, freshwater fish and plants in separate chapters. This report covers the state of plants of the WCP for the first time. The state of ecosystems and habitat

both inside and outside of protected areas is reported in a chapter on land-use and protected areas, and a chapter on freshwater ecosystems.

Several of these groups have had significant taxonomic revisions and the number of species may have changed since the previous State of Biodiversity report for the WCP. In addition, these changes have prompted complete reviews of the conservation status of these groups which provides a more up to date representation of conservation state. In those groups where revisions of conservation status are still required, there are plans to carry out these revisions within the next five years and hence within the next reporting period.

CapeNature has a suite of monitoring programmes that cover many different taxa with a particular focus on threatened species such as the Cape Vulture and natural processes ranging from protea seedling regeneration after fires to monitoring frog populations in relation to global climate change. Each of the monitoring programmes is covered in the taxon-specific chapter.

CapeNature is committed to conserving biodiversity on a scientific basis and supports research that will further this aim. CapeNature is fortunate to have established several collaborative research projects with researchers from various tertiary education facilities and research organisations. A list of the scientific activities by the Scientific Services division of CapeNature is found in Appendix 1.

Should you wish to engage CapeNature on any nature conservation related issues in the WCP, Please visit our website www.capenature.co.za to obtain contact details or contact any of the chapter authors directly.

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APPENDICES

Appendix 1. Publications by the staff of CapeNature Scientific Services for the period November 2002 to November 2006.

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13. Crawford, R.J.M., Hemming, M., Kemper, J., Klages, N.T.W., Randall, R.M., Underhill, L.G., Venter, A.D., Ward, V.L. and Wolfaardt, A.C. 2006. Molt of the African penguin, *Spheniscus demersus*, in relation to its breeding season and food availability. Acta Zoologica Sinica 52: 444-447.

14. Davies, A.J., Smit, N.J. and Reed, C.C. In press. An enigmatic intraerythrocytic parasite of *Parablennius cornutus*, from South Africa. Journal of Parasitology.

15. De Klerk, H.M., Fjeldså, J., Blyth, S. and Burgess, N.D. 2004. Gaps in the protected area network for threatened Afrotropical birds. Biological Conservation 117: 529-537.

16. De Klerk, H.M., Crowe, T.M., Fjeldså, J. and Burgess, N.D. 2002. Biogeographical patterns of endemic terrestrial Afrotropical birds. Diversity and Distribution, 8: 147-162.

17. De Klerk, H.M., Crowe, T.M., Fjeldså, J. and Burgess, N.D. 2002. Patterns of species richness and narrow endemism of terrestrial bird species in the Afrotropical region. J. Zool. London, 256: 327-342.

18. De Villiers, A.L. 2004. *Bufo pantherinus* A. Smith, 1828. Pp. 71-74 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

19. De Villiers, A.L. 2004. *Cacosternum capense* Hewitt, 1925. Pp. 224-227 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

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21. De Villiers, A.L. 2004. Genus *Capensibufo* Grandison, 1980 (Family Bufonidae). Pp. 85-86 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution,Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

22. De Villiers, A.L. 2004. Genus *Microbatrachella* Hewitt, 1926 (Family Petropedetidae). P. 240 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

23. De Villiers, A.L. 2004. *Heleophryne rosei* Hewitt, 1925. Pp. 108-111 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

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25. De Villiers, A.L. 2004. *Xenopus gilli* Rose and Hewitt, 1927. Pp. 260-263 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

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28. Du Preez, L.H., Cunningham, M. and Turner, A. 2004. *Bufo poweri* Hewitt, 1935. Pp. 76-77 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

29. Fjeldså, J., Burgess, N.D., Blyth, S and De Klerk, H.M. 2004. Where are the major gaps in the reserve network for Africa's mammals? Oryx 38(1): 17-25.

30. Horak, I.G., McKay, I.J., Henen, B.T., Heyne, H., Hofmeyr, M.D. and De Villiers, A.L. 2006. Parasites of domestic and wild animals in South Africa. XLVII. Ticks of tortoises and other reptiles. Onderstepoort Journal of Veterinary Research 73: 215-227.

31. Novellie, P.A., Lindeque, M., Lindeque, P.M., Lloyd, P.H. and Koen, J.H. 2002. Chapter 3. Status and Action Plan for the Mountain Zebra (Equus zebra). Pp 28-42. In: Equids: zebras, asses and horses. Status survey and conservation action plan. Moehlman, P.D. (ed.). IUCN/SSI Equid Specialist Group. IUCN, Gland (Switzerland).

32. Reed, C.C., Basson, L. and Van As, L.L. 2003. Myxozoans infecting the sharptooth catfish, *Clarias gariepinus* in the Okavango River and Delta, Botswana, including descriptions of two new species, *Henneguya samochimensis* sp. n. and *Myxobolus gariepinus* sp. n. Folia Parasitologica, 50(3): 183-189.

33. Rendall, D., Kollias, S., Ney, C. and Lloyd, P. 2005. Pitch (Fo) and formant profiles of human vowels and vowel-like baboon grunts: the role of vocalizer body size and voice-acoustic allometry. Journal of the Acoustical Society of America 117(2): 944-955.

34. Russel I.A. and N.D. Impson. (In press). Aquatic systems in and adjacent to Agulhas National Park with particular reference to the fish fauna. Koedoe.

35. Stanvliet, R., Jackson, J., Davis, G., De Swardt, C., Mokhoele, J., Thom, Q. and Lane, B.D. 2004. The UNESCO Biosphere Reserve concept as a Tool for Urban Sustainability: the CUBES Cape Town Case Study. Annals of the New York Academy of Sciences 1023: 80-104.

36. Stanvliet, R., Gilder, A. and Naude, K. (In press). The position of the UNESCO Biosphere Reserve concept in South Africa and guidelines for its implementation. Land Use Policy.

37. Stanvliet, R. and Parnell, S. 2006. The contribution of the UNESCO biosphere reserve concept to urban resilience. Management of Environmental Quality 7(4): 437–449.

38. Swanepoel, D., Underhill, L.G., Harebottle, D.M., Wheeler, M.J., and Williams, A.J. (In press). Waterbirds at Theewaterskloof Dam, Western Cape, South Africa. Ostrich.

39. Tolley, K.A., Burger, M. Turner, A.A. and Matthee, C.A. 2006. Biogeographic patterns and phylogeography of dwarf chameleons (*Bradypodion*) in an African biodiversity hotspot. Molecular Ecology 15: 781–793.

40. Turner, A. 2004. *Bufo garmani* Meek, 1897. Pp. 65-67 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

41. Turner, A., Theron J. and Minter, L.R. 2004. *Leptopelis mossambicus* Poynton, 1985. Pp. 159-160 in Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (eds.) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC and Avian Demography Unit, University of Cape Town, Cape Town.

42. Turner, A.A., De Villiers, A.L., Dawood, D. and Channing, A. 2004. A new species of *Arthroleptella* Hewitt, 1926 (Anura: Ranidae) from the Groot Winterhoek Mountains of the Western Cape Province, South Africa. African Journal of Herpetology, 53(1): 1-12.

43. Underhill, L.G., Crawford, R.J.M., Wolfaardt, A.C., Whittington, P.A., Dyer, B.M., Leshoro, T.M., Ruthenberg, M., Upfold, L.and Visagie, J. (In press). Regionally coherent trends in colonies of African Penguins *Spheniscus demersus* in the Western Cape, South Africa, 1987-2005. African Journal of Marine Science.

45. Ward, V. 2006. Austral winter records of the Grey Phalarope in southern Africa. Water Study Group Bulletin 109: 4.

47. Weldon, C., De Villiers, A. L. and Du Preez, L. H. (In press). Quantification of the African clawed frog trade from South Africa, with implications for biodiversity conservation. African Journal of Herpetology.

48. Whittington, P.A., Klages, N.T.W., Crawford, R.J.M., Wolfaardt, A.C. and Kemper, J. 2005. Age at first breeding of the African Penguin. Ostrich 76(1and2): 14-20.

49. Whittington, P.A. Randall, R.M. Crawford, R.J.M., Wolfaardt, A.C., Klages, N.T.W., Randall, B.M. Bartlett, P., Chesselet, Y. and Jones, R. 2005. Patterns of immigration to and emigration from breeding colonies by African Penguins. African Journal of Marine Science 27(1): 205-213.

50. Whittington, P.A. Randall, R.M., Randall, B.M., Crawford, R.J.M., Wolfaardt, A.C., Klages, N.T.W., Bartlett, P.A., Chesselet, Y.J. and Jones, R. 2005. Patterns of movements of the African penguin in South Africa and Namibia. African Journal of Marine Science 27(1): 215-229.

51. Williams, A.J. 2006. Bi-solstice breeding peaks of White-fronted Plovers *Charadrius marginatus* in an equable coastal environment. Wader Study Group Bulletin 109: 88-91.

52. Williams, A.J. 2006. Arrival and departure periods of Ruddy Turnstones from an especially favoured Namibian coastal locality. Wader Study Group Bulletin 109: 92-94.

53. Williams, A.J. and Simmons, R.E. 2006. The status of Curlew Sandpipers *Calidris ferruginea* on the Namib coast. International Wader Studies 19: 156-159.

54. Williams, A.J. and Ward, V.L. 2006. Sacred Ibis and Gray Heron predation of Cape Cormorant eggs and chicks; and a review of ciconiiform birds as seabird predators. Waterbirds 29: 321-327.

55. Wishart, M., Hughes, J., Stewart, B. and Impson, D. 2006. Extreme levels of intra-specific divergence among Cape Peninsula populations of the Cape galaxias, *Galaxias zebratus* Castelnau 1861, reveals a possible species complex. African J. Aquatic Sciences 31(1).

56. Wolfaardt, A.C. and Nel, D.C. 2003. Breeding productivity and annual cycle of rehabilitated African Penguins following oiling. African Journal of Marine Science 25: 537-547.

57. Wolfaardt, A.C., Underhill, L.G., Crawford, R.J.M. and Klages, N.T.W. 2001. Results of the 2001 Census of African Penguins *Spheniscus demersus* in South Africa: First Measures of the Impact of the Treasure Oil Spill on the Breeding Population. African Journal of Marine Science 25: 487-498.

58. Woodford, D.J. and Impson, N.D. 2004. A preliminary assessment of the impact of alien rainbow trout (*Oncorhynchus mykiss*) on indigenous fishes of the upper Berg River, Western Cape Province, South Africa. African J. Aquatic Sciences 29(1): 107-111.

59. Woodford, D.J., Impson, N.D., Day, J.A. and Bills, I.R. 2005. The predatory impact of invasive alien smallmouth bass, *Micropterus dolomieu* (Teleostei: Centrachidae), on indigenous fish in a Cape Floristic Region mountain stream. African J. Aquatic Sciences 30(2): 167-174.

POSTER PRESENTATIONS AT SYMPOSIA/CONGRESSES:

International

1. Barham, P.J., Barham, B.J., Underhill, L.G., Crawford, R.J.M., Leshoro, M.T., Oschadleus, D., Wolfaardt, A.C. and Williams, A.J. 2004. Impact of the Treasure spill on survival and breeding of African Penguins at Robben Island. Poster presented at the 5th International Penguin Conference. 6-10 September 2004. Ushuaia, Tierra Del Fuego, Argentina.

2. Barham, P.J., Crawford, R.J.M., Underhill, L.G., Leshoro, M.T., Meyer, M.A., Wolfaardt, A.C., Oschadleus, D. and Williams, A.J. 2004. Resighting rates of African Penguins relocated or oiled following the Treasure oil spill in 2000. Poster presented at the 5th International Penguin Conference. 6-10 September 2004. Ushuaia, Tierra Del Fuego, Argentina.

3. De Villiers, A.L. 2005. The critically endangered micro frog colonizes a man-made wetland. Poster presented at the 5th World Congress of Herpetology, 19-24 June 2005, Stellenbosch, South Africa.

4. Impson, N.D., Avery, G. and Kulenkamf, Z. 2006. The development of regulatory zones as a tool to improve management of invasive alien freshwater fishes in the CFR, South Africa. Poster presented at the 14th International Conference on Aquatic Invasive Species. Florida, USA.

5. Impson, D. and de Villiers, P. 2004. Living gold: Successful development of a flyfishery for South Africa's indigenous yellowfishes. Poster presented at the 4th World Fisheries Congress. 2-6 May 2004. Vancouver, Canada.

6. Mukerjee, A., Williams, A.J. and Underhill, L.G. 2004. Stork stalking at the tail-end of the range: Black Storks in the Western Cape province of South Africa. Poster presented at the 4th International Black Stork Conference. 15-20 April 2004. Davod, Hungary.

7. Sieben, E.J.J., Mucina, L., Boucher, C. and Roets, W. 2004. High Altitude Wetlands in the Cape Fold Mountains: a valuable asset of the Cape Floral Kingdom in South Africa under threat. Poster presented at the 7th International Wetlands Conference. 25-30 July 2004. Utrecht, Nederlands.

8. Roets, W. 2005. South Africa's National River Health Programme: informing management of the unique river systems of the Cape Floral Kingdom in the Western Cape Province of South Africa. Poster presented at the Wetland Wethydro Course. 19-26 June 2005. Biebrza National Park, Poland.

9. Tolley, K.A., Cherry, M.I. and De Villiers, A.L. 2005. Phylogeography of the toad genus *Capensibufo*, endemic to the Cape Floristic Region, South Africa. Poster presented at the 5th World Congress of Herpetology, 19-24 June 2005, Stellenbosch, South Africa.

10. Turner, A.A. and De Villiers, A.L. 2005. Western Cape Nature Conservation Board's long-term frog population monitoring project. Poster presented at the 5th World Congress of Herpetology, 19-24 June 2005, Stellenbosch, South Africa.

11. Van der Merwe, N. and De Klerk, H.M. 2005. A model for mapping natural areas in southern Africa. Poster presented at the International ESRI Conference, August 2005, Redlands, California, USA.

12. Van Dijk, D.E., De Villiers, A.L. and Geertsema, H. 2005. *Microbatrachella capensis* (Anura: Petropedetidae), Western Cape, South Africa. Poster presented at the 5th World Congress of Herpetology, 19-24 June 2005, Stellenbosch, South Africa.

13. Will, L., Dawood, A., Kryger, U. and De Villiers, A.L. 2005. Genetic variability between populations of the critically endangered frog *Microbatrachella capensis*. Poster presented at the 5th World Congress of Herpetology, 19-24 June 2005, Stellenbosch, South Africa.

14. Wolfaardt, A.C., Underhill, L.G., Whittington, P.A., Nel, D.C., Crawford, R.J.M., Williams, A.J. and Ryan, P.G. 2004. Rehabilitation of oiled African Penguins: a conservation success story. Poster presented at the 5th International Penguin Conference, 6-10 September, Ushuaia, Tierra Del Fuego, Argentina.

National

1. Botes, A., McGeoch, M.A., Robertson, H.G., Davids, H.P., Mahood, K. and Chown, S.L. 2006. Ants, altitude and change in the northern Cape Floristic Region. Poster presented at the Fynbos Forum, 9-11 August 2006, Goudini Spa, Rawsonville.

2. Burger, J. and Love, V. 2004. Sandveld in crisis – the role of record keeping in conservation planning and management. Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan (Voted best poster at Fynbos Forum 2004).

3. Buthelezi, S.N.P. 2005. Alien infestation vs chemical contamination: a glimpse at the Bitou and Keurbooms Rivers. Poster presented at the Fynbos Forum, 1-5 August 2005, Port Elizabeth.

4. Cunningham, M., Tolley, K., Henderson, K., Turner, A.A. and Whitaker, K. Herpetofaunal exploration of the Cape Fold Mountains: a photo documentary. Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

5. Davids, J and Van Noie A. 2005. EnviroYouth – Encouraging Leadership for a Sustainable Future. Poster presented at the Fynbos Forum, 1-5 August 2005, Port Elizabeth.

6. De Villiers, A.L. 2006. Is the Table Mountain ghost frog being threatened by reduced rainfall? Poster presented at the 8th Herpetological Association of Africa Symposium. 24-27 November 2006, Potchefstroom, South Africa.

7. Henen, B.T., Hofmeyr, M.D. and Baard, E.H.W. 2006. A utility for health profile assessments in chelonian conservation. Poster presented at the 8th Herpetological Association of Africa Symposium, 24-27 November 2006, Potchefstroom.

8. Le Roux, A and Smart, R. 2005. A Succulent Karoo Knowledge Centre in Kamieskroon, Namaqualand. Poster presented at the Arid Zone Ecology Forum, 13-15 September 2005, Barrydale.

9. Lloyd, P.H. 2004. The Himalayan thar on Table Mountain – quo vadis? Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

10. Love, V. 2004. Landuse Advice within Western Cape Nature Conservation Board. Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

11. Matoti, A. 2004. Degraded riparian ecosystems of South Western Cape rivers: challenges and management. Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

12. Mouton, P.le F.N., Baard, E.H.W., Turner, A., De Villiers, A.L. and Alblas, A. Effective conservation of amphibians and reptiles in the Greater Cederberg Biodiversity Corridor. Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

13. Mouton, P.le F.N., Baard, E.H.W., Turner, A., De Villiers, A.L. and Alblas, A. 2004. Effective conservation of amphibians and reptiles in the Greater Cederberg Biodiversity Corridor. Poster presented at the 7th Herpetological Association of Africa Symposium, 6-9 October 2004, Bayworld, Port Elizabeth, South Africa.

14. Reed, C.C., Roets, W. and Purves, A. 2004. Habitat Integrity of the Gourits River System. Poster presented at the Fynbos Forum, 10–13 August 2004, Club Mykonos, Langebaan.

15. Reed, C.C, Roets W. and Purves A. 2004. Habitat Integrity and SASS5 Assessment of the Gourits River System. Poster presented at the SASAQS Conference, 5-7 July 2004, Eskom Convention Centre, Midrand.

16. Roets W. 2002. Highlighting potential environmental impacts associated with water abstraction from the Table Mountain Group (TMG) Aquifer. Poster presented at the Regional Groundwater Conference of the Western Cape Branch, Groundwater Division, Geological Society of South Africa, 16 September 2002, Somerset West (Voted best poster).

17. Scott, J. 2004. How information was sourced and managed for utilization in the Cederberg Conservation Planning Project. Poster presented at the Fynbos Forum 10-13 August 2004, Club Mykonos, Langebaan.

18. Scott, J. and Barodien, G. 2004. How information was sourced and managed for utilization in the Cederberg Conservation Planning Project. Poster presentation at the Arid Zone Ecology Forum, 30 August-2 September, Victoria West.

19. Stanvliet, R. 2006. Identification and observation of human settlement indicators and its inclusion into the SAEON Nodes. Poster presented at the SAEON Summit, 27-29 March 2006, Centurion, Gauteng.

20. Weldon, C., De Villiers, A. and De Villiers, R. 2004. Frogs in demand! An assessment of *Xenopus laevis* exports from the Western Cape, South Africa. Poster presented at the 7th Herpetological Association of Africa Symposium, Bayworld, 6-9 October 2004, Port Elizabeth, South Africa.

21. Williams, A. J. 2004. Feathered Fynbos fauna foiled by fragmentation, felines, fire and formality: will specialist shrubland birds survive in the Blouberg Conservation Area. Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

22. Williams, A.J. 2004. Hidden menaces: impacts of roads and traffic on wildlife. Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

23. Williams, A.J. and Parsons, N. 2004. Outbreaks of avian cholera: are kelp gulls culprits? Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

24. Williams, A.J., Harebottle, D. and Wheeler, M. 2004. How significant are waterbird populations of Cape Metropole wetlands? Poster presented at the Fynbos Forum, 10-13 August 2004, Club Mykonos, Langebaan.

ORAL PRESENTATIONS AT SYMPOSIA/CONGRESSES:

International

1. Baard, E.H.W. 2004. The diversity and conservation of South African tortoises, with emphasis on two global biodiversity hotspots. Oral presentation at the IUCN Turtle Survival Alliance Conference, 16-17 August 2004, Orlando, Florida, USA.

2. Baard, E.H.W. 2005. CITES legislation and herpetological conservation in South Africa - a hindrance or practical conservation tool? Oral presentation at the 5th World Congress of Herpetology, 19-24 June 2005, Stellenbosch.

3. Brand, M. 2003. The importance of Wilderness as a core area for the conservation of the Cape Mountain Leopard. Oral presentation at the Wilderness Rangers Academy, Theme: The Wonders of Wilderness Discovery, 19-23 May 2003, Aspen, Colorado.

4. Hoekstra, T. 2004. Conservation to benefit previously disadvantaged communities and private landowners with emphasis on De Hoop Nature Reserve, South Western Cape, South Africa. Oral presentation at the 31st Natural Areas Conference, 13-16 October 2004, Chicago, USA.

5. Marr, S., Lowe, S., Woodford, D., Swartz, E. and Impson, N.D. 2006. There are no hopeless cases: mitigating the impact of invasive freshwater fishes in the CFR, South Africa. Oral paper presented at the 14th International Conference on Aquatic Invasive Species. Florida, USA

6. Impson, D., Woodford, D. and Bills, I.R. 2003. Conserving threatened endemic fishes of the Cape Floral kingdom: the Rondegat River as a case study of river rehabilitation. Oral presentation at the African Fish and Fisheries: Diversity and Utilization Conference, 10-14 November 2003, Cotonou, Benin.

7. Newman, S. and Wolfaardt A.C. 2004. How effective is the rehabilitation of oiled seabirds? Oral presentation at the Society of Conservation Biology seminar: Urbanizing landscapes, Conservation and Ecology of Emerging Diseases. New York, USA.

8. Ranger, S. 2006. Mainstreaming Biodiversity and Stakeholder Collaboration in CAPE, South Africa - Top Down and Bottom Up. Oral presentation at Managing Africa's Natural Ecosystems, Information and Best Practice Workshop, Serengeti National Park, 24-30 May 2006.

9. Roets, W. 2003. Implementation of South Africa's River Health Programme in the Unique River Systems of the Cape Floral Kingdom. Oral presentation at the 30th Natural Areas Conference, 24 – 27 September 2003, Madison, Wisconsin, USA.

10. Roets, W. 2005. South Africa's National River Health Programme: Informing management of the Unique River Systems of the Cape Floral Kingdom in the Western Cape Province of SA. Oral presentation at the Wetland Wethydro Course, 19-26 June 2005, Biebrza National Park, Poland.

11. Roets, W., Xu, Y., Meire, P. and Brendonck, L. 2006. Characterising and monitoring impacts on groundwater discharges to streams and rivers associated with the hard rock Table Mountain Group Aquifer in the Cape Floristic Kingdom (CFK): Kammanassie Case study. Oral presentation at an International EnviroWater Conference, 20-22 February 2006, Stellenbosch, South Africa.

12. Roets, W., Xu, Y., Meire, P. and Brendonck, L. 2006. Groundwater discharges to streams and rivers associated with the TMG aquifer. Oral presentation at the 9th International River Symposium, 4-7 September 2006, Brisbane, Australia.

13. Shaw, K.A. 2006. A review of the legislation concerning introduced non-native waterbirds. In: Schodde R ed. Proceedings of the 23rd International Ornithological Congress, Beijing. Acta Zoological Sinica52(Suppl.): 586-588.

14. Stanvliet, R. 2003. CUBES Cape Town Case Study. Oral presentation at the Urban Biosphere and Society: Partnership of Cities Conference, October 2003, New York.

15. Stanvliet, R. 2005. The contribution of the UNESCO biosphere reserve concept to urban resilience. Oral presentation at the International Conference for Integrating Urban Knowledge and Practice, 29 May-3 June 2005, Gothenburg, Sweden.

16. Stanvliet, R. 2006. Ecotourism in two Biosphere Reserves in the Western Cape Province, South Africa. Oral presentation at the Ecotourism Australia's 2006 International Conference, 30 October to 3 November 2006. Townsville, Australia.

17. Turner, A.A. 2005. A closer look at Moss Frog phylogeny. Oral presentation at the 5th World Congress of Herpetology, 19-24 June 2005, Stellenbosch.

18. Turner, A.A. 2006. IT constraints in CapeNature. Oral presentation at the Conservation International Global Symposium 2006 Defying Nature's End: The African Context, 20-24 June 2006, Antananarivo, Madagascar.

19. Turner, A.A. and Channing, A. 2006. Fine spatial scale phylogeography of Moss Frogs (*Arthroleptella*). Oral presentation at the 12th African Amphibian Working Group Meeting, 14-17 August, Abomey, Benin.

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Compiled by E.H.W. Baard and H.S. Gildenhuys 15 December 2006

CHAPTER 2
METHODS

Andrew Turner
aaturner@cncjnk.pgwc.gov.za

Methods specific to each chapter are included in that chapter. This chapter briefly outlines the general approach to retrieving biodiversity data by CapeNature Scientific Services.

Information on the distribution of plants and animals is stored in the CapeNature Biodiversity Database. This database houses taxonomic data and relationships for each taxon in the Western Cape. The database also holds distribution records for each taxon. Distribution data is not limited to CapeNature reserves and covers most of the province (and some of the other provinces). Distribution data is obtained from a variety of sources: museum and herbarium specimens, observations, photographs, audio recordings and observations, tissue samples, spoor & scats.

These distribution data are qualified by three measures of precision *viz*. date precision, locality precision and identification precision. These three measures, taken together, constitute an indication of the quality of the data. This allows one to choose the data that is appropriate for analysis or descriptive task at hand. For the purposes of this report, the data used to generate the endemism maps were restricted to the following levels of precision: Date – Unkown (the most lenient date precision), Locality – Nearest quarter degree square (an area roughly 25x27km), and Identification – Species (taxa not identifiable to species level or better i.e. subspecies or variety are excluded).

In the case of birds and plants, high-resolution distribution data are not available for many species. In these cases published distribution references from the literature were used.

Endemism maps were generated by custom software for use in ESRI ArcView 3.2, the Biodiversity Analysis Toolkit (BAT) developed in-house at CapeNature. A more detailed description of the BAT is available in the previous Western Cape State of Biodiversity report (Turner & Sutton 2002). Spatial analyses such as area represented by various data layers were also done using the BAT or standard features in ArcView 3.2 GIS.

Protected area data is stored in the CapeNature Reserves database. This database stores spatial and attribute data in a relational database that allows these data to be viewed and manipulated (updated, appended etc.) in ArcView 3.2GIS.

CHAPTER 3

FRESHWATER FISHES

N.D. Impson
impsond@cncjnk.pgwc.gov.za

TABLE OF CONTENTS

Executive Summary

This report focuses on progress in freshwater fish conservation management since the 2002 State of Biodiversity report. The main areas of progress have been the following:

1. Re-assessment of Conservation Status: the conservation status of fishes was re-assessed using the most recent IUCN criteria. The assessment yielded significant new information for Western Cape Province (WCP) fishes, as for the first time we included Evolutionary Significant Units (ESU's, term after Moritz 1994, in Roos 2004) in the analysis. This assessment covered 17 species, and six ESU's. Including ESU's, the WCP has 23 indigenous freshwater fish species of which 15 are endemic, six are near endemic and two are also found elsewhere. The majority of species are threatened. Of the 23 species, five are CR, eight are EN, three are VU and three are NT. Only one species can be regarded as Least Concern. Three are data deficient as they are undergoing major taxonomic revision.

2. Conservation genetics: all the freshwater fishes of the Cape Floristic Region (CFR) have benefited from major genetic and taxonomic work in the last decade. This work has revealed the existence of ESU's

in *Galaxias, Pseudobarbus* and *Sandelia*. These results allow us to better focus our limited resources – on research and monitoring of highly threatened and restricted fish species and on ecologically sustainable use of their habitat.

3. Biology and ecology of Clanwilliam sawfin: A study is underway which will produce valuable information on the life history of this highly threatened species. These results will have important implications for environmental flow requirements for rivers in the Olifants-Doring River System.

4. Management of alien fishes: several important objectives were met during the reporting period. The severe impact of smallmouth bass *Micropterus dolomieu* on indigenous fishes in the WCP was quantified. Ongoing research has revealed that the impact of predatory alien fishes affects the entire ecosystem, with significant changes in aquatic fauna and flora once bass have invaded a river and eliminated the indigenous fishes.

   Other important objectives met were the identification of priority rivers for alien fish control in the CFR, and a project under the auspices of the Cape Action for People and the Environment (CAPE) that will enable invasive alien fishes to be eradicated from priority fynbos rivers.

5. Monitoring of fishes: The establishment of the River Conservation Unit at CapeNature in 2003 has substantially increased monitoring effort on rivers in the Western Cape Province. Fish assessments were undertaken during the reporting period at over 120 monitoring sites in the province. The health of fish assemblages within these Water Management Areas is reported on in Chapter 10.

INTRODUCTION

Considerable progress has been made in improving our knowledge of conservation needs for freshwater fishes since the last State of Biodiversity report (see Impson et al. 2002). The main areas of progress have been in revising the conservation status and conservation genetics of indigenous fishes, the biology and ecology of Clanwillian sawfin *Barbus serra*, the identification of priority rivers for alien fish eradication and quantifying the impacts of smallmouth bass *Micropterus dolomieu* and rainbow trout *Oncorhynchus mykiss* in the province. This report summarises progress and achievements in these fields and identifies areas that should be focused on over the next five years.

In addition, substantial freshwater fish monitoring work has been undertaken since 2003, thanks to a formal partnership between Department of Water Affairs and Forestry (DWAF) and CapeNature (CN) established that year to provide impetus to the River Health Programme in the Western Cape Province (WCP). Substantial capacity was developed allowing in excess of 200 river monitoring sites to be established. Progress in this field is described in Chapter 10.

CONSERVATION STATUS

The conservation status of South Africa's fishes was assessed in 2006 as part of an IUCN assessment of aquatic biota in southern Africa. The overall assessment is being finalized and will be published in 2007. The freshwater fish assessment of the WCP was undertaken by Dr Ernst Swartz and Mr Roger Bills (South African Institute of Aquatic Biodiversity (SAIAB)), Dr Jim Cambray (Albany Museum) and the author. Our approach was to assess both species and recognized genetically distinct populations that are

referred to as Evolutionary Significant Units (ESU's, term after Moritz 1994, in Roos 2004). The proposed conservation status of these fishes is shown in Table 1.

The assessment yielded substantial changes to the status of certain species as well as to the overall conservation status of WCP freshwater fishes. There were several reasons for this. Firstly, when the 1996 assessment was done by the author and Stewart Thorne (previously of CapeNature), neither assessors had undergone training on the correct application of the IUCN criteria, leading to incorrect interpretation of certain criteria (e.g. area of occupancy, number of locations). A good example of a species affected by this was the Breede River redfin *Pseudobarbus burchelli*, previously Endangered and now Near Threatened. Secondly, this time we included redfin ESU's, as these are strong candidates for being described as true species in the near future. Thirdly, criteria and the way they are applied have changed since the 1996 fish assessment. Fourthly, our knowledge of species distributions has improved substantially over the last 10 years as a result of more comprehensive river surveys across the province.

Prior to this assessment, the WCP had 18 indigenous freshwater fish species, 8 of which were endemic and 8 near endemics. The reason for the high endemism, centering on the Olifants-Doring River system (Figure 1), is the influence of the Cape Floristic Region (CFR), most of which is located in the WCP. The CFR has a remarkable freshwater fish endemism (16 of 19 species endemic, 86%), exceeding that of the plants (Impson *et al*. 2002). Of the 18 species indigenous to the WCP, four were Critically Endangered (CR), five were Endangered (EN), four were Vulnerable (VU), and two were Least Concern (LC). Only three species, chubbyhead barb *Barbus anoplus*, Cape kurper *Sandelia capensis* and moggel *Labeo umbratus* were considered safe!

This assessment covers 17 species (the Eastern Cape redfin *Pseudobarbus afer* is now restricted to the Eastern Cape), and includes six ESU's (all redfins). With the ESU's included as "species", the WCP has 23 indigenous freshwater fish species of which a remarkable 15 are endemic, six are near endemic and two are found elsewhere in South Africa and Namibia. Of the 23 species, five are CR, eight are EN, three are VU and three are NT (Figure 2). Only one species, the moggel is regarded as Least Concern. Three are data deficient species (Cape kurper, chubbyhead barb and Cape Galaxias *Galaxias zebratus*) as they are undergoing major taxonomic revision. Preliminary work on *G. zebratus* indicates that it is a species complex with several (potentially up to seven) new species present! Several of these "species" occur as highly restricted and impacted populations e.g. Twee River Cape Galaxias and it is likely that they will be listed in one of the highly threatened categories once the taxonomic status of *G. zebratus* is better known.

RESEARCH ON GENETICS AND BIOLOGY

CONSERVATION GENETICS

The CFR (which falls mainly within the WCP) has a unique freshwater fish fauna, which is relatively species poor (19 species) but has a high degree of endemism (16 species)(Impson et al. 1999). Ichthyologists have long suspected that the region is home to more fish species, as many currently described species show morphological differences between sub-populations and/or are found in two or more long-isolated river systems increasing the chances of allopatric speciation.

Work by Bloomer and Impson (2000) showed species level genetic differences between Berg River redfin *Pseudobarbus burgi* from the Berg and Verlorevlei rivers. Skelton (1986) had earlier noted significant morphological differences between these populations. These findings encouraged scientists from several institutions (University of Pretoria, CapeNature, SAIAB) to submit an ambitious project proposal for CFR freshwater fishes to the Table Mountain Fund (TMF) in 2001.

Table 1. Current and proposed conservation status of freshwater fishes of the Western Cape Province.

Key: CR = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern, DD = Data Deficient,* = endemic species to WCP. † *Pseudobarbus afer* in the WCP will be described as a new species. The original *P. afer* is currently listed as Near Threatened and will be restricted to the Eastern Cape Province.

Species (ESU's in brackets)	Distribution	Conservation status	
		Current	Proposed
Family: Austroglanididae			
**Austroglanis barnardi* Barnards rock catlet	Olifants River System (ORS)	CR	EN
**Austroglanis gilli* Clanwilliam rock catlet	ORS	VU	VU
Family: Cyprinidae			
* *Barbus andrewi* Whitefish	Berg & Breede River systems	VU	EN
Barbus anoplus Chubbyhead barb	Gourits & Orange River System		DD
* *Barbus calidus* Clanwilliam redfin	ORS	EN	VU
* *Barbus erubescens* Twee River redfin	ORS	CR	CR
Barbus serra Sawfin	ORS	EN	EN
Labeo seeberi Clanwilliam sandfish	ORS	CR	EN
Labeo umbratus Moggel	Gourits, Orange, Sundays systems		LC
Labeobarbus capensis Clanwilliam yellowfish	ORS	VU	VU
**Pseudobarbus cf. afer* (Forest redfin)	Coastal rivers of southern Cape		NT
Pseudobarbus asper Small-scale redfin	Gourits and Gamtoos River System	VU	EN
* *Pseudobarbus burchelli* Breede River redfin	Breede River System	EN	NT
* *Pseudobarbus cf. burchelli* (Tradou redfin)	Tradou River of Breede system		CR
* *Pseudobarbus cf. burchelli* (Heuningnes redfin)	Heuningness River System		CR
**Pseudobarbus burgi* Berg River redfin	Berg River System	CR	EN
**Pseudobarbus cf. burgi* (Verlorenvlei redfin)	Verlorenvlei River System		CR
* *Pseudobarbus phlegethon* Fiery redfin	ORS	EN	EN
* *Pseudobarbus cf. phlegethon* (Doring River redfin)	ORS		CR
**Pseudobarbus tenuis* Slender redfin	Gourits River System	EN	NT
**Pseudobarbus cf. tenuis* (Keurbooms redfin)	Keurbooms River System		EN
Family: Galaxiidae			
Cape Galaxias *Galaxias zebratus*	Widespread in Cape Floristic) Region	NT	DD
Family: Anabantidae			
Cape kurper *Sandelia capensis*	Widespread in Cape Floristic) Region		DD

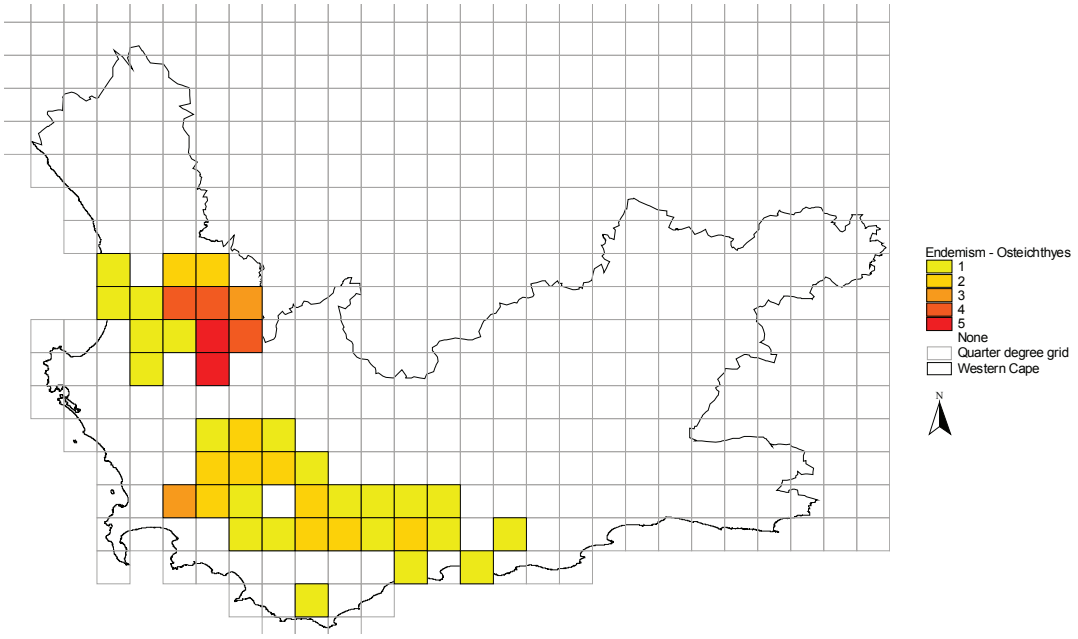

Figure 1. Numbers of endemic freshwater fish species per quarter degree square in the Western Cape province. The Cederberg area of the Olifants-Doring system is the major hotspot.

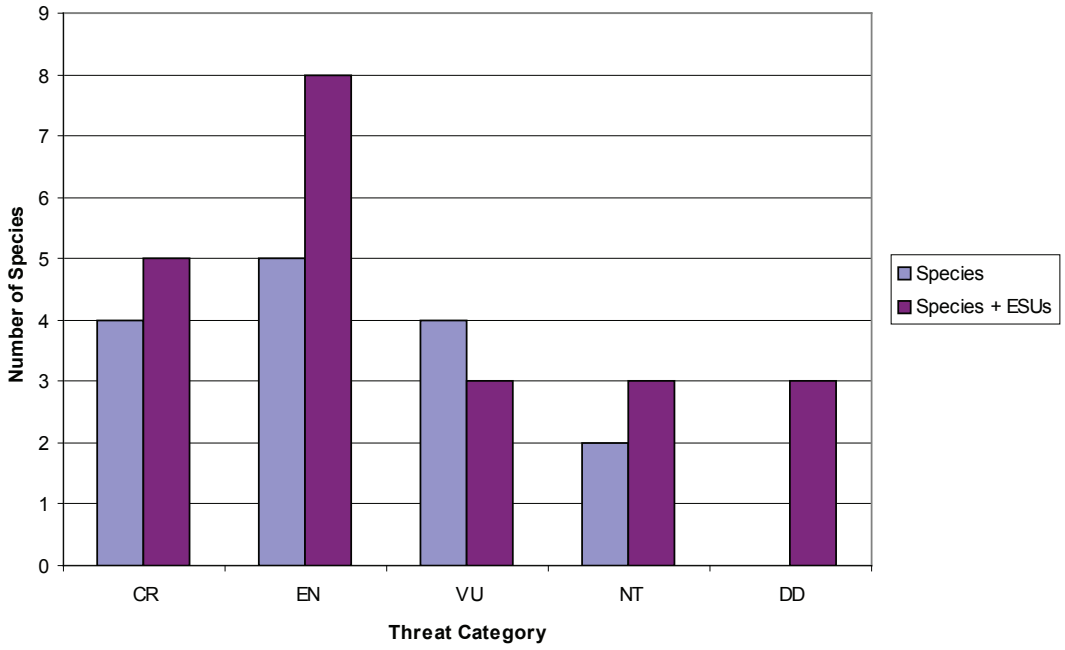

Figure 2. Conservation status of WCP freshwater fishes in 2002 (in blue) and proposed, including ESUs (in purple). CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened and DD = Data Deficient.

Thanks to substantial funding from TMF, three post-graduate researchers at the University of Pretoria undertook recently completed projects on the Cape Galaxias, Cape kurper and the redfin group *Pseudobarbus*. Heidi Roos (2004) and Roelien van Niekerk (2004) completed their MSc degrees on *Sandelia* and Cape Galaxias respectively while Ernst Swartz (2005) completed his PhD on the redfins.

The aim of these studies was to better understand the phylogeography of each fish group and identify if ESU's were present for conservation management purposes.

These projects yielded valuable results showing that several ESU's, that may each be an undescribed species, exist within *G. zebratus*, *S. capensis* and the six existing species of *Pseudobarbus*. Especially the *G. zebratus* complex is clearly not one species, and is the subject of a major taxonomic revision by specialists at the National Institute of Water and Atmospheric Research (New Zealand), the Albany Museum and SAIAB.

Dr E. Swartz compiled a list of unique lineages of freshwater fish in the CFR (Appendix 1) from these studies. Lineages that require special conservation attention due to their highly restricted distributions and/or small population sizes are shown in Table 2.

Table 2. Freshwater fish lineages requiring special conservation attention in the CFR.

Species	Distribution
B. erubescens	Twee River (Cederberg)
Tradouw redfin	Tradouw's Pass & above Barrydale (Breede System)
Verlorenvlei redfin	Verlorenvlei River, mainly below from Het Kruis bridge
Heuningnes redfin	Upper Heuningnes and Kars rivers
Krom *P. afer*	Upper Krom River near Joubertina
A. barnardi	Heks, Noordhoeks rivers and few in the Thee River
Doring redfin	Known from one locality each in the Breekkrans and Driehoeks rivers
Keurbooms redfin	Kransbos, Diep and Langbos rivers
Verlorenvlei galaxias	Known from Redelinghuis bridge, Verlorenvlei River
Diep galaxias	Malmesbury and lower down in the Diep River – Cape Flats?
Agulhas galaxias	Known from two localities in the Heuningnes and one in the Nuwejaars rivers
Kouga/Krom galaxias	Upper Krom and Kouga rivers

BIOLOGY AND ECOLOGY OF CLANWILLIAM SAWFIN

Mr Bruce Paxton, a PhD student at the University of Cape Town, undertook extensive fish surveys on the Olifants and Doring rivers during this period to determine the distribution and movement patterns of large indigenous cyprinids in these rivers (Paxton et al. 2002) and their implications for dam location and design (Paxton 2004). Mr Paxton is studying the biology and ecology of Clanwilliam sawfin in the Driehoeks-Matjies River System, with special focus on ecological flow requirements for this once widespread species. This information is seen as invaluable when recommending environmental flows, as well as for guiding management decisions such as rehabilitating river habitat and re-introducing sawfin, where appropriate.

ALIEN FISH MANAGEMENT

IDENTIFICATION OF PRIORITY RIVERS IN THE CFR FOR ALIEN FISH ERADICATION

1. THE SEVERITY OF THE ALIEN FISH INVASION AND THE NEED FOR RIVER REHABILITATION

The rivers of the CFR are home to unique communities of fish, aquatic invertebrates and riparian plants. Many of the CFR's freshwater fish species are threatened, primarily by invasive alien fishes and habitat degradation.

The effect of invasive alien fishes has been particularly severe with more than 15 invasive alien fish species recorded, including several highly detrimental species (e.g. carp *Cyprinus carpio*, smallmouth bass, sharptooth catfish *Clarias gariepinus* and rainbow trout)(see Impson et al. 2002). Many rivers are invaded, including mainstreams and tributaries. Surveys have repeatedly revealed that in river areas invaded by smallmouth bass, indigenous fishes (especially small species and juveniles of larger species) are absent or very uncommon. Predation on fish is not the only impact alien fish have on indigenous biota; they impact on other biotic components such as aquatic macro invertebrates and can alter habitat structure, which in turn affect ecosystem functioning.

To date, few, if any, permanent eradication actions of alien fishes have been undertaken in South African rivers, despite the urgency for such work. The success of the Working for Water Programme in South Africa has shown that it is possible to rehabilitate rivers previously invaded by alien vegetation. International studies, mainly in the U.S.A., have shown too that it is possible to permanently eradicate invasive alien fishes from parts of a river using piscicides and thus rehabilitate the river (e.g. Finlayson et al. 2000, Cailteux et al. 2001). South Africa needs successful eradications of invasive alien fishes, with the objective of restoring or rehabilitating biodiversity and ecosystem functioning, as well as to improve the conservation status of highly threatened fishes.

2. TABLE MOUNTAIN FUND PROJECT

The Cape Action for People and the Environment (C.A.P.E.) has provided the springboard for the development of projects to rehabilitate rivers infested with invasive alien fishes. In 2002, the Table Mountain Fund approved a project to quantify the impact of smallmouth bass on indigenous biota of a Cederberg stream and identify the priority rivers in the CFR for alien fish control programmes.

The project was completed in 2005, and through a series of expert workshops, identified the following:

- criteria for evaluating the most suitable rivers for alien fish control,
- a final list of the most promising rivers for alien fish eradication, and
- the most suitable method for eradicating alien fishes.

2.1 IDENTIFICATION OF RIVERS THAT HAVE POTENTIAL FOR ALIEN FISH CONTROL

A specialist workshop was held at SAIAB in Grahamstown on 23 October 2003 to identify rivers requiring alien fish control and criteria by which they should be evaluated to determine a final list of rivers for specific interventions.

The meeting was attended by freshwater ichthyologists and conservation managers that have expert knowledge on freshwater fish in the CFR. The participants were Paul Skelton (Managing Director: SAIAB),

Jim Cambray (Albany Museum), Anton Bok (fish consultant, ex Eastern Cape Nature Conservation), Roger Bills (freshwater fish curator: SAIAB), Ernst Swartz (SAIAB), Tom Barry (manager Gamkaberg Nature Reserve) and the author.

The specialists focussed on rivers within the Baviaanskloof, Cederberg and Gouritz Biodiversity Initiatives. These protected area networks have been identified as priorities for conservation action in the CAPE programme. It is important to note that the rivers listed below do not represent all the rivers infested with invasive alien fishes in these areas or within the CFR itself. Specialists agreed that, due to cost and time limitations, rivers for follow-up field evaluation should be limited to a maximum of seven for each area. Choice of rivers was influenced by recent genetic research on CFR freshwater fishes. Rivers chosen are listed in Table's 3-5.

2.2 IDENTIFICATION OF CRITERIA FOR ASSESSING RIVERS

The following criteria were identified as important for judging the suitability and appropriateness of rivers for alien fish eradication work. The criteria were grouped into five categories, namely biological, land-use, social, physical and logistical.

Biological category:

The key criteria identified were:

- biological diversity, including genetic diversity (e.g. unique lineages) of indigenous fishes;
- threatened and endemic fish and other aquatic species in study area;
- nature and status of alien fish invasion;
- nature and status of alien plant invasion, if present; and
- population sizes of indigenous fishes.

The most appealing rivers in this category would be those with high indigenous fish diversity, including threatened and endemic species and / or unique lineages. The riparian zone of the river and its catchment should not be invaded or have a low alien plant invasion. The alien fish invasion should be restricted to those species that can be effectively eradicated.

Table 3. Rivers selected with motivations in the Baviaanskloof Conservation Corridor.

River	Indigenous fish	Alien fish*	Alien Vegetation	River condition	Rehabilitation Distance	Weir/barrier	Land status †
Groot-kloof	1 sp	Bass	None	excellent	1 km	causeway	ECNC
Wit	2 spp	Bass, BT	None	excellent	5 km	?	ECNC
Baviaans-kloof	2 spp	Bass, BT, SC	Moderate (WFW)	Moderate to good	15 km	causeways	ECNC
Krom	2 spp	Bass	Moderate		?	Clear dams	ECNC, Pvt
Sepree	1 sp	Bass	Moderate	good	5 km	?	ECNC
Braam / Skrik	3 spp	Bass	Little		1 km	?	Pvt conser-vancy

Table 4. Rivers selected with motivations in the Greater Cederberg Biodiversity Corridor.

River	Indigenous fish	Alien fish*	Alien Vegetation	River condition	Rehabilitation Distance	Weir/ barrier	Land status†
Noord-hoek	6 spp	BT	negligible	V. good	?	no	Pvt
Jan Dissels	4 spp	SB	little	V. good	5-7 km	?	Pvt
Driehoek	4 spp	LB	little	V. good	7-10 km	no	CN, Pvt
Twee	2 spp	CY,CK, B	little	OK to V good	1-2 km (Heks)	no	CN, Pvt
Hex	5 spp ?	SB	negligible	Excellent	5-7 km?	no	Pvt
Tra Tra / Eselbank	5 spp?	SB	Little	OK to v. good	2-3 km	no	Pvt

Table 5. Rivers selected with motivations in the Gouritz Initiative.

River	Indigenous fish	Alien fish*	Alien Vegetation	River condition	Rehabilitation Distance	Weir/ barrier	Land status†
Paradys	4 spp	RT	no	excellent	3-5 km	no	CN
Swart-berg	?	BrT	no	excellent	3-5 km	B	CN
Asagaai-bosch	4 spp	MT, BT	no	good	1-3 km	no	CN, Pvt
Nels	6 spp	SY, BT, LB, C	Yes	good	3-5 km	no	CNC, Pvt
Cango	1 sp	RT	no	excellent	3-5 km	weir	CN
Langtou	3 spp	BT	?	good	?	weir	Pvt

* Where B = bluegill, BT = banded tilapia, BrT = brown trout, C = carp, CK = Cape kurper, CY = Clanwilliam Yellowfish, LB = Largemouth bass, MT = Mozambique tilapia, RT = rainbow trout, SB = smallmouth bass; † ECNC = Eastern Cape Nature Conservation Board, CN = CapeNature and Pvt = Privately owned.

Land-use category:

The key criteria identified were:

- land ownership;
- presence of in- or off-stream dams; and
- physical instream impacts due to land-use (e.g. Inter-Basin Transfers (IBT's), canalized rivers, regulated rivers).

Lesser criteria were:

- catchment-associated impacts (extent of land clearing, flow reduction activities);
- probability of future threats (e.g. land earmarked for development);
- groundwater abstraction; and
- accessibility of river (education versus interference).

The most appealing rivers in this category would be those within protected areas, with no upstream dams or IBT's in the catchment and with no or insignificant physical in-stream impacts.

Social category:

The key criteria in this category are regarded as:

- potential for co-operation with land-owners;
- conflicting interests (e.g. for water, angling for alien fishes);
- potential for river reserves (conservancies, natural heritage sites, rates benefits);
- job creation and capacity building; and
- eco-tourism attraction of rehabilitated river.

The most appealing rivers in this category would be those flowing through privately owned land where the landowner is already committed to river and fish conservation initiatives or has a strong potential to become committed. In these rivers, the alien fishes targeted for eradication are of no or little value to anglers. The eradication effort will result in significant job creation through the construction of barrier weirs and the rehabilitated river will be of significant value in terms of eco-tourism (e.g. snorkeling trails, flyfishing for indigenous fishes).

Physical category:

The key criteria identified were:

- presence of existing weirs and their appropriateness as barriers;
- presence and suitability of natural barriers (e.g. waterfalls);
- type and cost of structure needed as a barrier;
- habitat complexity of invaded river (e.g. backwaters, braided reaches, palmiet *Prionium serratum* beds); and
- distance of river that can be "saved".

Lesser criteria were:

- flow variability and does river flow change to sub-surface flow;
- impact of proposed barrier on migrating indigenous biota and the riverine ecosystem; and
- water chemistry.

The most appealing rivers in this category would be those with existing weirs or natural barriers that have invasive fishes above them, allowing effective eradication of such fishes without the addition of a barrier. Rivers that require small cheap barriers are priorities as are rivers where the eradication effort will "save" a long length of otherwise pristine river. Rivers confined to a single channel comprising riffles and pools are easier to rehabilitate than rivers with complex habitats.

Logistical category:

The key criteria identified were:

- cost of intervention;
- time required for complete eradication;
- cost benefit analyses (what we get out for the effort and cost involved);
- ease of access to eradicate fishes and construct barrier;
- current DWAF programme for constructing gauging weirs;
- existing structures as suitable barriers;
- % of river section under conservation;
- eradication methods needed for success; and
- project incorporated into existing or future management plans for river.

The most appealing rivers in this category would be accessible rivers in conservation areas that have been identified by DWAF as priorities for gauging weir construction. The eradication programme would preferably require a "once-off" application of an approved and easily obtainable piscicide.

2.3 IDENTIFICATION OF PRIORITY RIVERS FOR ALIEN FISH ERADICATION

During 2004, the author and a water engineer visited the rivers listed in Table's 3-5 and assessed their potential for alien fish eradication using the criteria listed above. On 9 and 10 December 2004, a second specialist fish workshop, on the above subject, was held at the offices of SAIAB in Grahamstown. The workshop was attended by the author, Sya Buthelezi (ex CapeNature), Sean Marr (Freshwater Research Unit, UCT), Roger Bills (SAIAB), Ernst Swartz (SAIAB), Rodger Smith (consultant, ex Eastern Cape Nature Conservation), Anton Bok (consultant, ex Eastern Cape Nature Conservation), Jim Cambray (Albany Musuem) and Denis Tweddle (SAIAB). The aim of the workshop was to identify a final priority list of rivers for alien fish eradication in the CFR based on the results of the fieldwork. At the workshop, participants deliberated over these priority rivers, using the selection criteria developed. The rivers listed in Table 6 were regarded as the most suitable for alien fish eradication in the areas surveyed.

2.4 USE OF PISCICIDES

After presentations by R. Bills (SAIAB) and the author (both certified piscicide practitioners), at the second specialist workshop described above, CFR fish specialists concluded that piscicides were the best fish eradication method currently available and could be safely used in South Africa's rivers and public dams provided that international best practice for piscicides use was followed and qualified piscicide applicators were used to supervise operations.

Table 6. Final priority list of rivers for alien fish eradication in three priority CAPE areas of the Cape Floristic Region. The number of indigenous species present in each river is shown in brackets.

Cedarberg	Gouritz	Baviaanskloof	Other
Noordhoeks (6) requires weir R275 000	Dorps (0)	Wit (2) requires weir R 290 000	ABI - Heuningness (3) requires weir R275 000
Twee (2)	Kleinkraaldoring (6) requires weir R250 000	Krom (2)	
Krom (1)	Paradys (2)	Bos (2-3)	
Rondegat (6)			
Tra Tra (4-6) requires weir R560 000			

3. CAPE PROJECT – PILOTING THE CONTROL OF ALIEN FISHES

This project is part of a Global Environment Facility (GEF) funded Invasive Alien Species Programme, a key implementing focal area of C.A.P.E. The aim of the Invasive Alien Fish component is to determine whether invasive alien fishes can be successfully eradicated from rivers that are priorities for conservation. Four rivers were selected from Table 6 for this project, namely the Krom, Rondegat and Twee rivers in the Greater Cederberg Biodiversity Corridor, and the Krom River in the Baviaanskloof Conservation Area

These rivers have been selected as they do not require the addition of an expensive barrier to prevent re-invasion by alien fish after the operation. The rivers are also not important for angling and are supported as candidates for invasive alien fish control by organised angling.

A key component of the project is an Environmental Impact Assessment to determine whether the preferred method of alien fish eradication is ecologically and socially acceptable. The EIA will be undertaken in 2007, allowing for alien fish eradication from approved rivers in early 2008 if approved by key decision makers and funders e.g. CapeNature, DWAF, Department of Environmental Affairs and Development Planning and the World Bank.

4. IMPACT OF RAINBOW TROUT AND SMALLMOUTH BASS IN THE CFR

These projects were initiated by CapeNature and involved close collaboration with the Freshwater Research Unit at UCT. Darragh Woodford studied the impact of rainbow trout in the upper Berg River for a BSc Honours thesis. This is the first time that the predatory impacts of rainbow trout have been quantified in inland waters of the CFR. The key findings, reported on in Woodford and Impson (2004) were:

"Impacts of alien rainbow trout (*Oncorhynchus mykiss*) on critically endangered Berg River redfin (*Pseudobarbus burgi*), Cape kurper (*Sandelia capensis*) and Cape galaxias (*Galaxias zebratus*) in the upper Berg River were investigated in terms of predation and spatial interactions. Trout stomach contents revealed that invertebrates dominate trout diet within the study area, whilst only six fish were recovered from 45 stomachs. The apparent low fish predation success of *O. mykiss* within the stream suggests a smaller impact compared to that of other alien piscivores such as bass (*Micropterus* spp.). *Galaxias zebratus* was the only fish species identified as prey, and its conservation status in the river requires

further investigation. Snorkelling surveys revealed that rainbow trout co-exist with *S. capensis* and adult *P. burgi* within pools on this river. *Galaxias zebratus* was absent from the pools, while *P. burgi* juveniles were segregated from rainbow trout along a depth gradient, possibly indicating avoidance behaviour. *Sandelia capensis* juveniles may avoid predation by hiding under rocks. Rainbow trout probably compete with indigenous fish for food and space in the pools, though this could not be quantified. The impacts of *O. mykiss* on all indigenous fauna within the river are likely to be density-dependent". (The critical factor, the length of time since invasion, is however not mentioned. This is critical as all you are now looking at is the result of the invasion. What was it before? Invading predators can drastically alter the species composition and behavior in a short period, often within months)

Darragh Woodford thereafter completed his MSc thesis on the impact of smallmouth bass on indigenous fishes in the Rondegat River, Cederberg. This work, part of the Table Mountain Fund project on alien fishes in the CFR, quantified the severe impact of smallmouth bass in this river. This is the first time this had been done in the CFR. The key findings, reported on in Woodford *et al.* (2005), were as follows:

"Fish populations in the Rondegat River, a mountain stream in the Olifants-Doring system in the Cape Floristic Region, South Africa were surveyed to assess the impact of predatory alien invasive smallmouth bass *Micropterus dolomieu* on the indigenous fishes. This was the first such attempt to quantify the predatory impacts of *M. dolomieu* within this region. The Rondegat River is home to five species of indigenous fish and is partially invaded by *M. dolomieu*, which has penetrated the lower river up to a waterfall barrier. Seasonal surveys were conducted at five sites above, and five below the waterfall. Physical habitat was measured at each site. Four of the five indigenous fish species were absent at bass-invaded sites. *Labeobarbus capensis*, while still present below the waterfall, appeared to have suffered a near-total loss of post-spawning recruits. Analysis of the physical habitat quality failed to explain the loss of indigenous species below the waterfall, although sedimentation may have increased the vulnerability of the catfish *Austroglanis gilli* to *M. dolomieu* predation by obliterating benthic cover. Consequently, predation by *M.dolomieu* was presumed to be the critical mechanism explaining the loss of indigenous fishes in the lower Rondegat River."

Mr Steven Lowe, a post doctoral student at SAIAB, is studying the ecological impact of smallmouth bass in the Witte River at Bainskloof. This work is different from previous studies on *M. dolomieu* in the WCP that have focussed on the impact of bass on indigenous fishes (see Christie 2002, Shelton 2003, Woodford 2005). Lowe's work looks at the impact of bass beyond this, by focussing on changes in the aquatic macro-invertebrate community and algal biomass. Preliminary unpublished results by Lowe show that:

- invasive *M. dolomieu* deplete indigenous fish and reduce the fish biomass;
- the invertebrate community composition is significantly altered at bass-invaded sites in a seasonally-dependent manner;
- differences between sites are not due to the environmental factors measured;
- the diversity of invertebrate taxa at invaded sites is significantly reduced although the abundances of some taxa (e.g. Baetidae and Simuliidae) are significantly increased;
- the drifting behaviour of Baetidae (the most numerous mobile invertebrates in the water column) is increased in invaded reaches (areas of reduced risk from predation);
- he size-class composition of some invertebrate populations is shifted towards larger individuals in bass-invaded reaches (probably due to decreased predation and/or increased speed of development); and
- algal density is significantly reduced in bass-invaded reaches from spring to late summer, but not in winter.

CONCLUSIONS AND RECOMMENDATIONS

THE FOLLOWING RESEARCH NEEDS ARE SEEN AS PRIORITIES FOR THE PERIOD 2007-2012.

- Determine the extent and severity of invasion of WCP rivers by sharptooth catfish.
- Determine the biology, ecology and rehabilitation requirements of Clanwilliam sandfish *Labeo seeberi*.
- Determine the biology, ecology and rehabilitation requirements of Berg-Breede whitefish *Barbus andrewi*.
- Undertake biodiversity management and recovery plans for all fish species listed as critically endangered and endangered.
- Quantify the recovery of biodiversity (fish, aquatic invertebrates, aquatic frogs) in rivers and dams after alien fishes have been eradicated.

DEVELOPMENTS THAT WILL AFFECT CONSERVATION MANAGEMENT OF INDIGENOUS FISHES OVER THE NEXT FIVE YEARS

Positive developments in the last decade that should lead to positive outcomes are:

- A major research effort in the last decade has improved our knowledge about which indigenous fishes we need to conserve, where and why.
- Major funders such as the Table Mountain Fund have generously supported freshwater fish research initiatives.
- Excellent collaboration is the present feature of freshwater fish research initiatives (e.g. CN, UCT, SAIAB, Albany Museum, University of Pretoria, CSIR) and monitoring work (CN, DWAF, CSIR).
- More regular and widespread fish monitoring has been undertaken, thanks to the establishment of the River Conservation Unit at CN. The RCU is funded by DWAF on a three yearly contract basis.
- There is strong agreement amongst key stakeholders that invasive alien fishes must be better controlled, and eradicated from priority areas.
- Most angling groups understand that alien fishes need to be controlled and confined to approved zones. An increasing number of prominent angling clubs in the WCP have a good working relationship with CN.
- CAPE, through the World Bank, has a dedicated project to pilot the control of invasive fishes in priority rivers. This is guided by a reference team with experts from CN, DWAF, UCT, SAIAB and two prominent and affected angling clubs. The project is about to embark on an ambitious Environmental Impact Assessment to determine the best fish eradication method, potential impacts of using it and how these can be best mitigated.
- CAPE Conservation Planning initiatives are now characterized by a strong willingness to integrate aquatic and terrestrial conservation needs, leading to more effective conservation plans.

Negative issues that need to be addressed are:

- There is a serious shortage of aquatic scientists and technicians in CapeNature dedicated to freshwater fish conservation issues. The author is the only dedicated fish scientist in the organization. A minimum of two ichthyologists supported by two technical officers is needed.

- There is a critical shortage of management staff in CN and DWAF dedicated to ecological issues of river management. The RCU is not a permanent solution to this problem. Efforts are ongoing to ensure that Catchment Management Agencies (CMA's), once these are established, will employ aquatic ecologists to provide ongoing management advice. In addition, CapeNature is to receive major additional funding for catchment management over the next three years from the WCP – it is essential that more aquatic scientists and aquatic extension staff are employed using these funds.
- Anglers and farmers still stock fish into rivers and dams without approval from CN. The recent illegal spread of sharptooth catfish in the south-western Cape has lead to the collapse of once outstanding bass fisheries (Impson 2006) and will add further predatory pressure on indigenous aquatic biota.
- Monitoring work on CFR fishes by CN and River Health personnel is defective in that voucher samples are not taken. This must be addressed in future, with voucher samples taken whenever appropriate (e.g. new sites, new records at sites).

ACKNOWLEDGEMENTS

Roger Bills, Ernst Swartz and Sean Marr are thanked for commenting on earlier drafts of this report.

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APPENDICES

Appendix 1. Priorities for the conservation of unique lineages of freshwater fish in the Western Cape Province. Adapted from information provided by E.R. Swartz of SAIAB.

CATEGORIES OF IMPORTANCE:

CRITICAL:	Unique species or lineage that only occurs in one catchment and under severe risk of extinction
HIGH:	Less than 3 populations left and under severe risk of extinction
MODERATE:	More generally under threat of extinction, but more than 3 populations exist and/or there are individuals surviving in the main stream/dams
LOW:	Safe for now with several secure populations

CRITICAL

B. erubescens	Twee River (Cederberg)
Tradouw redfin	Tradouw's Pass & above Barrydale (Breede System)
Verlorenvlei redfin	Verlorenvlei known from Het Kruis bridge and Redelinghuis bridge, therefore possibly between these localities as well
Heuningnes *P. burchelli*	Upper Heuningnes River known form only one locality
Krom *P. afer*	Known from only one locality between two waterfalls near Joubertina.

HIGH

A. barnardi	Heks, Noordhoeks and few in the Thee
Doring *P. phlegethon*	Known from one locality each in the Breekkrans and Driehoeks
Keurbooms *P. tenuis*	Kransbos, Diep and Langbos
Verlorenvlei galaxias	Known form Redelinghuis bridge
Diep galaxias	Malmesbury and lower down in the Diep River – Cape Flats?
Agulhas galaxias	Known from two localities in the Heuningnes and one in the Nuwejaars
Kouga/Krom galaxias	Upper Krom and Kouga

MODERATE

Berg *P. burgi*	Boesmans, Platkloof, Leeu, Hugo, Krom and Olifants
Olifants *P. phlegethon*	Rondegat, Boskloof, Noordhoeks, Thee and Oudste
Gamtoos *P. afer*	Braam, Witte, Ys, Baviaanskloof, Kabbeljous and Swart
Eastern *P. afer*	Coerney, Witte, Uie, Kaboega and Blindekloof

Western *S. capensis*	Langvlei, Verlorenvlei, Diep, Boesmans and Olifants Cederberg Galaxias
Cederberg *B. anoplus*	Possible unique populations in Marcuskraal-Kliphuis versus Oorlogskloof and possibly Breekkrans
Doring *A. gilli*	About 4 "populations"
L. seeberi	Breeding or attempting to breed in Oorlogskloof, Biedou and lower Doring. Seems to still be numerous in the mainstream
	Doring but without security for juveniles
B. andrewi	Brandvlei and Kwaggaskloof dams, Heks and reports from Riviersonderend and Bainskloof. Translocated to farm dams in the Breede and at least one dam in the Berg System
B. serra	Olifants gorge, Jan Dissels, Oorlogskloof, Biedou, Tra Tra and Driehoeks
L. capensis	Olifants gorge, Noordhoeks, Boskloof, Biedou, Driehoeks and introduced into the Twee
P. asper	9 populations in the Gourits, but is rapidly going extinct in the Groot (Gamtoos)
B. calidus	10 populations in the Cederberg
Olifants *A. gilli*	About 7 "populations" (possibly two forms in the Jan Dissels)

LOW RISK

Gourits *P. tenuis*	17 populations across the Gourits System
Breede *P. burchelli*	14 small populations in the Breede and one each in the Duiwenhoks and Goukou systems
Central *S. capensis*	> 20 populations across Breede, Gourits and coastal rivers
Central *Galaxias*	> 20 populations across Breede, Gourits and coastal rivers
Coastal *P. afer*	13 populations across several coastal systems
Central *B. anoplus*	Safe if they are not unique

CHAPTER 4

AMPHIBIANS

A.A. Turner & A.L. de Villiers

aaturner@cncjnk.pgwc.gov.za
atherton@cncjnk.pgwc.gov.za

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Executive Summary

From 2002 to 2007 there were several major advances in the knowledge of frogs and their conservation status in the Western Cape Province. Firstly, the Southern African Frog Atlas Project completed an atlas of frog distributions and conservation status for all frog species in South Africa, Lesotho and Swaziland. Secondly, there were a few key changes in the systematics of African frogs which has highlighted the unique assemblage of frog species, particularly in southern Africa. The result of this work is that we have better distribution, systematic and conservation data with which to assess the current state of frog conservation and crucially, allows us to plan appropriate monitoring and future conservation actions. Recent systematic and phylogeographic work is revealing higher levels of frog species richness and endemism for the Western Cape Province.

INTRODUCTION

The Western Cape Province (WCP) is home to a unique set of frogs which is demonstrated by the very high level of endemism – 27 of the 50 currently described species that occur in the WCP are not found anywhere else. This special situation is largely a result of the unique climate, diversity of landforms and vegetation (see Chapter 8 on Plants) and the long evolutionary history of the province.

As discussed in Chapter 5 on reptiles, this report treats amphibians separately from reptiles. In the WCP the only representatives of the amphibian class are frogs (Order Anura).

Amphibians have been widely recognized as useful indicator species because they have a bimodal life cycle as they are exposed to both aquatic and terrestrial environments. They have water permeable skins which easily absorb water soluble pollutants (e.g. Sparling *et al*. 2001, Blaustein *et al*. 2003). This, in combination with the recent discovery that there is a global decline in amphibian populations (e.g. Kiesecker *et al.* 2001, Pounds *et al*. 2001) has highlighted the importance of amphibians as environmental health indicators.

METHODS

General methods are covered in Chapter 2. Specific methods largely follow Baard & De Villiers 2002 with the following differences. Since the 2002 report by Baard & De Villiers there have been substantial contributions of good quality distribution data. The majority of these have come from two sources *viz*. the Southern African Frog Atlas Project (SAFAP) and the Species diversity, genetic diversity and conservation of the Cape Fold Montane Herpetofauna Project (CFMHP). The number of frog distribution records that we were able to draw on for the current report was 16 308 which represents a significant increase over the 6 595 records available for the 2002 report. An updated formal conservation assessment in the form of the Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (Minter *et. al*. 2004) frogs was used.

SYTEMATIC ACCOUNT

There have been a number of taxonomic changes regarding the amphibians of South Africa. This is due to a renewed interest in the group partially sparked by the SAFAP. In particular, the use of advertisement calls to identify frogs exposed at least two new frog species in the WCP. These changes are also the result of the application of modern molecular genetics techniques for assessing ancestral relationships. A complete list of the frog species known to occur in the WCP is given in Appendix 1. A list of those species that have undergone name changes is given in Appendix 2.

In the Western Cape Province, at least three new species have been discovered one of which one has been described (Turner *et al.* 2004), one species has been elevated from synonymy (Channing 2001) and another description is in preparation (Turner & Channing In prep.).

There have been two substantial revisions of the higher-level systematics of African frogs (Van der Meijden *et al.* 2005, Frost *et al*. 2006) and this has resulted in a number of name changes. For systematic clarity the old names are used in parentheses.

These revisions have revealed and highlighted both the uniqueness and diversity of the frogs in Africa and in particular the Southern African contribution to the "African Radiation" of frog species (see Van der Meijden *et al.* 2005).

DISTRIBUTION DATA

The SAFAP contributed enormously to the improvement of distribution data for frogs. This project alone added *circa*. 5,667 new frog distribution records for the Western Cape Province.

There are several species which require confirmation of their complete distribution ranges and taxonomic status. These cases may lead to some error in the current analysis of distribution and endemism but do, however, represent the best current knowledge.

ENDEMISM

As knowledge of the WCP frog fauna grows, so too does the number of species endemic to this province. This is due to several factors: the nature of the WCP environment which is very topographically complex, especially on a microhabitat scale; the long evolutionary history of the western Cape and the inaccessibility of many of the mountainous regions. It also a function of the fact that widespread species are not as easily overlooked.

Currently, 27 (54%) of the 50 known species are endemic to the Western Cape Province (see Table 1). This represents an increase in both the number of species recorded in the previous State of Biodiversity report (Baard & De Villiers 2002) and the number of endemic species viz. 22 of 44 (50%).

The pattern of endemism in the WCP is closely related to the Cape Fold Mountains with these mountains showing a higher diversity of endemic species than the lowlands (Figure 1). Within the Cape Fold Mountains, the south-western parts show the highest degree of endemism. This pattern is also in agreement with the pattern shown by endemic plants in the Cape Floristic Region (eg. Van Wyk & Smith 2001).

Table 1. Frog species endemic to the Western Cape Province.

Species	English name
Amietia (Afrana) vandijki	Van Dijk's river frog
Arthroleptella bicolor	Bainskloof moss frog
Amietophrynus (Bufo) pantherinus	western leopard toad
Arthroleptella drewesii	Drewes' moss frog
Arthroleptella landdrosia	Landdros moss frog
Arthroleptella lightfooti	Lightfoot's moss frog
Arthroleptella subvoce	northern moss Frog
Arthroleptella villiersi	De Villiers' moss frog
Breviceps acutirostris	strawberry rain frog
Breviceps gibbosus	Cape rain frog
Breviceps montanus	Cape mountain rain frog
Breviceps rosei	sand rain frog
Cacosternum capense	Cape caco
Cacosternum karooicum	Karoo Caco
Cacosternum platys	flat Caco
Capensibufo rosei	Cape mountain toad
Capensibufo tradouwi	Tradouw mountain toad
Heleophryne orientalis	eastern ghost frog
Heleophryne purcelli	Cape ghost frog
Heleophryne regis	southern ghost frog
Heleophryne rosei	Table Mountain ghost frog
Hyperolius horstockii	arum lily frog
Microbatrachella capensis	micro frog
Poyntonia paludicola	marsh frog
Strongylopus bonaespei	banded stream frog
Vandijkophrynus (Bufo) angusticeps	sand toad
Xenopus gilli	Cape platanna

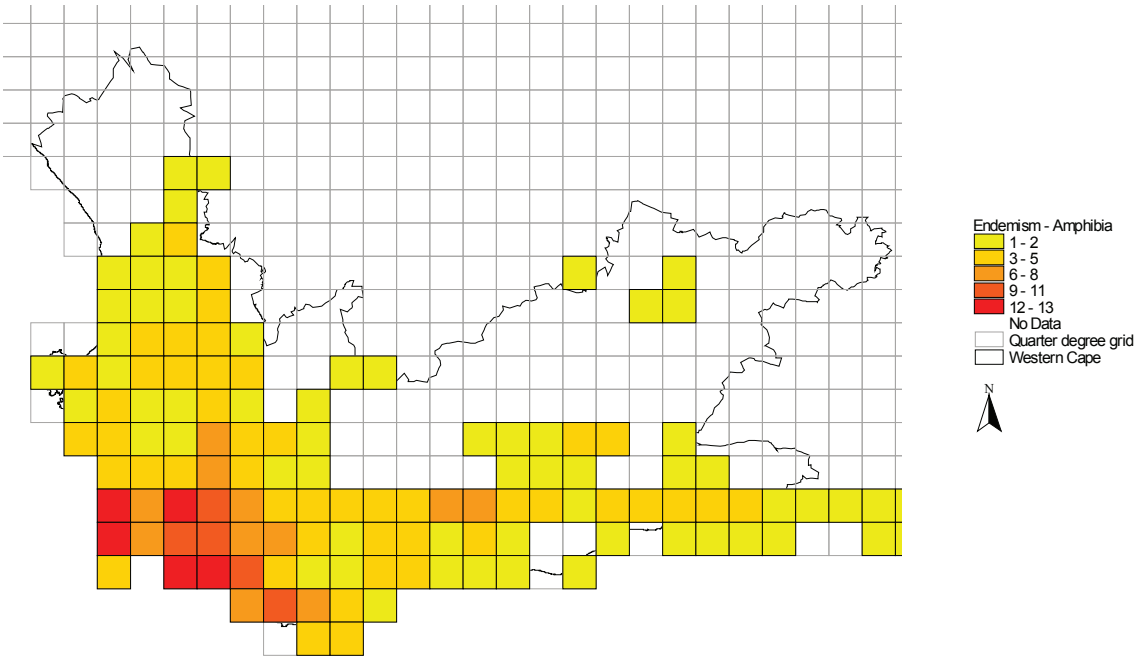

Figure 1. Numbers of endemic frog species per quarter degree square in the Western Cape Province.

CONSERVATION STATUS

Fortunately as part of the SAFAP, a complete revision of the conservation status of the South African frogs was undertaken in the Conservation Assessment and Management Plan for Southern African Frogs (CAMPSAF) (Harrison *et a*l. 2001). The results of this process were further refined, expanded and published in the Atlas and Red Data Book of the Frogs of South Africa, Lesotho & Swaziland (Minter *et al*. 2004). The result of this assessment was an increase in the number of threatened frogs. The numbers of frogs in each threat category is given in Figure 2. The degree to which this is as result of improved knowledge of our frog diversity as opposed to declines in populations is hard to assess given the limited frog population monitoring programmes. This is also partly due to the different criteria used to assess threat and the different threat categories used in the previous (Branch 1988) assessment compared to the most recent assessment (Minter *et al*. 2004). However the following can be said in an attempt to assess trends in conservation status. According to the authors of the species accounts, population declines are invoked for 7 of the 8 threatened species in the Western Cape Province.

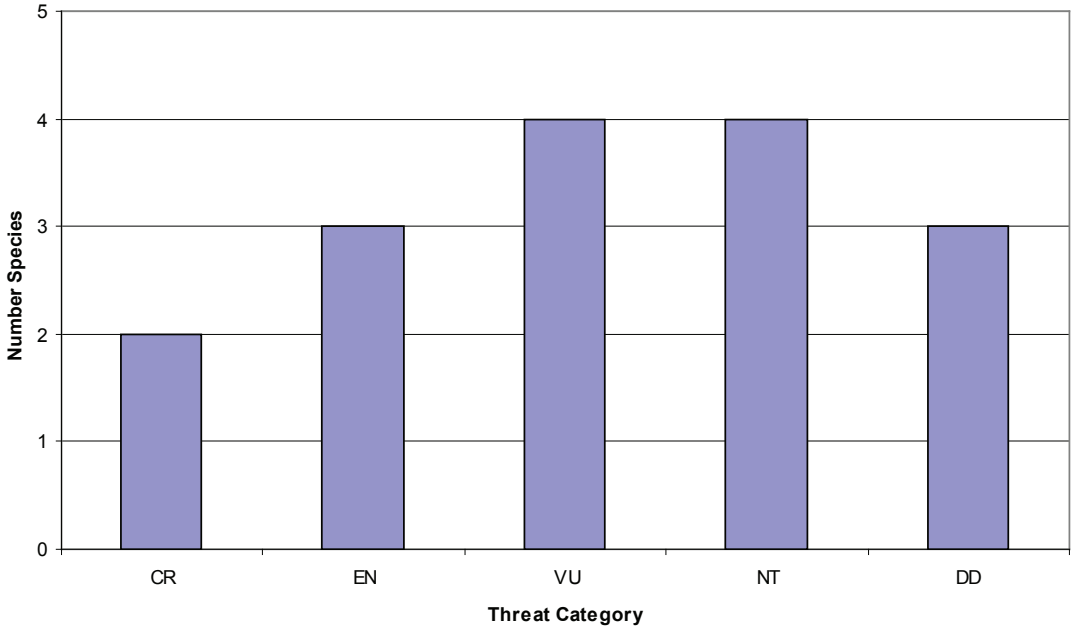

Figure 2. Conservation status of Western Cape Province frogs. CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened and DD = Data Deficient.

THREATENED SPECIES

CRITICALLY ENDANGERED

Heleophryne rosei

The Table Mountain ghost frog occurs in an area of less than 10km^2 on Table Mountain. Monitoring shows that it is still present in 6 streams (also see De Villiers 2004a). It requires perennial streams with clean water for breeding as ghost frog tadpoles may take more than 24 months to metamorphose. Although the entire distribution falls within a protected area, this frog is threatened by reservoirs changing water flow, water abstraction, invasive alien plant species and erosion. The potential longer-term threat of global climate change that is predicted to lead to reduced rainfall needs to be monitored and managed accordingly by ensuring sufficient water releases into the streams impacted by reservoirs.

Microbatrachella capensis

The micro frog is the most threatened lowland frog in the WCP (De Villiers 2004b). It has a restricted range and fragmented distribution comprising four geographically distinct populations. The total area of occupancy is less than 10km^2. It is endemic to particular fynbos wetlands in the coastal lowlands between Cape Town and Agulhas. Although 80% of this frog's previous habitat has been destroyed by development and associated impacts, at least 70% of this disappeared before the 1970's. About 50% of the remaining habitat is within protected areas.

ENDANGERED

Amietophrynus (Bufo) pantherinus

The western leopard toad is endemic to certain low-lying coastal areas ranging from the Cape peninsula to the Agulhas plain (De Villiers 2004c). It is threatened through most of its restricted and fragmented

range by development and habitat degradation. Although it is particularly threatened within the city of Cape Town, reasonable numbers of toads are still recorded on the Cape Peninsula and Cape Flats annually in this modified environment. Systematic surveys for this species in the eastern parts of its distribution range are required. The taxonomic status of this species requires further investigation.

Xenopus gilli

The Cape platanna is restricted to pristine fynbos wetlands in low-lying areas ranging from the Cape Peninsula to the Agulhas Plain. Development and habitat fragmentation have severely impacted the area of occupancy of this species resulting in a loss of more than 50% of its habitat (De Villiers 2004d). This applies particularly to the Cape Flats and Cape Peninsula where extensive urban development has taken place. Fortunately, large healthy populations occur in protected areas in the Table Mountain National Park and the Agulhas National Park.

Afrixalus knysnae

The Knysna leaf-folding frog continues to be of concern as distribution records are still very infrequent and its habitat is under active threat from development and alien invasive plant species. However it is possible that a large proportion of this frog's distribution may fall within protected areas. Further distribution and population data are required.

VULNERABLE

Cacosternum capense

CapeNature annual frog surveys and the SAFAP yielded a good number of observations of the Cape caco. Over 90% of these observations were from agricultural lands, previously Renosterveld where the species appears to be persisting (De Villiers 2004e). However many herbicides and pesticides are known to be lethal or cause damaging sub-lethal effects to frogs (*e.g.* Storfer 2003). If crop management procedures can be altered to use herbicides and pesticides that are not harmful then this species' continued existence may be bolstered. Research to examine the effect of agrochemicals on this species is required especially in the light of the persistence of this species despite the application of these agricultural chemicals. This is crucial, as this endemic lowland species is not well represented within the upland-biased protected area network of the Western Cape Province.

Breviceps gibbosus

The Cape rain frog is a terrestrially breeding frog that prefers areas with shrub vegetation predominantly on loamy soils or occasionally on moist sand overlying clay. Most of its habitat has been lost to habitat transformation and the remaining areas are fragmented (Harrison & Minter 2004). Despite this, many known populations appear healthy and the remaining distribution range is still relatively large. There does seem to be a limited ability of these frogs to adapt to urban gardens but it is not known whether these populations are viable.

Capensibufo rosei

Rose's mountain toad has a restricted distribution in the south-western Cape Fold Mountains (see De Villiers 2004f). It is a species of concern as it is largely restricted to high elevations and is potentially susceptible to the effects of climate change. Fortunately most of its distribution range falls within the protected area network.

Strongylopus springbokensis

The Namaqua stream frog occurs peripherally in the far northern parts of the WCP with its main range to the north. The distribution and population status of this species in the WCP is largely unknown and requires further survey work.

NEAR THREATENED

Arthroleptella lightfooti

Lightfoot's moss frog is restricted to the Cape Peninsula and most populations occur within protected areas. Genetic comparisons between the various populations are still underway but a preliminary comparison of calls from the populations does not indicate significant differences between the populations. There are several very good populations within the Table Mountain National Park. The threats to this species are too frequent fires and global climate change which may lead to drier conditions. The widely distributed nature of the populations of this species means the species as a whole is not in any immediate risk of extinction. The category of Near Threatened should be maintained for this species pending further information (Turner & Channing in prep.).

Arthroleptella landdrosia

It appears that the Landroskop moss frog is better viewed as a species complex which requires more work to fully understand the species boundaries. Fortunately, however, as the group is currently defined, the majority of the distribution range falls within the protected area network. However, one divergent population has a highly restricted range confined to the Houwhoek mountain and may be very susceptible to alien invasive plant species, too frequent fires and global climate change.

Poyntonia paludicola

The marsh frog is easily overlooked due to its extreme cryptic colouration and lives in very specific mountain seeps. The males are also only vocal in suitable conditions. This species does occur in several places, mostly within protected areas. It is however a habitat specialist and their habitat will be threatened by too frequent fires, alien invasive plants species and possibly by global climate change. It is a species well suited to population monitoring as it is likely to be sensitive to habitat and climate change. The species seems to have suffered a local extinction in Swartboskloof, Jonkershoek Nature Reserve as no observations of this species have been made at this locality since 2001 (Dr L. du Preez, North-West University pers. comm.).

Pyxicephalus adspersus

The giant bull frog only occurs peripherally in the Western Cape Province and has a very wide distribution outside this province. It is unlikely to be at risk of any threats that require intervention within the Western Cape Province.

DATA DEFICIENT

Amietia(Afrana) vandijki

Both known major localities for Van Dijk's river frog fall in protected areas. Research is still required to assess the degree of divergence between the Swartberg and Langeberg populations.

Cacosternum karooicum

The Karoo caco is easily overlooked as it is inactive and concealed for most of the year. The widely separated known localities suggest a large distribution range and more distribution information is required to properly understand this species' requirements. There are no known threats.

Arthroleptella drewesii

The known distribution range of Drewes' moss frog has been extended from the Kleinrivier mountains northwards to include the Babilonstoring mountains. It occurs in several protected areas on these mountains. It is not currently facing any direct threats but fire in these areas must be managed so that

they are neither too frequent (<10 year fire return intervals) or so extensive as to burn all the seepage areas on a mountain range.

Other species that require conservation assessment include *Arthroleptella subvoce*, an undescribed *Arthroleptella sp.* (Turner & Channing in prep.) and an undescribed *Capensibufo* (Tolley, Cherry & De Villiers in prep.).

HABITAT STATUS

Amphibian habitats continue to remain a concern. Amphibians are dependent on moist environments and many require good quality water for reproduction. The Western Cape Province is largely an arid region which places extreme demands on the limited sources of fresh water. CapeNature is in a key position as most of the sources of fresh water in the WCP are under its management. These sources are generally in the mountainous areas and are commonly referred to as mountain catchment areas (MCAs). These areas are generally well protected with regard to amphibians and their habitat. However there are three important threats to the amphibians in these areas:

- too frequent fires;
- rapid global climate change;
- difficult and large areas to manage.

These will be discussed in the section below on threats.

Amphibians are good environmental health indicators as they are sensitive to both terrestrial and aquatic changes. In particular, species in the genus *Heleophryne* (ghost frogs) require very clean, flowing and well-oxygenated water. They are intolerant of silt and chemical pollution. In addition, this water must be available perennially as the tadpoles may take two to three years to metamorphose. Thus these species will be useful for monitoring the long-term presence of good quality water.

The mountainous regions of the WCP provide the source for most of the clean water for the province. These areas have some degree of legal protection but are remote, vast and staffing is inadequate (Bigalke 2000). It is thus essential to maintain and expand their protection.

The situation in the lowlands is different. Much lowland wetland habitat has already been lost to agriculture and urban development (see Chapter 9). Very little of the remaining wetland habitat is protected in formally proclaimed conservation areas. However there are two initiatives currently underway to improve conservation in the remaining natural habitat. First, on the Agulhas plain the Agulhas Biodiversity Initiative (ABI) is planning for conservation in an area that supports micro frog, western leopard toad and Cape platanna populations. Second, CapeNature's Stewardship Programme is focussing on private land owners in the lowlands for entering into stewardship agreements where the land owners, in conjunction with CapeNature, undertake to manage the land according to conservation principles.

The Survey of Cederberg Amphibians and Reptiles for Conservation and Ecotourism (SCARCE) is collecting valuable amphibian distribution information in the sandveld lowlands of the west coast, an area that has historically received little attention.

An important improvement in the Kleinmond area is the initiation of a large Working for Water project to clear the alien vegetation between Kleinmond and Bot River, an area that contains important frog habitat. Another positive action in this area is the formal establishment of the Brodie Link Nature Reserve which will help to link Kogelberg Nature Reserves to the coast. Unfortunately however, housing development

between Rooiels and Kleinmond continues to degrade habitat in the interceding valley between Brodie Link and Kogelberg nature reserves.

THREATS

Loss of habitat continues to be the primary threat to the continued existence of threatened amphibians in the WCP. The most threatened taxa are those occurring in the lowlands, particularly along the coast. Pressure to develop undeveloped land for urban housing and related infrastructure continues. Notable amongst development applications that will impact large or important amphibian habitats are those developments proposed between Rooiels and Bot River in the Kogelberg Biosphere Reserve.

The legal status of the various parcels of land that make up the MCAs will be discussed in Chapter 9. Appropriate legal status for many mountain catchments is still lacking.

When fires are too frequent, vegetative cover is reduced too often and for too long to maintain appropriate shelter, moisture retention and breeding habitat for many of the wetland and terrestrial breeding frog species. Stream-breeding species survive fire better as the streams and their banks provide shelter from fires. Unfortunately many species do not breed in streams and thus will be negatively impacted by frequent fires.

Water abstraction may be a growing threat to amphibians too. This is a difficult threat to quantify in the short-term as there are likely to be significant lags in measurable frog population responses. It is thus crucial to have long-term frog monitoring in place to assess the impacts of water abstraction particularly if it will occur in mountain catchments. Water abstraction has reduced the extent of suitable breeding habitat for the Table Mountain ghost frog (*Heleophryne rosei*) as sections of stream are now reservoirs.

Global climate change is also likely to threaten certain frog species. Climate change models for the WCP indicate a general warming and drying trend (Midgely *et al*. 2005). As a water and moisture dependent group, this is likely to impact negatively on frogs. The drying trend is likely to be more severe in the lower-lying areas which is unfortunately where two of the most threatened species occur *i.e*. *Xenopus gilli* and *Microbatrachella capensis*. Higher rainfall is predicted for the mountains but this rainfall is likely to be less regular and extreme events are likely to be more frequent. Although high rainfall is expected to be positive for most frog species a less regular rainfall pattern may be detrimental. This is because most of the WCP experiences very dry, hot summers which are critical periods for the frogs to survive. If the onset of the winter rains is delayed for too long, this could prove fatal. On the other hand, if summers experience increased rainfall this could help the frogs survive the summers. However increased summer rain will lead to increases in the amount of grass and fuel for fire generally. This will make fires more intense and can shorten the fire interval which may have a negative effect on the frogs. The effects of global climate change are complex and it is difficult to predict the nett effect on frogs in the WCP. If the predicted effects of climate change are considered in conjunction with predicted land-use changes the threats are likely to be exacerbated (see Hannah *et al.* 2005). This makes the continuation and expansion of frog monitoring programmes all the more crucial.

INVASIVE ALIEN SPECIES

Baard & De Villiers (2002) noted that small populations of the painted reed frog, *Hyperolius marmoratus*, have been recorded from the Cape Flats. The painted reed frog was historically known to occur no further

west than Tsitsikamma near the eastern-most parts of the Western Cape (Passmore & Carruthers 1995). Since then, several additional populations have been recorded in the southwestern parts of the WCP. Several of these populations are large and expanding rapidly. Dorsal colouration patterns and analysis of genetic markers have shown that these populations have not spread from the closest natural populations in the eastern parts of the WCP but are recent introductions from further north (Tolley, Davies & Chown in review).

Painted reed frogs are well known for their ability to climb and can conceal themselves very well during the day which makes it relatively easy for them to be accidentally transported on nursery plants, bunches of bananas, in caravans *etc*. Their ability to tolerate moderate levels of desiccation (e.g. Withers *et al*. 1984) and direct sunlight make them more likely to survive long journeys than many other frogs. Taken together, these factors make the painted reed frog a successful local invasive species to the western parts of the WCP. The effects of this invasion are not known. Possible negative effects could be outcompeting the arum lily frog *Hyperolius horstockii* but this is unlikely as both species occur syntopically in the eastern parts of the WCP and Eastern Cape.

The invasion has spread very rapidly but has been largely restricted to artificial farm dams that maintain their water in the summer months when *Hyperolius marmoratus* prefers to breed. CapeNature is currently collaborating with the DST-NRF Centre for Invasion Biology based at the University of Stellenbosch to assess and monitor the invasion and will pursue research to understand and control the invasion as necessary.

The small population of *Amietophrynus (Bufo) gutturalis* in garden ponds in Constantia, Cape Town reported by Baard & De Villiers (2002) still exists although attempts to eradicate this population continue (see De Villiers 2006).

MONITORING

CapeNature continues to monitor the high priority threatened frog species: Table Mountain ghost frog (*Heleophryne rosei*), Cape platanna (*Xenopus gilli*), western leopard toad (*Amietophrynus (Bufo) pantherinus)* and micro frog (*Microbatrachella capensis*). CapeNature conducts annual monitoring of the breeding activity and habitat threats to these species. This allows appropriate recommendations to be made to landowners and managers.

The distribution and conservation status of the other Red Data Book listed species are monitored on an ongoing basis with a full systematic surveys every ten years.

In addition, CapeNature initiated a long-term frog monitoring project (LTFMP) in collaboration with the Declining Amphibian Task Force (DAPTF) in 2002. This was done as a direct result of recommendations flowing from the CAMPSAF and SAFAP.

The LTFMP is monitoring frog presence and abundance at a mid- and a high-altitude site. As frogs are sensitive to environmental change they are an ideal group to monitor the effects of climate change. The dramatic amphibian declines elsewhere in the world warrant particular attention to be paid to this group. That some of the global amphibian declines have been 'enigmatic' by lacking an obvious cause and have often occurred in natural and protected areas amplifies the need for such a monitoring programme in the WCP.

The results of the monitoring thus far do not indicate any dramatic changes in frog presence or abundance with the exception of an apparent local extinction of *Poyntonia paludicola* at the mid-altitude monitoring site at Swartboskloof in the Jonkershoek Nature Reserve. The continued presence of other populations of this species elsewhere does not indicate a general problem, but this species does warrant close monitoring.

LEGAL STATUS

Since the previous report, national legislation has been introduced to afford legal protection to threatened and protected species in terms of the National Environmental Management: Biodiversity Act (NEMBA) Act 10 of 2004. At the time of this report the only frog species proposed to be listed as a threatened or protected species in terms of the NEMBA is the giant bullfrog *(Pyxicephalus adsperus)* which is discussed above. This means that threatened frogs in the WCP are not currently afforded protection by this part of the national environmental legislation which may be seen to be contrary to the intention of this Act. Protection of these species in the WCP will continue to be afforded by the provincial ordinance as all amphibians are listed as protected species. National legislation to protect these species can be derived indirectly through National Environmental Management Act (NEMA) through the control of listed activities or through the application of Biodiversity Management Plans as contemplated in NEMBA. It is recommended that Biodiversity Management Plans be drawn up for all threatened frog species in the WCP to bolster their legal status.

CapeNature is currently revising the provincial ordinance and bringing it in line with the NEMBA.

PUBLIC AWARENESS

There has been relatively good press coverage of the plight of threatened amphibians in the WCP with particularly good coverage by the daily newspaper Die Burger. Although we are not aware of any studies that have assessed public awareness of frog conservation issues, many people are aware that the Table Mountain ghost frog, western leopard toad and micro frog are endangered. There is has been excellent public participation in monitoring western leopard toad populations on Cape Town's south peninsula.

However the public and even many biologists are not able to identify frog species. This problem is not unique to the amphibians and there is a general lack of taxonomic and systematic skills across most animal and plant groups. This is a problem that should be addressed at both national and provincial levels. This basic knowledge is the foundation for all other scientific knowledge and is critical for adequate conservation assessment and action. CapeNature is fortunate in having amphibian expertise on hand. However the museum with which we interact closely (Iziko South African Museum in Cape Town) does not have a herpetologist and struggles to provide an adequate service, which we value highly and is crucial.

In 2005 CapeNature in conjunction with the University of Stellenbosch and the Herpetological Association of Africa was privileged to host the 5th World Congress of Herpetology in Stellenbosch, the first time this event was held in Africa. This event brought together over 400 delegates from 50 countries to present the latest international herpetological research.

Greater awareness of the role of frogs as environmental health indicators is desirable. Coupled to this should be the message that frogs are, in general, sensitive to disturbance and pollutants. The role of frogs in providing ecosystem services, including functioning as environmental health indicators, needs to be quantified, valued and made known to a wider audience.

RESEARCH

CapeNature is committed to conserving biodiversity on a scientific basis and supports research that will further this aim. CapeNature is fortunate to have established several collaborative research projects with researchers from various tertiary education facilities and research organisations. CapeNature actively participates in CapeHerp which is a forum for the sharing of current herpetological research and activities in the WCP.

The SAFAP made an invaluable contribution to both the knowledge of where our frogs occur, their conservation status and revealed the presence of undescribed species. Atlassing projects of this nature provide a broad-based reference point for future studies and allow an assessment of changes over time and space to be made, which is essential for monitoring the state of our biodiversity.

The Greater Cederberg Biodiversity Corridor (GCBC) initiative of the Cape Action Plan for People and the Environment has lead to the development of the Survey of Cederberg Amphibians and Reptiles for Conservation and Ecotourism (SCARCE) which is obtaining and analysing amphibian and reptile (see Chapter 5 on reptiles) distribution records from across the GCBC planning domain to assess representivity and species turnover across this space. The data accumulated from this project will aid the targeting of sites for incorporation into our Stewardship programme and may generally inform land-use options in this area.

The CFMHP has also made a very significant contribution to fine-scale distribution data and will reveal a better understanding of the evolution of the Western Cape amphibian fauna through phylogenetic analyses. This in turn will inform planning that will allow for the continuation of evolutionary processes and identify key areas of diversity.

There are various systematic problems that have been identified through these large projects. Dr Tolley of the South African National Biodiversity Institute, Dr Cunningham of the University of the Free State and Dr Channing of the University of the Western Cape (UWC) are tackling these problems in conjunction with Andrew Turner and Atherton De Villiers of CapeNature, using current technology and analytical methods.

Surveys for the presence of the Chytrid fungus (*Batrachochytrium dendrobatidis*), which has been implicated in amphibian declines, in WCP frogs have been carried out by Dr Weldon, Dr du Preez and colleagues from North-West University and Dr Channing and Dr Hopkins of UWC. They found this fungus to be present in several frog species. However the presence of this fungus has not yet been associated with population declines in any WCP frog species.

The effects of agrochemicals on frog populations requires further research.

CAPACITY

Neither CapeNature nor South African National Parks employ a full-time herpetologist. Despite its limited research capacity, CapeNature is making a valuable contribution to the understanding of amphibian diversity, status and distribution in the WCP. Recent research indicates that yet more work is required to complete the species inventory for the province. Continued collaboration with external researchers is essential to maximise efficacy of conservation staff.

CONCLUSIONS AND RECOMMENDATIONS

There has been a major improvement in knowledge of frog species distributions since the 2002 report. Wisely, this new information was immediately interpreted to yield updated conservation status assessments for all South African frog species. Unfortunately the revised assessment has listed more species as threatened. This is partly the result of better knowledge and better assessment but it is also largely due to continued habitat transformation. Although there have been dramatic improvements in our knowledge of the distribution of frogs in the WCP there are still several gaps and more data collection is required in these areas.

More systematics research is needed to elucidate current problems and fully describe alpha frog diversity. Fortunately most of this work is already underway. Much more work is required to adequately assess and document the habitat requirements, thus informing conservation actions required for these species.

The CapeNature long-term frog population monitoring programme has been initiated at two montane sites and is running well. This monitoring must continue and should ideally expand to include a lowland site.

Several species require Population and Habitat Viability Assessments (PHVAs) *viz. Heleophryne rosei* and *Amietophrynus (Bufo) pantherinus*. These PHVAs should form part of comprehensive Biodiversity Management Plans (as provided for by NEMBA) to promote the continued existence of these species. A list of the conservation actions suggested in the previous report (Baard & De Villiers 2002), their implementation over the last five years and current recommendations for the conservation of the IUCN listed species is given in Table 2.

The Johannesburg Zoo has set up a captive frog breeding project to develop amphibian breeding skills. CapeNature supports the development of these skills but does not consider captive breeding a requirement for the conservation of threatened species in the WCP at this stage.

Global climate change is predicted to impact lowland frogs negatively, especially as this effect will act in concert with other threats. The effects of climate change on mountain living species is not easily predicted but if the overall effect is an increase in weather variability it is likely that the nett effect will be negative.

Table 2. Recommended conservation actions for Western Cape Province frogs

Taxon	2002 Recommendation	2002 Recommendations implemented?	2007 Recommendations
Heleophryne rosei Table Mountain ghost frog	All sites to be included in conservation action plan.	Conservation action plan not drafted.	Biodiversity management plan to be written and submitted in terms of NEMBA. Conduct PHVA.
Microbatrachella capensis micro frog	All sites to be included in conservation action plan.	Conservation action plan not drafted.	Biodiversity management plan to be written and submitted in terms of NEMBA.
Xenopus gilli Cape platanna	All sites to be included in conservation action plan.	Conservation action plan not drafted.	Biodiversity management plan to be written and submitted in terms of NEMBA. More distribution data should be collected.

Taxon	2002 Recommendation	2002 Recommendations implemented?	2007 Recommendations
Amietophrynus (Bufo) pantherinus Western leopard toad	Adequate buffer zones around, and connectedness of breeding localities are important aspects to be considered. Taxon undertakes mass migrations to breeding sites, and many succumb to road traffic.	Monitoring of breeding activity formalised and expanded but only on the Cape Peninsula and Cape Flats.	Biodiversity management plan to be written and submitted in terms of NEMBA. Conduct PHVA. More distribution data and locations of breeding sites east of the Cape Flats are required.
Cacosternum capense Cape caco	Status needs to be closely monitored.	On-going surveys conducted.	Susceptibility to agro-chemicals needs to be ascertained. Continue surveys.
Capensibufo rosei Cape mountain Toad	Little or no data on status.	Distribution and genetic data are still actively collected. Phylogenetic analyses nearly completed. Included in monitoring projects.	Continue to collect new distribution data in light of systematic changes. Continue monitoring.
Arthroleptella drewesii Drewes' moss frog	Little or no data on status. Ensure proper continued conservation management of habitat.	New distribution data collected. Phylogeographic analysis underway.	Specific actions to be published in conservation assessment (Turner in prep).
Arthroleptella lightfooti Lightfoot's moss frog	Little or no data on status. Ensure proper continued conservation management of habitat	New distribution data collected. Phylogeographic analysis underway.	Specific actions to be published in conservation assessment (Turner in prep)..
Arthroleptella landdrosia Landdros moss frog	Ensure proper continued conservation management of habitat.	New distribution data collected. Phylogeographic analysis underway.	Specific actions to be published in conservation assessment (Turner in prep)..
Breviceps gibbosus Cape rain frog	Threatened by development, agriculture, etc. but able to survive in urban areas.	No actions specified in 2002.	Identify private land with good populations and incorporate this species in management plans.
Poyntonia paludicola marsh frog	Little or no data on status. Indicator of mountain sponges and seeps.	New distribution data collected. Included in long-term frog monitoring programme.	Continue to collect new distribution data and continue to monitor populations.
Afrixalus knysnae Knysna leaf-folding frog		No actions specified in 2002.	Collect new distribution data and start population monitoring.
Strongylopus springbokensis Namaqua stream frog		No actions specified in 2002.	No special action required in the WCP.
Amietia vandijki Van Dijk's river frog		No actions specified in 2002.	Phylogeographic study required.

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APPENDICES

Appendix 1. Frogs species known to occur in the Western Cape with South African and IUCN Red List status.

Family	Scientific name	English name	SARDB Status	IUCN Status
Bufonidae	*Vandijkophrynus (Bufo) angusticeps*	sand toad	Null	Null
Bufonidae	*Vandijkophrynus (Bufo) gariepensis*	Karoo toad	Null	Null
Bufonidae	*Amietophrynus (Bufo) pantherinus*	western leopard toad	ENDANGERED (B1ab+2ab)	ENDANGERED (B1ab+2ab)
Bufonidae	*Amietophrynus (Bufo) pardalis*	eastern leopard toad	Null	Null
Bufonidae	*Amietophrynus (Bufo) rangeri*	raucous toad	Null	Null
Bufonidae	*Vandijkophrynus (Bufo) robinsoni*	paradise toad	Null	Null
Bufonidae	*Poyntonophrynus (Bufo) vertebralis*	southern pigmy toad	Null	Null
Bufonidae	*Capensibufo rosei*	Cape mountain toad	VULNERABLE (B1ab+2ab)	VULNERABLE (B1ab+2ab)
Bufonidae	*Capensibufo tradouwi*	Tradouw mountain toad	Null	Null
Heleophrynidae	*Heleophryne orientalis*	NULL	Null	Null
Heleophrynidae	*Heleophryne purcelli*	Cape ghost frog	Null	Null
Heleophrynidae	*Heleophryne regis*	southern ghost frog	Null	Null
Heleophrynidae	*Heleophryne rosei*	Table Mountain ghost frog	CRITICALLY ENDANGERED (B1ab+2ab)	CRITICALLY ENDANGERED (B1ab+2ab)
Hyperolidae	*Afrixalus knysnae*	Knysna leaf-folding frog	ENDANGERED (B1ab+2ab)	ENDANGERED (B1ab+2ab)
Hyperolidae	*Hyperolius horstockii*	arum lily frog	Null	Null
Hyperolidae	*Hyperolius marmoratus*	painted reed frog	Null	Null
Hyperolidae	*Kassina senegalensis*	bubbling kassina	Null	Null
Hyperolidae	*Semnodactylus wealii*	rattling frog	Null	Null
Brevicipitidae	*Breviceps acutirostris*	strawberry rain frog	Null	Null
Brevicipitidae	*Breviceps fuscus*	plain rain frog	Null	Null
Brevicipitidae	*Breviceps gibbosus*	Cape rain frog	VULNERABLE (B1ab+2ab)	VULNERABLE (B1ab+2ab)
Brevicipitidae	*Breviceps montanus*	Cape mountain rain frog	Null	Null
Brevicipitidae	*Breviceps namaquensis*	Namaqua rain frog	Null	Null
Brevicipitidae	*Breviceps rosei*	sand rain frog	Null	Null
Pipidae	*Xenopus gilli*	Cape platanna	ENDANGERED (B1ab+2ab)	ENDANGERED (B1ab+2ab)
Pipidae	*Xenopus laevis*	common platanna	Null	Null
Pyxicephalidae	*Amietia (Afrana) angolensis*	common river frog	Null	Null
Pyxicephalidae	*Amietia (Afrana) fuscigula*	Cape river frog	Null	Null
Pyxicephalidae	*Amietia (Afrana) vandijki*	van Dijk's river frog	Data Deficient	Data Deficient
Pyxicephalidae	*Arthroleptella bicolor*	Bainskloof moss frog	Null	Null
Pyxicephalidae	*Arthroleptella drewesii*	Drewes' moss frog	Data Deficient	Data Deficient
Pyxicephalidae	*Arthroleptella landdrosia*	Landdros moss frog	Near Threatened	Near Threatened
Pyxicephalidae	*Arthroleptella lightfooti*	Lightfoot's moss frog	Near Threatened	Near Threatened

Family	Scientific name	English name	SARDB Status	IUCN Status
Pyxicephalidae	*Arthroleptella subvoce*	Northern moss frog	Null	Null
Pyxicephalidae	*Arthroleptella villiersi*	De Villiers' moss frog	Null	Null
Pyxicephalidae	*Cacosternum boettgeri*	common caco	Null	Null
Pyxicephalidae	*Cacosternum capense*	Cape caco	VULNERABLE (B1ab+2ab)	VULNERABLE (B1ab+2ab)
Pyxicephalidae	*Cacosternum karooicum*	Karoo Caco	Data Deficient	Data Deficient
Pyxicephalidae	*Cacosternum namaquense*	Namaqua caco	Null	Null
Pyxicephalidae	*Cacosternum nanum*	Bronze Caco	Null	Null
Pyxicephalidae	*Cacosternum platys*	Flat Caco	Null	Null
Pyxicephalidae	*Microbatrachella capensis*	micro frog	CRITICALLY ENDANGERED (B2ab)	CRITICALLY ENDANGERED (B2ab)
Pyxicephalidae	*Poyntonia paludicola*	marsh frog	Near Threatened	Near Threatened
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bullfrog	Near Threatened	Null
Pyxicephalidae	*Strongylopus bonaespei*	banded stream frog	Null	Null
Pyxicephalidae	*Strongylopus fasciatus*	striped stream frog	Null	Null
Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	Null	Null
Pyxicephalidae	*Strongylopus springbokensis*	Namaqua stream frog	VULNERABLE (B1ab+2ab)	VULNERABLE (B1ab+2ab)
Pyxicephalidae	*Tomopterna delalandii*	Cape sand frog	Null	Null
Pyxicephalidae	*Tomopterna tandyi*	Tandy's sand frog	Null	Null

Appendix 2. Frogs occurring in the Western Cape for which the name has changed as per Frost *et al.* 2006.

Old Name	New Name
Bufo angusticeps	*Vandijkophrynus angusticeps*
Bufo gariepensis	*Vandijkophrynus gariepensis*
Bufo pantherinus	*Amietophrynus pantherinus*
Bufo rangeri	*Amietophrynus rangeri*
Bufo robinsoni	*Vandijkophrynus robinsoni*
Bufo vertebralis	*Poyntonophrynus vertebralis*
Afrana angolensis	*Amietia angolensis*
Afrana fuscigula	*Amietia fuscigula*
Afrana vandijki	*Amietia vandijki*

CHAPTER 5

REPTILES

A.A. Turner, A.L. de Villiers & E.H.W. Baard

aaturner@cncjnk.pgwc.gov.za
atherton@cncjnk.pgwc.gov.za
baarde@cncjnk.pgwc.gov.za

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Executive Summary

Both reptile systematics and conservation status are out of date and in need of urgent review. There are plans underway to revise both these aspects that are crucial to evaluating the state of reptiles in the Western Cape Province. There are several active research projects that are making significant contributions to the knowledge of Western Cape Province reptiles and these will help provide the basis for more rigorous conservation assessments in the future. A substantial number of new distribution records have been accumulated, particularly from formalized surveys. There is insufficient population monitoring of reptiles and this is an area that needs to be addressed.

INTRODUCTION

The 2002 Western Cape State of Biodiversity report dealt with reptiles and amphibians in one chapter (Baard & De Villiers 2002). This report treats each class separately and this approach is taken for several reasons:

1. the conservation status of South African amphibians has been formally revised within the last reporting period (Minter *et al.* 2004);
2. the conservation status of South African reptiles is outdated (Branch 1988) and has not yet been revised; and
3. the two classes, although often treated together, are biologically very different and interact with the environment and humans in very different ways (see Chapter 4 on Amphibians).

The Western Cape Province (WCP) is home to a large number of reptile species. One hundred and forty eight of the 411 species and subspecies (36%) found in South Africa are known to occur here. This is due to the diversity of habitats in the province and the ability of reptiles to utilise all these habitats.

The Southern African Reptile Conservation Assessment (SARCA) was launched in May 2005 to begin a revision of the distribution and conservation status of Southern Africa's reptile species, and will revise the outdated SA Red Data List for Reptiles and Amphibians (Branch 1988). This project is funded by the South African National Biodiversity Institute (SANBI) and run in collaboration with the Avian Demography Unit of the University of Cape Town.

METHODS

General methods are covered in Chapter 2. Specific methods largely follow Baard & and De Villiers 2002 with the following differences. Since the 2002 report by Baard & De Villiers *op. cit.*) there have been substantial contributions of good quality and in the form of recent distribution data. The majority of these have come from the species diversity, genetic diversity and conservation of the Cape Fold Montane Herpetofauna Project (CFMHP) and the Survey of Cederberg Amphibians and Reptiles for Conservation and Ecotourism (SCARCE). The number of reptile distribution records that we were able to draw on for the current report was 24 216 which represents a significant increase over the 13 754 records available for the 2002 report.

SYSTEMATIC ACCOUNT

As reported in the previous report (Baard and De Villiers 2002), systematic knowledge of the Western Cape Province's reptiles is still in an alpha taxonomic stage with new species still being discovered and described. In the WCP, at least 9 new species have been discovered and one has been described (Bauer *et al*. 2003). This mirrors the situation in southern Africa generally where current estimates put the total number of reptile species at 520 or more (Branch 2006), which represents a dramatic increase from the last published total of 397 (Branch 1998). A complete list of described reptile taxa known to occur in the WCP is given in Appendix 1.

A major advance has been the resolution of the Western and Eastern Cape dwarf chameleon (*Bradypodion*) taxonomy by Dr Krystal Tolley (SANBI) (Tolley & Burger, 2004, Tolley *et al.* 2004, Tolley *et al.* 2006a). We now have a much clearer view of the systematics of this group although we are still awaiting the description of several new species. In addition, we have also gained insight into the evolution of this group in conjunction with vegetation and climatic changes that are also likely to have been important drivers of evolution and speciation in other groups.

Advances have also been made in the notoriously difficult lacertid family with the phylogenetic work done by Sakwa Makhoka (University of Stellenbosch) focussing on the genus *Pedioplanis* (Makokha 2006). Greater insights into the Gekkonid genera *Afrogecko* and *Goggia* are being provided by the ongoing work by Kelley Whitaker (University of Pretoria) and Bill Branch (Bayworld).

The extensive revisionary work of Bauer and colleagues (see Bauer references in Branch 2006) is clarifying systematic relationships in several lizard groups *e.g. Pachydactylus, Pedioplanis, Scelotes, Nucras, Afroedura*.

The ability of field-based herpetologists to discover new species is unfortunately greater than the ability of systematists to name and describe them. However, co-operation on this task seems to be improving and is currently being addressed by a proposal to re-evaluate the systematics of Southern African reptiles (see Tolley *et al.* 2006b, Cunningham *et al.* 2006 and Branch 2006).

Given the dynamic state of reptile taxonomy, we include both subspecies and species in this chapter. Recent trends indicate that many described subspecies deserve specific status and to ignore the currently described subspecies may in effect be ignoring valid species. Some examples of this are *Pseudocordylus capensis robertsi*, *Acontias lineatus grayi,* and *Agama atra knobeli.*

Contrary to the previous report (Baard & De Villiers 2002), we do not provide summary statistics for the snakes, lizards and tortoises separately. Recent phylogenetic analyses (e.g. Vidal & Hedges 2004) show that the grouping commonly referred to as lizards (incorporating the families Scincidae, Lacertidae, Chameleonidae, Amphisbaenidae, Varanidae etc.) is paraphyletic with respect to snakes (families Colubridae, Elapidae, Viperidae etc.) and thus is not a justified systematic grouping.

DISTRIBUTION DATA

Distribution data have steadily accumulated since the previous report. Two major contributions to these data have come from the CFMHP and the Survey of Cederberg Amphibians and Reptiles for Conservation and Ecotourism (SCARCE). Further contributions are expected to start flowing in from the SARCA.

The current report is based on a total of 28354 reptile records for the Western Cape Province.

ENDEMISM

Reptile endemism in the WCP is lower in comparison to amphibians (see Chapter 4) and freshwater fish (see Chapter 3), but recent research indicates that the species richness has been underestimated as cryptic species continue to be revealed. These new species are generally endemic to the WCP and will increase the level of reptile endemism. Currently 23 of the 148 (16%) known indigenous reptile species and subspecies are endemic to the WCP (Table 1).

Table 1. Reptile species endemic to the Western Cape province.

Scientific Name	English Name
Psammobates geometricus	geometric tortoise
Bradypodion damaranum	Knysna dwarf chameleon
Bradypodion gutturale	Robertson dwarf chameleon
Bradypodion pumilum	Cape dwarf chameleon
Cordylus minor	dwarf girdled lizard
Cordylus niger	black girdled lizard
Cordylus oelofseni	Oelofsen's girdled lizard
Pseudocordylus capensis	graceful crag lizard
Pseudocordylus nebulosus	dwarf crag lizard
Afroedura hawequensis	Hawequa flat gecko
Afrogecko swartbergensis	Swartberg African leaf-toed gecko
Goggia braacki	Braack's dwarf leaf-toed gecko
Goggia microlepidota	small-scaled leaf-toed gecko
Australolacerta australis	southern rock lizard
Scelotes bipes	silvery dwarf burrowing skink
Scelotes gronovii	Gronovi's dwarf burrowing skink
Scelotes kasneri	Kasner's dwarf burrowing skink
Scelotes montispectus	Tableview dwarf burrowing skink
Bitis armata	southern adder

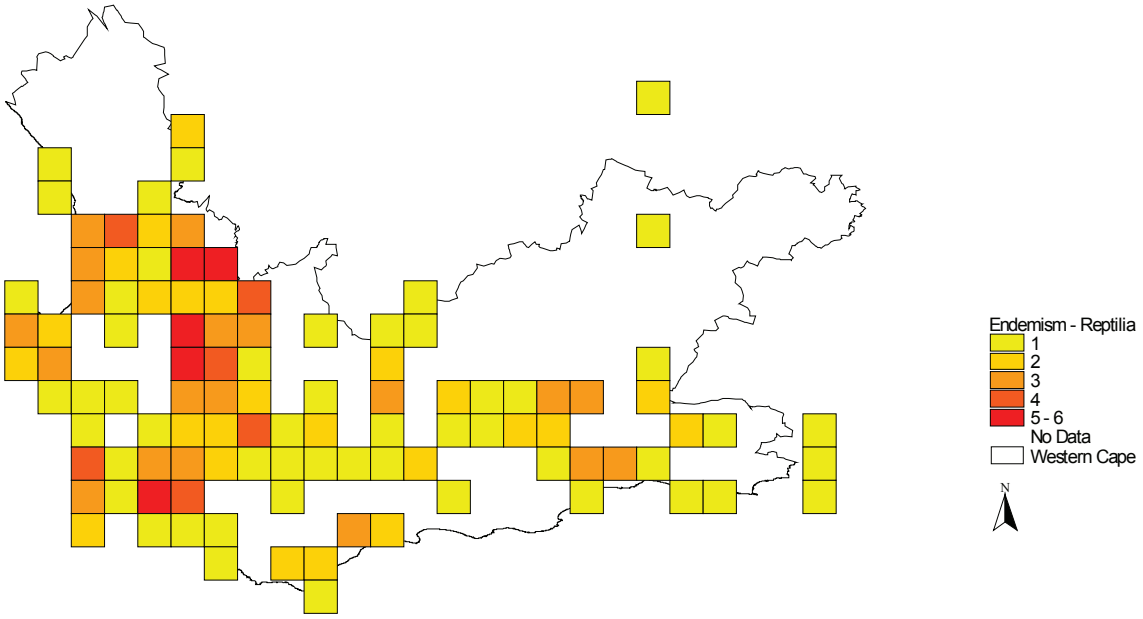

Figure 1. Map showing reptile endemism for each quarter degree in the Western Cape Province.

Although comprehensive geographic coverage of reptile occurrence of the WCP has not yet been achieved, Figure 1 indicates a general pattern of increased endemism over the Cape Fold Mountains. This is probably a result of the complex topography, old age and changing climate and vegetation patterns over time (e.g. see Linder & Hardy 2004).

CONSERVATION STATUS

The conservation status South African reptiles has not been formally assessed since the 1988 South African Red Data Book – Reptiles and Amphibians (Branch 1988). This situation is currently being addressed by the SARCA project. The SARCA is partially based on the concept of atlassing reptile species distributions, as done very successfully by the Southern African Bird Atlas Project (Harrison *et al.* 1997a, 1997b) and Southern African Frog Atlas Project (Minter *et al.* 2004). However it differs from these two atlas projects in that it does not aim, at least in its initial phase, to provide complete geographic coverage of Southern Africa. Instead it is taking a more directed approach by focussing on areas that are both historically neglected in terms of reptile distribution data and likely to house a representative diversity of reptiles. This approach is necessitated by the short time frame of SARCA Phase 1 relative to the enormity of the South African land surface and its incredible wealth of reptile diversity.

The conservation status of WCP reptiles is summarised in Figure 2. Each currently listed species' conservation status (Branch 1988 and IUCN 2006) is discussed below.

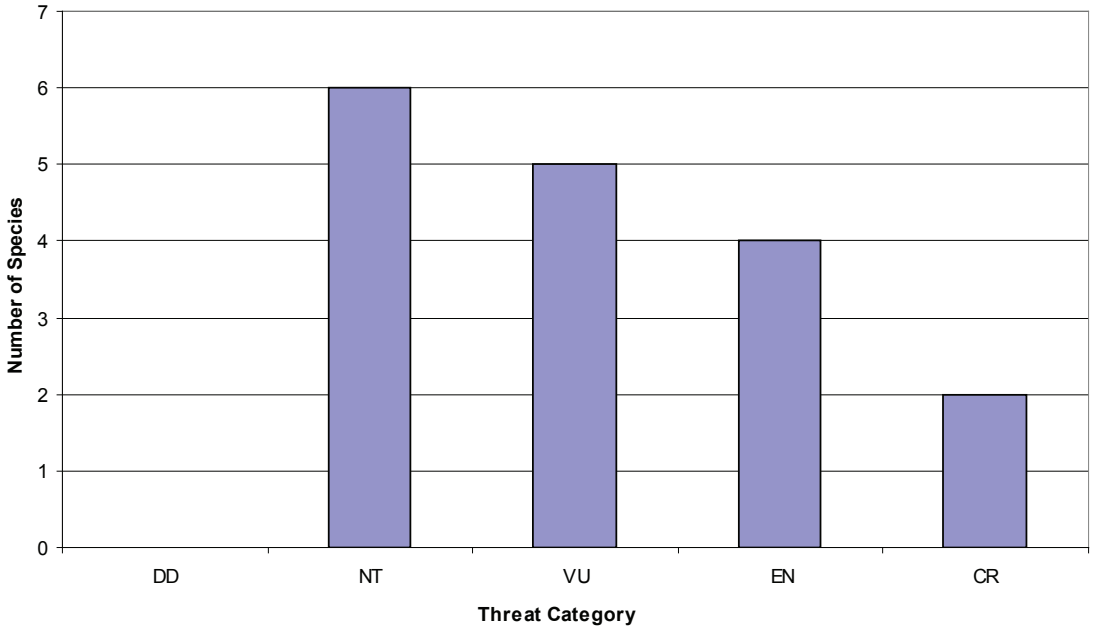

Figure 2. Number of reptiles species in each IUCN threat category. CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened and DD = Data Deficient.

CRITICALLY ENDANGERED

Eretmochelys imbricata and Dermochelys coriacia

Only the marine turtles *Eretmochelys imbricata* (hawksbill turtle) and *Dermochelys coriacia* (leatherback turtle) are currently classified as Critically Endangered. Both these species typically frequent warmer waters to the north and east of the WCP and do not breed on WCP shores. However, it is unknown to what extent they are making use of WCP waters as migratory routes or feeding sites. It is also unknown to what extent fishing activities in WCP marine waters affect these species. Several specimens, and mostly sub-adults, have washed up on WCP shores, usually following periods of rough seas or of significant upwelling events following strong off-shore winds causing ocean temperatures to drop significantly.

ENDANGERED

Psammobates geometricus

The conservation status of the geometric tortoise remains very concerning as suitable habitat for this species continues to be lost to agriculture. Remaining populations and natural lowland renosterveld habitats as reported by Baard (1997) remain under threat of being ploughed, overgrazed or otherwise disturbed. The extent of the habitat varies from small (<10 ha) to reasonably large (>1000 ha), but as population status surveys over the full extent of occurrence have not been systematically undertaken during this reporting period and thus population trends are currently unknown. During the reporting period, a very promising development has been the establishment of the CapeNature Stewardship Programme through which remaining Critically Endangered lowland habitats are being targeted for inclusion into the protected area network, as has been the case recently with the Voëlvlei- Conservancy, as recommended by Baard (1995, 1997). Several other habitats critical to the survival of isolated geometric tortoise populations, however, remain unprotected and there is a reasonably high risk of losing these if no proactive steps are taken.

In order to assess the conservation status of this species properly, a Population and Habitat Viability Assessment is urgently required. Recent analysis of aspects such as its breeding ecology and the potential

impact of more arid climatic conditions in future on fecundity and breeding success, may render this species highly vulnerable (Dr Retha Hofmeyr, UWC, pers. comm.). The geometric tortoise may be classified in a higher threat category pending further research into its general ecology and a proper analysis of its current extent of occurrence, area of occupancy and updated population status surveys.

VULNERABLE

Scelotes kasneri

Kasner's dwarf burrowing skink is rarely encountered which is probably due to its fossorial lifestyle. Recent records may indicate that its distribution is greater than previously known and may extend much further inland. The effect of increasing agriculture and urban expansion within the distribution range of this species should be examined before the conservation status of this species can be reliably determined.

Cordylus cataphractus

The armadillo lizard has a wide distribution and may be locally abundant but is very habitat specific and is restricted to certain areas with appropriate rock shelters. From a conservation status point of view and based on its wide distribution, relatively healthy population numbers and non-arable habitat, this species may be regarded as not threatened by any of the general threatening processes experienced in the region such as agricultural and urban expansion, coastal development or alien invasive species.

Legal commercial trade in this species is not permitted in the WCP. This species is in demand in the pet trade, and illegal collection of this species, despite strict legislation, appears to continue as witnessed by the arrest of several illegal collectors over the reporting period. Due to its gregarious lifestyle, the collection involves large numbers of individuals and may threaten small populations with local extinction.

Cordylus mclachlani

McLachlan's girdled lizard is now known to occur widely in the Cederberg mountains which are fortunately mostly within protected areas. The extent to which this species is traded is unknown. Based on its large distribution within these protected areas, its conservation status as Vulnerable should be reassessed.

Pseudocordylus nebulosus

The dwarf crag lizard was recently the subject of a focussed research project which also re-assessed its conservation status, including its extent of occurrence and area of occupancy (Costandius *et al.* 2006). These authors recommended keeping this species in the VU category as its range is larger than previously known, although still small at less than 11 km^2. This species occurs within a formally protected area as well, which renders it reasonably protected against the typical threats such as habitat destruction, invasive alien species, *etc.*, and following the recent assessment of its status (Costandius *et al.* 2006), a formal monitoring programme is being put in place to continue monitoring its status (see section on monitoring below). While Mouton and Van Wyk (1995) were concerned about the illegal collection of specimens from the type locality and the threat of uncontrolled, frequent wildfires bringing habitat change, this concern may be less now that a formal assessment of its habitat has shown that it occurs in a wider area which is not generally accessible to the public. Habitat change due to more frequent fires and a more arid climate in future (it appears to frequent damper habitats), however, cannot be excluded.

Lamprophis fiskii

The enigmatic Fisk's house snake appears to have a very wide distribution over the drier parts of the province. It is rarely encountered as is borne out by only four records in the CapeNature biodiversity

database and another two known records for the Western Cape Province (also see Baard 2000) probably due to its fossorial and nocturnal habits. However this species is still illegally traded and thus remains a concern. Its current listing as Vulnerable is still appropriate.

Bitis schneideri
The Namaqua dwarf adder is very seldom seen and occurs only peripherally in the WCP (only one WCP record in the CapeNature Biodiversity Database). This species is threatened by coastal mining activities north of the Olifants River and there is also a demand for this species in the pet trade.

NEAR THREATENED

Scelotes gronovii
Gronovi's dwarf burrowing skink occurs in an area with rapid ongoing habitat destruction. The impact of habitat transformation for potato farming, coastal town development and its associated threats along the West Coast is unknown.

Gerrhosaurus typicus
There has been an increase in the number of observations of the Namaqua plated lizard although significant field effort is required to establish the presence of this species. Its apparent scarcity is probably due to its largely fossorial habits and wariness.

Afroedura hawequensis
The Hawequa flat gecko occurs in fairly inaccessible sites although apparently at low density. More information is required to adequately asses the conservation status of this species and it should rather be regarded as Data Deficient at present.

Goggia microlepidota
The small-scaled leaf-toed gecko may be removed from this category and placed in the Least Concern category due to its relative abundance and large distribution range. Also, the generally inaccessible habitats it occupies, indicates that the category of Least Concern is more appropriate.

Lamprophis fuscus
Very little is known about the yellow-bellied house snake and very few recent observations have been made. It is undoubtedly rare throughout its range, but the reasons for this are unknown as it does not appear to be fossorial in habit.

RARE

Naja woodi
There has been an increase in the number of records of the black spitting cobra based on several recent and regular observations in the southern parts of its range (Jaco van Deventer, CapeNature pers. comm.). This is perhaps an anthropogenic effect of increased agricultural activities which may be modifying both habitats (drier, open areas) and food resources (rodents) to the favour of this species. This species appears to be reasonably abundant and widespread and should be assessed according to the current IUCN categories (IUCN 2001).

DATA DEFICIENT

This important category was not in use when the reptiles were last formally assessed for conservation status (Branch 1988). It is important to place those species in this category for which there is not enough

or the reliable information to assign a threat category. This serves to highlight those species for which more information is required but which will only be obtained by active research.

Species not currently listed that are candidates for listing in a threat category pending further information include *Scelotes montispectus, Cordylus oelofseni, Bitis armata, Psammophis leightoni.*

LEGAL STATUS

The legal status of reptiles in the WCP is currently being revised on two fronts. Firstly, at a national level, the National Environmental Management: Biodiversity Act (NEMBA) Act 10 of 2004 provides the legal protection through the listing of threatened and protected species and by the implementation of Biodiversity and Ecosystem Management Plans. The lists of threatened and protected species require review and the implementation of Biodiversity and Ecosystem Management Plans remains to be tested as a binding legal instrument but has the potential to be very useful.

Secondly, CapeNature is currently revising the provincial ordinance and bringing it in line with the NEMBA, and the policy on the conservation and utilisation on herpetofauna has been updated.

HABITAT STATUS

Reptiles are widely distributed across all habitats in the WCP including the marine environment, although the relatively cold waters of this coast are not ideal for the six marine species recorded from the WCP coast. Several habitats are especially important for reptile conservation. These include those habitats that are themselves threatened with destruction and those particular habitat features that are essential for certain requirements of reptiles *e.g.* specialised shelter needs.

In the first category, the reptiles restricted to the Sand Fynbos, Strandveld and Renosterveld vegetation types of the Cape West Coast are being placed under increasing pressure from coastal development, primarily for holiday housing, water abstraction, and in particular, centre-pivot irrigation agriculture, primarily for potato farming (see Chapter 9). These remnant patches of lowland fynbos types still harbour populations of Cape sand snakes (*Psammophis leightoni*). The conservation status of this species is uncertain as taxonomic clarity regarding species and distribution boundaries are still unclear despite the revision by Broadley (2002). However, this problem should be readily resolved using molecular techniques which are currently underway (Chris Kelly, Oxford University, pers. comm.).

In the second category there are several places that have special microhabitats necessary for the survival of several species. Exposed rocky koppies with abundant cracks and fissures are essential for many cordylid and other rupicolous lizard species. Fortunately, many areas of exposed Table Mountain Sandstone fall within conserved areas and this allows for extensive habitat conservation for those species reliant on these. Exposed sandstone and granite koppies are less well protected particularly in the northern and northwestern parts of the province, and there may be a particular concern as regards the isolated nature of and the increasing fragmentation of natural veld/habitat between koppies to act as efficient corridors for the movement of koppie-dwelling species such as the southern speckled padloper and several cordylid species.

A large proportion of lowland Renosterveld (both coastal and inland) vegetation types have been lost to agriculture. Fortunately, few reptiles are confined to this vegetation type, such as the geometric tortoise and a morphotype of dwarf chameleon (*Bradypodion sp.*) associated with this vegetation type.

Current research by Krystal Tolley and collaborators at SANBI is investigating the taxonomic status and distribution of this chameleon taxon and will be instructive when assessing its conservation status.

THREATS

Loss of habitat is likely to remain the greatest single threat to reptiles in the WCP. While more research is required on the habitat requirements for several reptile species, many species appear to occur at low densities indicating that relatively large areas are required to host viable populations. It is important that research be undertaken to test this hypothesis and to quantify the area required for at least several umbrella species (species whose protection serves to protect many co-occurring species).

Illegal collection for the pet trade remains a threat and constant vigilance by conservation agencies such as CapeNature is required to curtail this activity. Greater public awareness of this particular threat is the most effective way to counter it. Anyone seen catching a reptile in the WCP should be able to produce a valid permit from CapeNature allowing that activity, failing which, the incident should be reported to CapeNature or another law enforcement authority. The reporting of suspicious behaviour of visitors to the West Coast region, and the reporting of unusual room contents by cleaning staff of a local hotel have led to the arrest of illegal collectors of several species which are popular on the international pet trade. This public vigilance is to be commended.

Global climate change is predicted to have varying effects on the Western Cape Province (Midgely *et al*. 2005). One of these effects is a general drying and warming trend, especially in the western part of the province. Many southern African reptiles are well adapted to drier conditions and are not likely to be adversely affected by small increases in temperature and decreases in annual rainfall. However, there is a suite of cold-adapted, mountain summit-dwelling lizards that are likely to be negatively impacted. They occur at the summits because they are relictual populations from previously wider occurring populations during colder climates. If these species cannot tolerate the degree of warming they will go extinct as the mountain tops are the last thermal refuges. Other species, which may rely on good and regular rainfall to maintain and promote successful breeding events, may also be negatively affected. This may put certain species in the western parts of the province at risk.

INVASIVE ALIEN SPECIES

Fortunately the WCP is affected by few invasive alien species. The flowerpot snake (*Rhamphotyphlops braminus*) is continuing to spread via anthropogenic means as recent records continue to be derived from urban areas *viz*. Porterville. The effect of this small, fossorial, insectivorous species on local species and ecosystems is unknown. Containing its spread may be possible by more careful screening of soil used in nurseries but is unlikely to be a practicable solution. Controlling and containing escaped populations is also unlikely to be feasible due to their fossorial behaviour.

The taxonomy of the tropical house gecko (*Hemidactylus mabouia*/*mercatorius*) group of geckos is still being clarified, but the presence of geckos in this group in the WCP is undoubtedly the result of people translocating these geckos, probably unknowingly, in caravans, trailers, firewood *etc*. The spread of these geckos in the WCP is not well documented and is not the subject of active research. Historical occurrence records from Gordon's Bay and Simonstown (Brooke, Lloyd & De Villiers 1986) were not assessed in this reporting period. There has been a single record of this species at the Algeria campsite in the Cederberg

Wilderness Area. It is not known whether any of these populations are breeding successfully. The effect of this gecko on local species such as *Afrogecko porphyreus* is unknown but is unlikely to have a serious impact unless *Hemidactylus sp*. populations increase very significantly. Surveys in areas where *Hemidactylus* sp. are known to occur in the WCP should prove useful.

In the current reporting period Cape dwarf geckos (*Lygodactylus capensis*) were recorded as present and breeding for the first time in the Western Cape Province (De Villiers 2006). The number of records of Cape dwarf geckos in the WCP which are naturally indigenous to the northern and eastern parts of South Africa are increasing. This gecko has no reptilian ecological analogue in the WCP and is thus unlikely to displace any local reptile species. Its affect on other species or ecosystems is unknown.

MONITORING

Only the geometric tortoise has been the subject of population monitoring operations since the previous report by Baard and De Villiers (2002). These monitoring activities followed to some extent the monitoring protocol as recommended by Baard (1993), but effectively, since 1994, detailed studies and monitoring has only taken place at the Elandsberg Private Nature Reserve and Voëlvlei Nature Reserve populations and the fragmented Chelancé-Onderplaas-Hartebeestrivier population to the immediate West of Worcester in the Breede River valley (Eberle 2003). Subsequent to Baard's (1990) work on the Elandsberg population, intensive ecological studies, including habitat use and home range, feeding ecology, breeding and fecundity, and general population ecology and dynamics have been completed for this population by Dr Retha Hofmeyr and her research team from the University of the Western Cape (Hofmeyr pers. comm.). The Voëlvlei population has been monitored by the Waterval Nature Reserve staff. These data require detailed analysis and integration with that of the Elandsberg population to ascertain the population status of the combined area.

Plans to re-activate and repeat a population status survey of all remaining geometric tortoise populations and any new sites as identified by the CapeNature Stewardship Programme, unfortunately did not materialise because of budget constraints during the 2006-07 financial year. This will be re-visited in the 2007-08 financial year.

A plan has recently been developed to monitor the dwarf crag lizard (*Pseudocordylus nebulosus*), a high altitude, water-associated species (Costandius *et al.* 2006) which is likely to be sensitive to global climate change. The recommendations by Costandius *et al.* (2006) have been drafted into a formal population monitoring plan to be executed on a regular basis in order to keep track of this high-altitude, cold-adapted, melanisitc species

Except for the possibility to conduct a population status survey of the southern speckled padloper (*Homopus signatus cafer*), no other reptiles have been identified at this stage for focussed population monitoring.

PUBLIC AWARENESS

A pamphlet illustrating the tortoises of the WCP and their conservation issues was published during this reporting period. This pamphlet has been very well received and continues to make a useful contribution to the awareness of tortoises in the WCP.

CapeNature has regularly met with the Cape Reptile Club (CRC) and has established a successful working relationship with its members. Interaction with the CRC has covered issues ranging from legal matters, conservation principles to genetic conservation.

In the WCP members of the public occasionally encounter snakes on their properties and require to have them removed. Currently there are several private individuals permitted to catch these animals and release them in a suitable and safe natural environment. CapeNature has engaged with all interested and affected parties and is in the process of formalising these arrangements.

In 2004 a group of herpetologists from the Universities of Cape Town, Stellenbosch and Western Cape, and CapeNature formed CapeHerp, an informal association of people interested in herpetological research and conservation. CapeNature continues to be an active member of CapeHerp and provides input into directing herpetological research and activities.

In 2005 CapeNature in conjunction with the University of Stellenbosch and the Herpetological Association of Africa was privileged to host the 5th World Congress of Herpetology in Stellenbosch, the first time this event was held in Africa. This event brought together over 400 delegates from 50 countries to present the latest international herpetological research.

RESEARCH

In addition to the systematic research mentioned above, there have been university-led research projects including feeding, breeding and physiological health of tortoises; chameleon, skink *(Trachylepis)* and Cape grass lizard *(Chamaesaura anguina anguina)* reproductive biology, cordylid lizard distribution, behaviour and ecology; and Agama Phylogeography. Other research has focused on the behaviour and population biology of dwarf adders.

CAPACITY

The WCP is still fortunate to have herpetological expertise within its staff although none of the three authors is employed in the post of herpetologist. Herpetological expertise within South African National Parks and the SA Museum is lacking (see Chapter 4). CapeNature continues to be actively involved in herpetological research and reaps the rewards of conservation-directed research and information sharing through regular interaction with other herpetologists.

CONCLUSIONS & RECOMMENDATIONS

It is difficult to assess the change in the state of the WCP reptiles since the previous report, as the formal conservation assessment (SARCA) will only be completed in 2009. However, based on the information at hand, indications are that we have underestimated the level of reptile species richness and endemism. Fortunately, it appears that improving our knowledge of the distribution of the reptiles has resulted in larger known areas of occurrence for many species. However, it is also clear that there has been very significant destruction of natural habitats for reptiles. This often means that not only is there a reduction of suitable habitat, but that remaining suitable habitats become isolated and subsequently, dispersal

between these remnant vegetation patches becomes very hazardous or even impossible. Reptiles, and in particular snakes and chelonians, are easily killed by vehicles on roads and are also more vulnerable to predators when in exposed positions (Rosen & Lowe 1994, Bonnet *et al*. 1999, Dodds *et al*. 2004, Steen & Gibbs 2004).

Very little is known of the size of habitat required to support viable populations of each reptile species. Research elsewhere indicates that reptile species may require much larger areas for survival than previously suspected (Gibbons *et al.* 2000). Until more research into the spatial and habitat requirements of several threatened species have been done, a conservative approach in this regard may be appropriate.

It is clear that there is still much work to be done on the Western Cape Province's reptiles. This includes investigating the basic systematics, conducting distribution and population status surveys, completing conservation status assessments, researching basic habitat requirements, population biology and ecology, and assessing whether the current and future protected area network would be adequate to protect representative samples of the reptile fauna of this region. The SARCA will contribute significantly to updating the conservation status of the reptiles and bring the assessment in line with standardised IUCN methods.

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APPENDICES

Appendix 1. List of all reptile species and subspecies known to occur within the Western Cape province. Species introduced to the province are marked with an asterisk.

Family	Scientific name	English name	SARDB Status	IUCN Status
Agamidae	*Agama aculeata aculeata*	ground agama	Null	Null
Agamidae	*Agama anchietae*	Anchieta's agama	Null	Null
Agamidae	*Agama atra atra*	southern rock agama	Null	Null
Agamidae	*Agama atra knobeli*	southern rock agama	Null	Null
Agamidae	*Agama hispida*	spiny agama	Null	Null
Chamaeleonidae	*Bradypodion damaranum*	Knysna dwarf chameleon	Null	Null
Chamaeleonidae	*Bradypodion gutturale*	Robertson dwarf chameleon	Null	Null
Chamaeleonidae	*Bradypodion karrooicum*	Karoo dwarf chameleon	Null	Null
Chamaeleonidae	*Bradypodion occidentale*	Namaqua dwarf chameleon	Null	Null
Chamaeleonidae	*Bradypodion pumilum*	Cape dwarf chameleon	Null	Null
Chamaeleonidae	*Bradypodion ventrale*	southern dwarf chameleon	Null	Null
Chamaeleonidae	*Chamaeleo namaquensis*	Namaqua chameleon	Null	Null
Cheloniidae	*Caretta caretta*	loggerhead turtle	Vulnerable	Endangered (A1abd)
Cheloniidae	*Chelonia mydas*	green turtle	Vulnerable	Endangered (A2bd)
Cheloniidae	*Eretmochelys imbricata*	hawksbill sea turtle	Vulnerable	Critically Endangered (A1bd)
Cheloniidae	*Lepidochelys olivacea*	olive ridley turtle	Vulnerable	Endangered (A1abd)
Colubridae	*Amplorhinus multimaculatus*	many-spotted snake	Null	Null
Colubridae	*Crotaphopeltis hotamboeia*	herald snake	Null	Null
Colubridae	*Dasypeltis scabra*	common egg eater	Null	Null
Colubridae	*Dipsina multimaculata*	dwarf beaked snake	Null	Null
Colubridae	*Dispholidus typus typus*	boomslang	Null	Null
Colubridae	*Duberria lutrix lutrix*	common slug eater	Null	Null
Colubridae	*Lamprophis aurora*	Aurora house snake	Null	Null
Colubridae	*Lamprophis capensis*	Brown House Snake	Null	Null
Colubridae	*Lamprophis fiskii*	Fisk's house snake	Rare	VULNERABLE (A2cd, B1+2c)
Colubridae	*Lamprophis fuscus*	yellow-bellied house snake	Rare	LOWER RISK (Near Threatened)
Colubridae	*Lamprophis guttatus*	spotted house snake	Null	Null
Colubridae	*Lamprophis inornatus*	olive house snake	Null	Null
Colubridae	*Lycodonomorphus rufulus*	common brown water snake	Null	Null
Colubridae	*Lycophidion capense capense*	Cape wolf snake	Null	Null
Colubridae	*Philothamnus hoplogaster*	green water snake	Null	Null
Colubridae	*Philothamnus natalensis occidentalis*	eastern green snake	Null	Null
Colubridae	*Prosymna sundevallii sundevallii*	Sundevall's shovel-snout	Null	Null
Colubridae	*Psammophis crucifer*	cross-marked grass snake	Null	Null

Family	Scientific name	English name	SARDB Status	IUCN Status
Colubridae	*Psammophis leightoni*	forkmarked sand snake	Null	Null
Colubridae	*Psammophis namibensis*	Namib Sand Snake	Null	Null
Colubridae	*Psammophis notostictus*	Karoo Whip Snake	Null	Null
Colubridae	*Psammophylax rhombeatus rhombeatus*	spotted skaapsteker	Null	Null
Colubridae	*Pseudaspis cana*	mole snake	Null	Null
Colubridae	*Telescopus beetzii*	Namib tiger snake	Null	Null
Cordylidae	*Chamaesaura anguina anguina*	Cape grass lizard	Null	Null
Cordylidae	*Cordylus aridus*	Dwarf Karoo Girdled Lizard	Null	Null
Cordylidae	*Cordylus cataphractus*	armadillo girdled lizard	Vulnerable	Vulnerable (A2d)
Cordylidae	*Cordylus coeruleopunctatus*	blue-spotted girdled lizard	Null	Null
Cordylidae	*Cordylus cordylus*	Cape girdled lizard	Null	Null
Cordylidae	*Cordylus macropholis*	large-scaled girdled lizard	Null	Null
Cordylidae	*Cordylus mclachlani*	McLachlan's girdled lizard	Restricted	VULNERABLE (D2)
Cordylidae	*Cordylus minor*	dwarf girdled lizard	Null	Null
Cordylidae	*Cordylus niger*	black girdled lizard	Null	Null
Cordylidae	*Cordylus oelofseni*	Oelofsen's Girdled Lizard	Null	Null
Cordylidae	*Cordylus peersi*	Peers's girdled lizard	Null	Null
Cordylidae	*Cordylus polyzonus*	Karoo girdled lizard	Null	Null
Cordylidae	*Pseudocordylus capensis*	graceful crag lizard	Null	Null
Cordylidae	*Pseudocordylus capensis robertsi*	graceful crag lizard	Null	Null
Cordylidae	*Pseudocordylus microlepidotus microlepidotus*	Cape crag lizard	Null	Null
Cordylidae	*Pseudocordylus microlepidotus namaquensis*	Cape crag lizard	Null	Null
Cordylidae	*Pseudocordylus nebulosus*	Dwarf Crag Lizard	Null	Vulnerable (D2)
Crocodylidae	*Crocodylus niloticus*	Nile crocodile	Vulnerable	Null
Dermochelyidae	*Dermochelys coriacea*	leatherback sea turtle	Vulnerable	Critically Endangered (A1abd)
Elapidae	*Aspidelaps lubricus lubricus*	coral snake	Null	Null
Elapidae	*Hemachatus haemachatus*	Rinkhals	Null	Null
Elapidae	*Homoroselaps lacteus*	spotted harlequin snake	Null	Null
Elapidae	*Naja nivea*	Cape cobra	Null	Null
Elapidae	*Naja woodi*	black spitting cobra	Rare	NULL
Elapidae	*Pelamis platurus*	Yellow-bellied Sea Snake	Null	Null
Gekkonidae	*Afroedura hawequensis*	Hawequa flat gecko	Restricted	LOWER RISK (Near Threatened)
Gekkonidae	*Afrogecko porphyreus*	marbled leaf-toed gecko	Null	Null
Gekkonidae	*Afrogecko swartbergensis*	Swartberg African leaf-toed gecko	Null	Null
Gekkonidae	*Chondrodactylus angulifer angulifer*	giant ground gecko	Null	Null
Gekkonidae	*Chondrodactylus bibronii*	Bibron's gecko	Null	Null

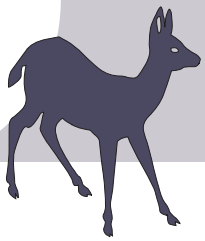
Family	Scientific name	English name	SARDB Status	IUCN Status
Gekkonidae	*Goggia braacki*	Braack's Dwarf Leaf-toed Gecko	Null	Null
Gekkonidae	*Goggia hewitti*	Hewitt's Dwarf Leaf-toed Gecko	Null	Null
Gekkonidae	*Goggia hexapora*	Cedarberg Dwarf Leaf-toed Gecko	Null	Null
Gekkonidae	*Goggia lineata*	striped leaf-toed gecko	Null	Null
Gekkonidae	*Goggia microlepidota*	small-scaled leaf-toed gecko	Restricted	LOWER RISK (Near Threatened)
Gekkonidae	*Goggia rupicola*	Namaqualand Dwarf Leaf-toed Gecko	Null	Null
Gekkonidae	*Hemidactylus mabouia**	Tropical house gecko	Null	Null
Gekkonidae	*Lygodactylus capensis**	Cape dwarf gecko	Null	Null
Gekkonidae	*Pachydactylus austeni*	Austen's gecko	Null	Null
Gekkonidae	*Pachydactylus capensis*	Cape gecko	Null	Null
Gekkonidae	*Pachydactylus formosus*	NULL	Null	Null
Gekkonidae	*Pachydactylus geitje*	Ocellated gecko	Null	Null
Gekkonidae	*Pachydactylus kladaroderma*	Thin-skinned Thick-toed Gecko	Null	Null
Gekkonidae	*Pachydactylus labialis*	Western Cape gecko	Null	Null
Gekkonidae	*Pachydactylus maculatus*	spotted gecko	Null	Null
Gekkonidae	*Pachydactylus mariquensis mariquensis*	Marico gecko	Null	Null
Gekkonidae	*Pachydactylus oculatus*	golden spotted gecko	Null	Null
Gekkonidae	*Pachydactylus purcelli*	western spotted gecko	Null	Null
Gekkonidae	*Pachydactylus weberi*	Weber's gecko	Null	Null
Gekkonidae	*Ptenopus garrulus maculatus*	common barking gecko	Null	Null
Gerrhosauridae	*Cordylosaurus subtessellatus*	dwarf plated lizard	Null	Null
Gerrhosauridae	*Gerrhosaurus flavigularis*	yellow-throated plated lizard	Null	Null
Gerrhosauridae	*Gerrhosaurus typicus*	Namaqua plated lizard	Rare	LOWER RISK (Near Threatened)
Gerrhosauridae	*Tetradactylus seps*	short-legged seps	Null	Null
Gerrhosauridae	*Tetradactylus tetradactylus*	common long-tailed seps	Null	Null
Lacertidae	*Australolacerta australis*	southern rock lizard	Restricted	NULL
Lacertidae	*Meroles knoxii*	Knox's desert lizard	Null	Null
Lacertidae	*Meroles suborbitalis*	spotted desert lizard	Null	Null
Lacertidae	*Nucras lalandii*	Delalande's sandveld lizard	Null	Null
Lacertidae	*Nucras livida*	Karoo sandveld lizard	Null	Null
Lacertidae	*Nucras tesselata*	striped sandveld lizard	Null	Null
Lacertidae	*Pedioplanis burchelli*	Burchell's sand lizard	Null	Null
Lacertidae	*Pedioplanis laticeps*	Cape sand lizard	Null	Null
Lacertidae	*Pedioplanis lineoocellata pulchella*	spotted sand lizard	Null	Null
Lacertidae	*Pedioplanis namaquensis*	Namaqua sand lizard	Null	Null

Family	Scientific name	English name	SARDB Status	IUCN Status
Lacertidae	*Tropidosaura gularis*	Cape mountain lizard	Null	Null
Lacertidae	*Tropidosaura montana montana*	common mountain lizard	Null	Null
Leptotyphlopidae	*Leptotyphlops gracilior*	slender thread snake	Null	Null
Leptotyphlopidae	*Leptotyphlops nigricans*	black thread snake	Null	Null
Leptotyphlopidae	*Rhamphotyphlops braminus**	flowerpot snake	Null	Null
Pelomedusidae	*Pelomedusa subrufa*	marsh terrapin	Null	Null
Scincidae	*Acontias lineatus grayi*	striped legless skink	Null	Null
Scincidae	*Acontias lineatus lineatus*	striped legless skink	Null	Null
Scincidae	*Acontias litoralis*	coastal legless skink	Null	Null
Scincidae	*Acontias meleagris meleagris*	Cape legless skink	Null	Null
Scincidae	*Scelotes bipes*	silvery dwarf burrowing skink	Null	Null
Scincidae	*Scelotes caffer*	Cape dwarf burrowing skink	Null	Null
Scincidae	*Scelotes gronovii*	Gronovi's dwarf burrowing skink	Restricted	LOWER RISK (Near Threatened)
Scincidae	*Scelotes kasneri*	Kasner's dwarf burrowing skink	Restricted	VULNERABLE (A2c)
Scincidae	*Scelotes montispectus*	NULL	Null	Null
Scincidae	*Scelotes sexlineatus*	striped dwarf burrowing skink	Null	Null
Scincidae	*Trachylepis capensis*	Cape skink	Null	Null
Scincidae	*Trachylepis homalocephala*	red-sided skink	Null	Null
Scincidae	*Trachylepis occidentalis*	western three-striped skink	Null	Null
Scincidae	*Trachylepis sulcata sulcata*	western rock skink	Null	Null
Scincidae	*Trachylepis variegata variegata*	variegated skink	Null	Null
Scincidae	*Typhlosaurus caecus*	Cuvier's blind legless skink	Null	Null
Testudinidae	*Chersina angulata*	angulate tortoise	Null	Null
Testudinidae	*Geochelone pardalis*	leopard tortoise	Null	Null
Testudinidae	*Homopus areolatus*	parrot-beaked tortoise	Null	Null
Testudinidae	*Homopus boulengeri*	Karoo padloper	Null	Null
Testudinidae	*Homopus femoralis*	greater padloper	Null	Null
Testudinidae	*Homopus signatus cafer*	southern speckled padloper	Restricted	LOWER RISK (Near Threatened)
Testudinidae	*Homopus signatus signatus*	Namaqua speckled padloper	Null	Lower Risk (Near Threatened)
Testudinidae	*Psammobates geometricus*	geometric tortoise	Endangered	Endangered (A1ac, B1+2c)
Testudinidae	*Psammobates tentorius tentorius*	tent tortoise	Null	Null
Testudinidae	*Psammobates tentorius trimeni*	Namaqua tent tortoise	Null	Null
Testudinidae	*Psammobates tentorius verroxii*	Bushmanland tent tortoise	Null	Null
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Null	Null
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	Null	Null
Viperidae	*Bitis arietans arietans*	puff adder	Null	Null

Family	Scientific name	English name	SARDB Status	IUCN Status
Viperidae	*Bitis armata*	Southern Adder	Null	Null
Viperidae	*Bitis atropos*	berg adder	Null	Null
Viperidae	*Bitis caudalis*	horned adder	Null	Null
Viperidae	*Bitis cornuta*	many-horned adder	Null	Null
Viperidae	*Bitis rubida*	Red Adder	Null	Null
Viperidae	*Bitis schneideri*	Namaqua dwarf adder	Vulnerable	Vulnerable (A2cd)
Viperidae	*Causus rhombeatus*	common night adder	Null	Null

CHAPTER 6

MAMMALS



PH Lloyd
lloydp@cncjnk.pgwc.gov.za

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Executive Summary

The Western Cape Province, and to a lesser extent the Cape Floristic Kingdom, have suffered disproportionately large biodiversity losses due to these areas being occupied by European settlers long before other regions in the country which resulted in a local loss of megaherbivores and many of the smaller medium-to-larger sized herbivores, as well as many of their predators, such as lions, spotted hyaenas, cheetahs, and wild dogs. The loss of the megaherbivores, albeit probably occurring in relatively low densities, begs many questions of their role in ecosystem functioning. Reintroduction of locally extinct species therefore needs to be undertaken at a scale where none of the endemic species is likely to suffer. This report indicates the mammalian species which occurred historically and those which still occur naturally in the Western Cape, particularly those that are endemic to the region, as well as the recently revised conservation status of all these species, and highlights changes since the previous report of 2002. It also points out gaps in our knowledge and suggests priorities for future actions.

INTRODUCTION

As previously reported (Lloyd 2002), both the Western Cape Province (WCP), and the Cape Floristic Kingdom (CFK), most of which is encapsulated by the WCP, are generally regarded as having low mammalian biodiversity values when compared with the rest of South Africa. In real terms, however, this is misleading, due to the extremely high mammalian diversity in the rest of the country, and is seen in better perspective when compared with other temperate parts of the world. Western Europe, for example, which is roughly ten times the size of the WCP, has roughly the same number of mammalian species.

The State of Biodiversity report for mammals published in 2002 was originally intended to reflect the status quo as it existed in 2000, but in fact reflected the status as of early 2002. The current report reflects the situation as of the end of 2006, five years since the data used for the 2002 report. This report will merely highlight the changes that have taken place in the interim and the reader is thus advised to consult Lloyd (2002) for greater detail.

METHODS

Since the last report scientific names have been revised according to the most recent systematic revision of South African mammals (Bronner *et al*. 2003, Skinner and Chimimba 2005). This has taken cognisance of some of the latest molecular systematic evaluations as well as revisions of some of the more traditional systematic methods.

Also subsequent to the last report further published distributional data have become available (Avery, Avery & Palmer 2005). Currently 29 051 mammalian records have been entered into the institutional database. These comprise records of varying spatial precision, ranging from point data (precise to the nearest second) through to quarter-degree square resolution.

SYSTEMATIC ACCOUNT

The systematic references in the previous report have in the interim been supplemented by at least three major additions to the South African mammofaunal literature, each differing in their emphasis on a variety of issues concerning South African (and WCP) mammals. In chronological order the relevant publications are Bronner *et al.* (2003), concentrating on the most recent molecular and classical systematic changes and reviews of mammals in southern Africa; Friedmann and Daly (2004), concentrating on the conservation status of taxa in South Africa; and Skinner and Chimimba (2005), effectively covering the basic natural history of southern African taxa.

As a result of this revised and updated information, mostly gleaned from Bronner *et al*. (2003), several taxa have either been renamed, had their status elevated, been incorporated into others, been deleted (as a result of earlier incorrect identification), or been shown to have a wider distribution than previously known. The result is that instead of ±280 mammal species being recorded for South Africa at the time of the previous report, there are currently at least 294 recorded for the country. In the Western Cape, at least 168 species are recognized (Appendix 1), as opposed to the 160 recorded in the previous report. In terms of percentages, however, the Western Cape still includes only 57% of the species occurring in South Africa.

ENDEMISM

There are still only six species endemic to the WCP (Table 1), but the number of species endemic to the CFK has increased to 10, versus the eight recorded in the previous report. The six species endemic to the Western Cape include five of the previous six, since one species, the long-tailed forest shrew *(Myosorex longicaudatus)*, previously thought to be endemic to the WCP, is now known to occur more widely and is now regarded as near-endemic to the WCP. The sixth endemic species is *Dasymys capensis* (the Cape marsh rat), which was elevated from subspecific status within *Dasymus incomtus* (the African marsh rat). Of the original eight species endemic to the CFK all are still recognized with the addition of two species: *Dasymus capensis* and *Amblysomus corriae* (the fynbos golden mole), including specimens previously identified as *A. hottentotus devilliersi* (Bronner et al. 2003), to provide a total of 10 CFK endemics.

The original six species considered to be near-endemic to the WCP are still so considered with the addition of two species; namely *Myosorex longicaudatus* and *Amblysomus corriae*. One of the original six *(Raphicerus melanotis)* is now also considered near-endemic to the CFK.

Table 1. Mammal species endemic to the Western Cape province.

Species	English name
Acomys subspinosus	Cape spiny mouse
Bathyergus suillus	Cape dune molerat
Cryptochloris zyli	Van Zyl's golden mole
Dasymys capensis	Cape water rat
Hippotragus leucophaeus	Bluebuck (extinct)
Tatera afra	Cape gerbil

CONSERVATION STATUS

In terms of conservation status the most significant changes have come about as a result of a Conservation Assessment and Management Plan workshop held in 2002 and which culminated in a Red Data Book of the mammals of South Africa published in 2004 (Friedmann and Daly 2004) which (dramatically) updates the previous SA Red Data Book on mammals (Smithers, 1986). The new IUCN categories (IUCN 2001) were used to evaluate the threat status of the South African mammals (Friedmann and Daly 2004); namely Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Data Deficient (DD) and least Concern (LC).

Two of the Western Cape mammals are considered Critically Endangered (CR), namely the riverine rabbit (*Bunolagus monticularis*) and Van Zyl's golden mole (*Cryptochloris zyli*), the latter endemic to both the WCP and the CFK. A further four mammalian species of the Western Cape are considered Endangered (EN); the white-tailed mouse (*Mystromys albicaudatus*), the African wild dog (*Lycaon pictus*), and two marine species represented by the southern elephant seal (*Mirounga leonina*) and a subspecies of the blue whale (*Balaenoptera musculus intermedia*). In addition, a further twelve species in the Western Cape (some of which became locally extinct) are considered to be Vulnerable (VU), namely the lion (*Panthera leo*), the cheetah (*Acinonyx jubatus*), the black rhinoceros (*Diceros bicornis*), the Cape subspecies of the mountain zebra (*Equus zebra zebra*), the bontebok (*Damaliscus pygargus pygargus*), the blue duiker (*Philantomba monticola*), Grant's golden mole (*Eremitalpa granti*), De Winton's long-eared bat (*Laephotis wintoni*), and four species of cetacean; namely Bryde's whale (*Balaenoptera edeni*), the sperm whale (*Physeter macrocephalus*), the humpback dolphin (*Sousa chinensis*), and the Indian Ocean bottle-nosed dolphin (*Tursiops aduncus*).

Apart from the threatened species (CR, EN, and VU), a further 17 Western Cape mammals fall within the Near Threatened (NT) category, whilst a further 32 Western Cape mammals have also been placed in the Data Deficient (DD) category. This in effect means that 67 (two CR, four EN, 12 VU, 17 NT, and 32 DD) Western Cape mammals either are, or could potentially soon be, facing a threat to their future survival (*i.e.* just over 42%). Only 99 (58%) of the Western Cape mammals fall within the Least Concern (LC) category. Two species have not yet been properly evaluated, respectively the leopard seal (*Hydrurga leptonyx*), and the crabeater seal (*Lobodon carcinophagus*), and one, the bluebuck (*Hippotragus leucophaeus*), is extinct. The Least Concern (LC) category includes *Equus quagga burchellii* (surviving southern plains zebra), whereas *Equus quagga quagga* (quagga) is also Extinct (EX).

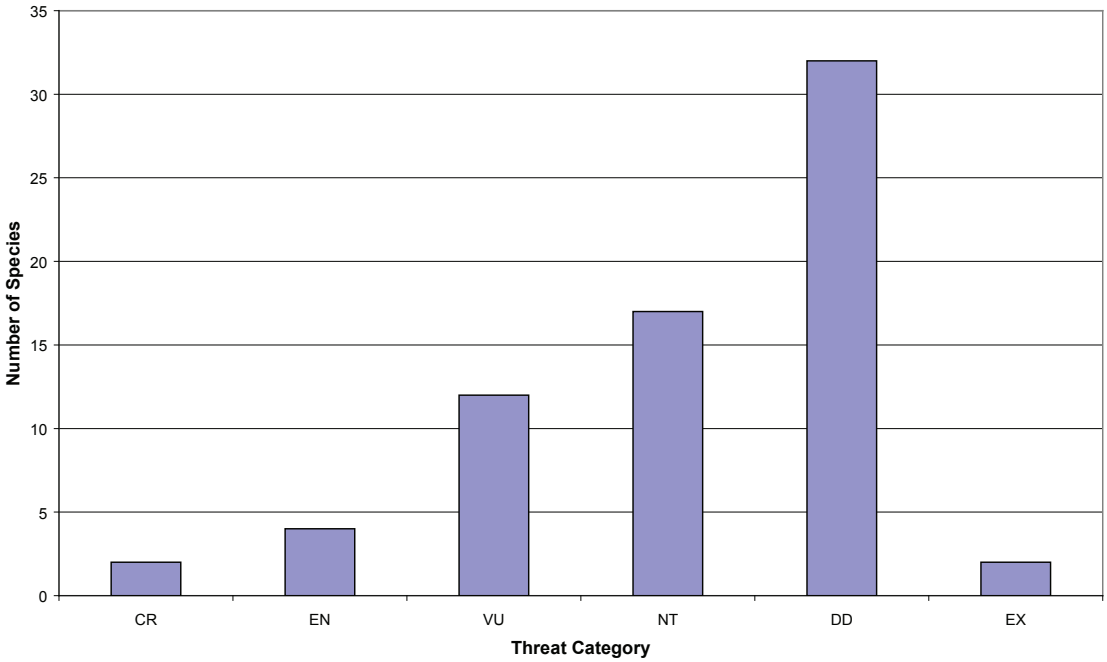

Figure 1. Conservation status of Western Cape mammals. CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, DD = Data Deficient and EX = Extinct.

The current Red Data Book, in contrast with the earlier "South African Red Data Book – Terrestrial Mammals" (Smithers, 1986), includes marine mammals and therefore comparisons, especially since categories no longer correspond, are difficult to make. However, if the top three categories of threat for the two publications are compared with respect to the terrestrial mammals, it is interesting to note that whereas the 1986 publication recorded 18 taxa within their Endangered, Vulnerable and Rare categories, the 2004 publication lists only 12 terrestrial mammalian taxa in its Critically Endangered, Endangered and Vulnerable categories.

The six species, lion (*Panthera leo*); spotted hyaena (*Crocuta crocuta*); wild dog (*Lycaon pictus*); black rhinoceros (*Diceros bicornis*); hippopotamus (*Hippopotamus amphibius*); and buffalo (*Syncerus caffer*) extinct in the province (Lloyd 2002) and which had not yet been re-established in formal provincial or national conservation areas, have as yet still to be re-established. A seventh species extinct in the WCP which was intended for release in the Karoo National Park prior to publication of the previous report, namely the cheetah (*Acinonyx* jubatus), will now only be released in 2007. However, most of these species have at various times been re-established on, and sometimes subsequently removed from, private land, as well as additional numbers of surviving species such as brown hyena (*Parahyaena brunnea*) and elephant (*Loxodonta africana*)., It is hoped that through the Stewardship Programme some of these properties may well attain formal statutory conservation status.

An encouraging recent discovery has been the fact that riverine rabbit (*Bunolagus monticularis*) sightings and specimens have been recorded from several localities in the Robertson-Montagu-Touws River-Barrydale-Klaarstroom region. Current phylogeographic research is being undertaken to compare these animals with those recorded from the Great Karoo. An interesting feature of these new localities is that they include sites situated at some distance from riverine floodplains, whereas earlier observations appeared to be restricted to floodplain environments.

HABITAT STATUS

Since the last report significant gains have been at least provisionally made in the conservation estate due to the achievements of the Stewardship Programme but at this stage few statistics are available since few, if any, agreements have been completely finalized thus far, despite many being close to being finally signed. A good example of this is the imminent signing of an agreement with Sanbona Wildlife Reserve to establish a contractual provincial nature reserve, which when it is formally established, will be the first statutory conservation area to offer protection to the riverine rabbit. Furthermore it represents an area of ±60 000 ha adjacent to the ±67 000 ha of Anysberg Nature Reserve and several other neighbouring private conservation areas some of which have an area of ±10 000 ha or more. With potential links to the Langeberg conservation areas, the Breede River Corridor and the greater De Hoop complex, combined with the Agulhas Biodiversity Initiative (ABI) initiative, this represents a further example of what could become one of the major biodiversity initiatives, with their associated corridors, within the Western Cape Province. Similar developments in the province are taking place within the Greater Cederberg Biodiversity Corridor, the Gouritz Initiative, and the Garden Route Initiative, with others also being developed in the Eastern Cape Province, all of which contribute to the greater effectiveness of current conservation efforts in the Western.

THREATS

The threats mentioned in the previous report (Lloyd 2002) *viz*. habitat loss, loss of genetic integrity, inappropriate translocations of species and associated pathogens and environmental pollution, still apply. However, recent published and draft national legislation is likely to ameliorate some of these threats once the appropriate regulations, norms, and standards are finalized.

INTRODUCED SPECIES

The issues surrounding the utilization of mammalian biodiversity remain as complex as they were when discussed in the previous report. Proposed new environmental regulations supporting the National Environmental Management: Biodiversity Act, however, could be of considerable assistance in resolving many of the current problems involving alien and extralimital species and associated genetic, pathogenic and ecological issues, with varying degrees of support from both the conservation authorities and responsible sectors of the wildlife industry. The irresponsible and often illegal movement of mammalian game species throughout the country has at times led to ecological threats posed by alien and extralimital taxa; to genetic threats which include hybridization of closely related taxa; and pathogenic threats due to the unnatural transmission of diseases affecting a variety of mammals. Although some of the provinces have mammalian translocation policies, the new legislation will lead to translocation norms and standards at a national level, and include at least some support from members of the game industry.

MONITORING

Researchers from Durham University have resurrected Cape mountain zebra monitoring at De Hoop Nature Reserve and are expanding the monitoring to other reserves supporting Cape mountain zebra. This form of monitoring monitors each individual over the course of their life. Researchers attached to the Universities of Bergen and Bristol are working on the Western Cape populations of leopards to estimate population sizes and genetic relatedness.

PUBLIC AWARENESS

There are positive signs in terms of engagement with certain elements of the wildlife industry and other human/wildlife issues. These signs include slowly changing attitudes to so-called "problem animals" and greater sensitivity towards genetic issues as was evidenced by contributions from the agricultural community at a recent workshop on human-wildlife conflict (Daly *et. al*. 2006). A further advance was the adoption by the Western Cape Nature Conservation Board (CapeNature) of a prescriptive policy on the sourcing of non-human primates for use in justifiable, humane and ethically approved medical research in line with the European Union's guidelines.

An area in which considerable indirect progress has been made as a result of the provincial Stewardship Programme. The precedents set by the Western Cape Nature Conservation Board in its preparedness to make appropriate taxa conditionally available to members of the private sector in order to remove inappropriate taxa, have gone a long way in assisting the resolution of such problems. Acknowledgement has to be given to several of our partners in conservation; especially SANParks, for assisting us on several occasions in gaining access to appropriate animals.

RESEARCH

Appropriate research, based in many cases on requests emanating from CapeNature, continues to be undertaken on issues that are of considerable importance to conservation and serves as testimony to the considerable value resulting from such co-operation for all parties concerned. These requests have included ecological studies focused on "problem" species and genetic studies on species with widespread but apparently fragmented distributions. In this regard some of the more important projects recently undertaken or currently underway include home range and genetic studies on leopards in the Cederberg and genetic studies of other taxa with fragmented populations such as the Cape mountain zebra and riverine rabbit. The human-wildlife conflict workshop alluded to above (Daly *et al.* 2006) also provided information on current and future research efforts in regard to so-called "problem animals"

A researcher from Colorado State University is working on tuberculosis in dassies (*Procavia capensis*) and the research team working on the behavioural ecology of baboons at De Hoop and coordinated by Dr Peter Henzi of the Bolton Institute continues its work.

The preparation of the 2004 Red Data Book has stimulated several new projects. Probably the most important gap is precise locality information for the larger and medium-sized mammals, as well as the lack of information on the current artificial distribution of alien and extralimital taxa.

CAPACITY

There is currently only a single scientist whose primary mandate is mammals but also covers terrestrial invertebrates and biodiversity policy development and initiation. Management of mammal-related issues is carried out by the conservation services staff of the board within its 10 business units (many of whom are either unqualified or only recently qualified), and a programme manager tasked with a "Wildlife Management" portfolio, who has limited formal training in mammalogy. By way of contrast, the former Cape Province had at least 11, and at times up to 16, scientists that were involved in mammalian issues. This should be seen against the increasing interest by the game industry in moving their operations into the WCP, which is also probably the province with the strictest translocation criteria in the country. It is therefore not particularly surprising that the mammal component of Scientific Services section is responsible for by far the majority of permit applications and needs urgent bolstering of capacity.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions reached in the previous report (Lloyd 2002) and the recommendations made, are still appropriate but in the interests of those who do not have access to that report, a brief summary is provided.

For historic reasons the mammals that suffered most in the WCP were the megaherbivores and larger carnivores which were mostly perceived as threats to human life, livestock and crops. The next most vulnerable group were the medium-to-larger sized game animals. Their size, palatability and utility in terms of products they could provide lead to heavy persecution. Many species in this latter group have been re-established in the landscape, either by conservation authorities or by the game industry. The latter, however, have unfortunately also been responsible for the establishment of alien and extralimital taxa, many of which pose ecological, genetic or pathogenic threats to indigenous biodiversity. The latest national biodiversity legislation attempts to limit these threats.

The recently proposed landscape conservation initiatives have shown considerable progress since the last report and planning is currently fairly advanced in terms of restoring many of the magaherbivores, larger carnivores and medium-to-large game animals to the landscape, with the fortuitous side-effect of simultaneously providing further refuges for an enormous suite of smaller organisms. However, these landscape initiatives do have their limitations and one of these is the fact that both wetland and lowland environments frequently tend to be under-represented. Those mammals, for example, associated with relatively linear environments such as permanent and temporary watercourses, are at the risk of floods, desertification, the effect of impoundments, and other water extraction, pollution, and insensitive agricultural development. Species such as the riverine rabbit and water rat do not necessarily benefit as much as other species do in such large-scale landscape initiatives, and this must be addressed when planning such initiatives, and wherever possible spatial corridors should be seen as priorities.

Another aspect of mammalian conservation which, with one or two major exceptions, is cause for concern, is the lack of information on many of our marine mammals and the need for more marine protected areas, and information on where best to establish these protected areas.

Habitat specialists, such as many bat and fossorial species, are also often not sufficiently well-catered for by the current protected area network. Formalized monitoring programmes for threatened and endemic WCP mammals should remain one of the top priorities.

ACKNOWLEDGEMENTS

N.G. Palmer is once again thanked for his contributions.

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APPENDICES

Appendix 1. Mammal species indigenous to the Western Cape with South African and IUCN Red List status.

Family	Taxon	English Name	IUCN Status	SARDB Status
Balaenidae	*Eubalaena australis*	Southern right whale	Least Concern	Vulnerable
Balaenopteridae	*Balaenoptera acutorostrata*	Minke whale	Null	Data Deficient
Balaenopteridae	*Balaenoptera bonaerensis*	Antarctic minke whale	Least Concern	Null
Balaenopteridae	*Balaenoptera borealis*	Sei whale	Null	Vulnerable
Balaenopteridae	*Balaenoptera edeni*	Bryde's whale	Null	Vulnerable (D1)
Balaenopteridae	*Balaenoptera musculus brevicauda*	Pygmy blue whale	Data Deficient	Null
Balaenopteridae	*Balaenoptera musculus intermedia*	Antarctic true blue whale	Endangered (D)	NULL
Balaenopteridae	*Balaenoptera physalus*	Fin whale	Null	Vulnerable
Bathyergidae	*Bathyergus janetta*	Namaqua dune molerat	Near Threatened	Vulnerable
Bathyergidae	*Bathyergus suillus*	Cape dune molerat	Least Concern	Least Concern
Bathyergidae	*Cryptomys damarensis*	Damarland molerat	Least Concern	Null
Bathyergidae	*Cryptomys hottentotus*	Common molerat	Least Concern	Null
Bathyergidae	*Georychus capensis*	Cape molerat	Least Concern	Least Concern
Bovidae	*Alcelaphus buselaphus*	Red hartebeest	Least Concern	Null
Bovidae	*Antidorcas marsupialis*	Springbuck	Least Concern	Null
Bovidae	*Damaliscus pygargus pygargus*	Bontebok	Vulnerable (D1)	Vulnerable (D1)
Bovidae	*Hippotragus leucophaeus*	Bluebuck (extinct)	Extinct	NULL
Bovidae	*Oreotragus oreotragus*	Klipspringer	Least Concern	Null
Bovidae	*Oryx gazella*	Gemsbok	Least Concern	Null
Bovidae	*Pelea capreolus*	Grey rhebuck	Least Concern	Null
Bovidae	*Philantomba monticola*	Blue duiker	Vulnerable (C1+2a)	NULL
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern	Null
Bovidae	*Raphicerus melanotis*	Grysbok	Least Concern	Least Concern
Bovidae	*Sylvicapra grimmia*	Common duiker	Least Concern	Null
Bovidae	*Syncerus caffer*	Buffalo	Least Concern	Null
Bovidae	*Tragelaphus oryx*	Eland	Least Concern	Null
Bovidae	*Tragelaphus scriptus*	Bushbuck	Least Concern	Null
Bovidae	*Tragelaphus strepsiceros*	Kudu	Least Concern	Null
Canidae	*Canis mesomelas*	Black-backed jackal	Least Concern	Null
Canidae	*Lycaon pictus*	Wild dog	Endangered (D)	ENDANGERED
Canidae	*Otocyon megalotis*	Bat-eared fox	Least Concern	Null
Canidae	*Vulpes chama*	Cape fox	Least Concern	Null
Cercopithecidae	*Cercopithecus pygerythrus*	Vervet monkey	Null	Null
Cercopithecidae	*Papio hamadryas*	Chacma baboon	Least Concern	Least Concern
Chrysochloridae	*Amblysomus corriae*	Fynbos golden mole	Near Threatened	Near Threatened
Chrysochloridae	*Amblysomus hottentotus*	Hottentot golden mole	Data Deficient	Data Deficient

Family	Taxon	English Name	IUCN Status	SARDB Status
Chrysochloridae	*Chlorotalpa duthieae*	Duthie's golden mole	Least Concern	Least Concern
Chrysochloridae	*Chlorotalpa sclateri*	Sclater's golden mole	Data Deficient	Data Deficient
Chrysochloridae	*Chrysochloris asiatica*	Cape golden mole	Data Deficient	Data Deficient
Chrysochloridae	*Cryptochloris zyli*	Van Zyl's golden mole	Critically Endangered (B1ab+2ab; D)	Critically Endangered (B1ab+2ab; D)
Chrysochloridae	*Eremitalpa granti*	Grant's golden mole	VULNERABLE (B2ab)	RARE
Delphinidae	*Cephalorhynchus heavisidii*	Heaviside's dolphin	Data Deficient	Insufficiently Known
Delphinidae	*Delphinus capensis*	Long-beaked common dolphin	Least Concern	Null
Delphinidae	*Delphinus delphis*	Short-beaked common dolphin	Least Concern	Insufficiently Known
Delphinidae	*Feresa attenuata*	Pygmy killer whale	Data Deficient	Insufficiently Known
Delphinidae	*Globicephala macrorhynchus*	Short-finned pilot whale	Data Deficient	Insufficiently Known
Delphinidae	*Globicephala melas*	Long-finned pilot whale	Null	Null
Delphinidae	*Grampus griseus*	Risso's dolphin	Data Deficient	Insufficiently Known
Delphinidae	*Lagenorhynchus obscurus*	Dusky dolphin	Data Deficient	Insufficiently Known
Delphinidae	*Orcinus orca*	Killer whale	Data Deficient	Insufficiently Known
Delphinidae	*Peponocephala electra*	Melon-headed whale	Least Concern	Insufficiently Known
Delphinidae	*Pseudorca crassidens*	False killer whale	Least Concern	Insufficiently Known
Delphinidae	*Sousa chinensis*	Indian hump-backed dolphin	VULNERABLE (B1ab)	NULL
Delphinidae	*Stenella attenuata*	Spotted dolphin	Data Deficient	Insufficiently Known
Delphinidae	*Stenella coeruleoalba*	Striped dolphin	Least Concern	Insufficiently Known
Delphinidae	*Stenella longirostris*	Spinner dolphin	Null	Insufficiently Known
Delphinidae	*Tursiops aduncus*	Indian Ocean bottlenosed dolphin	Vulnerable (B2ab, C2a)	NULL
Delphinidae	*Tursiops truncatus*	Atlantic Ocean bottlenosed dolphin	Data Deficient	Insufficiently Known
Elephantidae	*Loxodonta africana*	African elephant	Least Concern	Vulnerable
Emballonuridae	*Taphozous mauritianus*	Mauritian tomb bat	Least Concern	Null
Equidae	*Equus quagga burchellii*	Burchell's plains zebra	Null	Null
Equidae	*Equus quagga quagga*	Quagga	Extinct	EXTINCT
Equidae	*Equus zebra zebra*	Cape Mountain zebra	Vulnerable (D1)	Vulnerable (D1)
Felidae	*Acinonyx jubatus*	Cheetah	Vulnerable (D1)	Vulnerable
Felidae	*Caracal caracal*	Caracal	Least Concern	Null
Felidae	*Felis nigripes*	Black-footed cat	Least Concern	Null

Family	Taxon	English Name	IUCN Status	SARDB Status
Felidae	*Felis silvestris*	African Wild Cat	Least Concern	Null
Felidae	*Leptailurus serval*	Serval	Near Threatened	Null
Felidae	*Panthera leo*	Lion	Vulnerable (D1)	Null
Felidae	*Panthera pardus*	Leopard	Least Concern	Null
Herpestidae	*Atilax paludinosus*	Water mongoose	Least Concern	Null
Herpestidae	*Cynictis penicillata*	Yellow mongoose	Least Concern	Null
Herpestidae	*Galerella pulverulenta*	Cape grey mongoose	Least Concern	Null
Herpestidae	*Herpestes ichneumon*	Large grey mongoose	Least Concern	Null
Herpestidae	*Suricata suricatta*	Suricate	Least Concern	Null
Hippopotamidae	*Hippopotamus amphibius*	Hippopotamus	Least Concern	Null
Hyaenidae	*Crocuta crocuta*	Spotted hyaena	Near Threatened	Null
Hyaenidae	*Parahyaena brunnea*	Brown hyaena	Near Threatened	Vulnerable
Hyaenidae	*Proteles cristatus*	Aardwolf	Least Concern	Null
Hystricidae	*Hystrix africaeaustralis*	Porcupine	Least Concern	Null
Kogidae	*Kogia breviceps*	Pygmy sperm whale	Least Concern	Insufficiently Known
Kogidae	*Kogia sima*	Dwarf sperm whale	Least Concern	Insufficiently Known
Leporidae	*Bunolagus monticularis*	Riverine rabbit	Critically Endangered (C2a)	Critically Endangered (C2a)
Leporidae	*Lepus capensis*	Cape hare	Least Concern	Null
Leporidae	*Lepus saxatilis*	Scrub hare	Least Concern	Null
Leporidae	*Pronolagus rupestris australis*	Smith's red hare ssp. australis	Null	Null
Leporidae	*Pronolagus saundersiae*	Hewitt's red rock rabbit	Least Concern	Null
Macroscelididae	*Elephantulus edwardii*	Cape rock elephant-shrew	Least Concern	Least Concern
Macroscelididae	*Elephantulus rupestris*	Smith's rock elephant-shrew	Least Concern	Null
Macroscelididae	*Macroscelides proboscideus*	Round-eared elephant-shrew	Least Concern	Null
Molossidae	*Sauromys petrophilus*	Flat-headed free-tailed bat	Least Concern	Null
Molossidae	*Tadarida aegyptiaca*	Egyptian free-tailed bat	Least Concern	Null
Muridae	*Acomys subspinosus*	Cape spiny mouse	Least Concern	Least Concern
Muridae	*Aethomys chrysophilus*	Red veld rat	Least Concern	Null
Muridae	*Aethomys granti*	Grant's rock mouse	Least Concern	Least Concern
Muridae	*Aethomys namaquensis*	Namaqua rock mouse	Least Concern	Null
Muridae	*Dasymys capensis*	Cape water rat	Near Threatened	Null
Muridae	*Dendromus melanotis*	Grey climbing mouse	Least Concern	Null
Muridae	*Dendromus mesomelas*	Brants' climbing mouse	Least Concern	Null
Muridae	*Dendromus mystacalis*	Chestnut climbing mouse	Least Concern	Null
Muridae	*Desmodillus auricularis*	Short-tailed gerbil	Least Concern	Null
Muridae	*Gerbillurus paeba*	Hairy-footed gerbil	Least Concern	Null
Muridae	*Grammomys dolichurus*	Woodland mouse	Data Deficient	Null

Family	Taxon	English Name	IUCN Status	SARDB Status
Muridae	*Malacothrix typica*	Large-eared mouse	Least Concern	Null
Muridae	*Mastomys coucha*	Multimammate mouse	Least Concern	Null
Muridae	*Mastomys natalensis*	Natal multimammate mouse	Least Concern	Null
Muridae	*Mus minutoides*	Pygmy mouse	Least Concern	Null
Muridae	*Myomyscus verreauxi*	Verreaux's mouse	Least Concern	Least Concern
Muridae	*Mystromys albicaudatus*	White-tailed mouse	Endangered (A3c)	NULL
Muridae	*Otomys irroratus*	Vlei rat	Least Concern	Null
Muridae	*Otomys laminatus*	Laminate vlei rat	Least Concern	Least Concern
Muridae	*Otomys saundersiae*	Saunders' vlei rat	Least Concern	Least Concern
Muridae	*Otomys unisulcatus*	Bush vlei rat	Least Concern	Least Concern
Muridae	*Parotomys brantsii*	Brants's whistling rat	Least Concern	Null
Muridae	*Parotomys littledalei*	Littledale's whistling rat	Near Threatened	Null
Muridae	*Petromyscus barbouri*	Barbour's rock mouse	Least Concern	Least Concern
Muridae	*Petromyscus collinus*	Pygmy rock mouse	Least Concern	Null
Muridae	*Rhabdomys pumilio*	Striped mouse	Least Concern	Null
Muridae	*Saccostomus campestris*	Pouched mouse	Least Concern	Null
Muridae	*Steatomys krebsii*	Krebs' fat mouse	Least Concern	Null
Muridae	*Tatera afra*	Cape gerbil	Least Concern	Least Concern
Mustelidae	*Aonyx capensis*	African clawless otter	Least Concern	Null
Mustelidae	*Ictonyx striatus*	Striped polecat	Least Concern	Null
Mustelidae	*Mellivora capensis*	Honey badger	Near Threatened	Null
Mustelidae	*Poecilogale albinucha*	African striped weasel	Data Deficient	Null
Myoxidae	*Graphiurus murinus*	Woodland dormouse	Least Concern	Null
Myoxidae	*Graphiurus ocularis*	Spectacled dormouse	Least Concern	Least Concern
Neobalaenidae	*Caperea marginata*	Pygmy right whale	Least Concern	Insufficiently Known
Neobalaenidae	*Megaptera novaeangliae*	Humpback whale	Near Threatened	Vulnerable
Nycteridae	*Nycteris thebaica*	Egyptian slit-faced bat	Least Concern	Null
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern	Null
Otariidae	*Arctocephalus pusillus*	Cape fur seal	Null	Null
Otariidae	*Arctocephalus tropicalis*	Subantarctic fur seal	Least Concern	Null
Phocidae	*Hydrurga leptonyx*	Leopard seal	Null	Null
Phocidae	*Lobodon carcinophagus*	Crabeater seal	Null	Null
Phocidae	*Mirounga leonina*	Southern elephant seal	Endangered (A2)	NULL
Physeteridae	*Physeter macrocephalus*	Sperm whale	Vulnerable (A2bd)	VULNERABLE (A1bd)
Procavidae	*Procavia capensis*	Rock dassie	Least Concern	Null
Pteropodidae	*Epomophorus wahlbergi*	Wahlberg's epauletted fruit bat	Least Concern	Null
Pteropodidae	*Rousettus aegyptiacus*	Egyptian fruit bat	Least Concern	Null
Rhinocerotidae	*Diceros bicornis*	Black rhinoceros	Vulnerable	Endangered
Rhinolophidae	*Rhinolophus capensis*	Cape horseshoe bat	Near Threatened	Near Threatened

Family	Taxon	English Name	IUCN Status	SARDB Status
Rhinolophidae	*Rhinolophus clivosus*	Geoffroy's horseshoe bat	Near Threatened	Null
Soricidae	*Crocidura cyanea*	Reddish-grey musk shrew	Data Deficient	Null
Soricidae	*Crocidura flavescens*	Greater red musk shrew	Data Deficient	Null
Soricidae	*Crocidura fuscomurina*	Tiny musk shrew	Data Deficient	Null
Soricidae	*Crocidura silacea*	Lesser grey-brown musk shrew	Data Deficient	Null
Soricidae	*Myosorex longicaudatus*	Long-tailed forest shrew	Near Threatened	Near Threatened
Soricidae	*Myosorex varius*	Forest shrew	Data Deficient	Null
Soricidae	*Suncus infinitesimus*	Least dwarf shrew	Data Deficient	Null
Soricidae	*Suncus varilla*	Lesser dwarf shrew	Data Deficient	Null
Suidae	*Potamochoerus larvatus koiropotamus*	Bushpig ssp. koiropotamus	Least Concern	Null
Vespertilionidae	*Cistugo lesueuri*	Lesueur's wing-gland bat	Near Threatened	Null
Vespertilionidae	*Eptesicus hottentotus*	Long-tailed serotine bat	Least Concern	Null
Vespertilionidae	*Kerivoula lanosa*	Lesser woolly bat	Near Threatened	Null
Vespertilionidae	*Laephotis wintoni*	Winton's long-eared bat	Vulnerable (D2)	Null
Vespertilionidae	*Miniopterus fraterculus*	Lesser long-fingered bat	Near Threatened	Null
Vespertilionidae	*Miniopterus schreibersii*	Schreiber's long-fingered bat	Near Threatened	Null
Vespertilionidae	*Myotis tricolor*	Temminck's hairy bat	Near Threatened	Null
Vespertilionidae	*Neoromicia capensis*	Cape serotine bat	Least Concern	Null
Viverridae	*Genetta genetta*	Small-spotted genet	Least Concern	Null
Viverridae	*Genetta tigrina*	Large-spotted genet	Least Concern	Null
Ziphidae	*Berardius arnuxii*	Arnoux's beaked whale	Data Deficient	Insufficiently Known
Ziphidae	*Hyperoodon planifrons*	Southern bottlenose whale	Least Concern	Insufficiently Known
Ziphidae	*Mesoplodon densirostris*	Blainville's beaked whale	Data Deficient	Insufficiently Known
Ziphidae	*Mesoplodon grayi*	Gray's beaked whale	Data Deficient	Insufficiently Known
Ziphidae	*Mesoplodon hectori*	Hector's beaked whale	Data Deficient	Insufficiently Known
Ziphidae	*Mesoplodon layardii*	Layard's beaked whale	Data Deficient	Insufficiently Known
Ziphidae	*Mesoplodon mirus*	True's beaked whale	Data Deficient	Insufficiently Known
Ziphidae	*Ziphius cavirostris*	Cuvier's beaked whale	Data Deficient	Data Deficient

CHAPTER 7

AVIFAUNA

Kevin Shaw
shawka@cncjnk.pgwc.gov.za

TABLE OF CONTENTS

Executive Summary

Evaluating the state of birds in the Western Cape Province was simplified in that all the relevant information on each species within southern Africa has been synthesized in Roberts Birds of southern Africa, which was published in 2006. This revision also included the taxonomic changes, which does however make comparison with the previous SOB report more complex. Inroads have been made into conservation issues identified in the previous SOB 2000 report and a number of strategies e.g. House Crow eradication strategy, are in place and have/are being implemented. There are, however still a number of issues that have not been adequately addressed. These include the increasing populations of certain species to the detriment of the environment and which cause problems for humans, and will need to be dealt with as they will become more prominent in the near future.

INTRODUCTION

This chapter describes the state of avifaunal biodiversity within the Western Cape Province (hereafter referred to as the WCP) and is an update of the previous State of Biodiversity chapter on the Avifauna of the Western Cape Province (Shaw 2002). The avifaunal chapter in the state of biodiversity report 2000 adequately covered the state of avifaunal biodiversity up until 2002. This chapter highlights the progress made and changes that have occurred since then. One of the highlights that have occurred since the previous chapter is the publication of the seventh edition of Roberts Book of Birds (Hockey *et. al*. 2005).

METHODS

The majority of the data contained in the database held by the Scientific Services Division of the Western Cape Nature Conservation Board at Jonkershoek is still largely the same as it was when it was analysed for the SOB 2000 report as most of the data was accumulated during the South African Bird Atlas Project (SABAP) between 1987 and 1991 (Harrison *et. al*. 1997a and 1997b). New distribution records have been entered into the database which has also been altered to reflect new taxonomic changes as set out in the new Roberts Book of Birds (Hockey *et. al*. 2005). Analyses of the data were carried out using a geographical information system package (Arc View Ver.3.2a) in combination with a database package (MS Access).

The nomenclature in this report follows that used by the authors of the Roberts Book of Birds (Hockey *et. al*. 2005).

AVIFAUNAL STATISTICS

The Roberts book of birds indicates that a total of 510 (excluding 7 locally extinct) bird species occurs in the Western Cape Province (Appendix 1). This is 51 species more than the figure given in the SOB 2000 report (Shaw 2002). The reason for this increase is the taxonomical changes that have occurred in the last few years where a species has been split into two or more species and the increase of pelagic species due to the recent popularity of pelagic birding trips. There has not been an increase in the number of exotic species in the western Cape and the ten species mentioned in the SOB 2000 report (Shaw 2002) *i.e*. House Crow *Corvus splendens*, Peafowl *Pavo cristatus*, Indian Myna *Acridotheres tristis*, Chukar Partridge *Alectoris chukar*, Mute Swan *Cygnus olor*, Mallard Duck *Anas platyrhynchos*, Chaffinch *Fringilla coelebs*, Feral Pigeon *Columba livia*, House Sparrow *Passer domesticus*, and European Starling *Sturnus vulgaris*, are still present. Of the total number of species occurring within the province, 132 are either vagrants or the southern limits of their distribution range just extend into the province. If one excludes the latter group of species and the ten exotic species previously mentioned, the Western Cape supports substantial populations of 368 bird species. The total number of species occurring within South Africa (Hockey *et. al*. 2005) is 722. The Western Cape therefore supports 51% of South Africa's avifaunal biodiversity.

Six of the species occurring within the Western Cape can be classified as near endemic (up to 70% of the distribution range occurring within the province). They are the Cape Rock-jumper *Chaetops frenatus*, Victorin's Warbler *Cryptillas victorini*, Protea Seedeater *Serinus leucopterus*, Cape Sugarbird *Promerops cafer*, Cape Siskin *Pseudochloroptila totta* and the Orange-breasted Sunbird *Anthobaphes violacea*. All six species are endemic to the Cape Floristic Kingdom, the boundaries of which extend just outside the Western Cape Provincial boundary.

The Western Cape now has one endemic species due to the new taxonomic changes which split the Long-billed Lark group into separate species. The endemic species is the Agulhas Long-billed Lark *Certhilauda brevirostris*. These taxonomic changes have also increased the number of species endemic to South Africa, Lesotho and Swaziland to 39, of which 28 occur in the Western Cape.

The number of species recorded within protected areas of the province was determined using data from the Avian Demography Unit's Birds in Reserves Project (BIRP) which records the presence of birds within protected areas. Data are still being collected and submitted, but it is highly unlikely that the statistics will change significantly. Of the 510 species recorded in the Province (excluding the eight species which are extinct within the Province, see below), 463 were recorded within the BIRP sites. A large percentage of these species are however vagrants or oddities and if species with fewer than five sightings 5 are removed, the number of species recorded within the BIRP sites within the Western Cape is reduced to 347 species.

Sixty-one of the species recorded in the Western Cape are listed in the latest Red Data Book of Birds (Barnes 2000). Figure 1 illustrates the number of species per IUCN threat category. A further seven species are known to have become extinct within the Province. They are the Southern Bald Ibis *Geronticus calvus*, Bearded Vulture *Gypaetus barbatus*, Egyptian Vulture *Neophron percnopterus*, Lappet-faced Vulture *Aegypius tracheliotus*, Cape Parrot *Poicephalus robustus*, Wattled Crane *Bugeranus carunculatus* and African Scops Owl *Otus senegalensis*. Currently no reintroductions of these species are planned as in most cases they disappeared from the Province due to habitat loss and until this is addressed, reintroductions would be pointless.

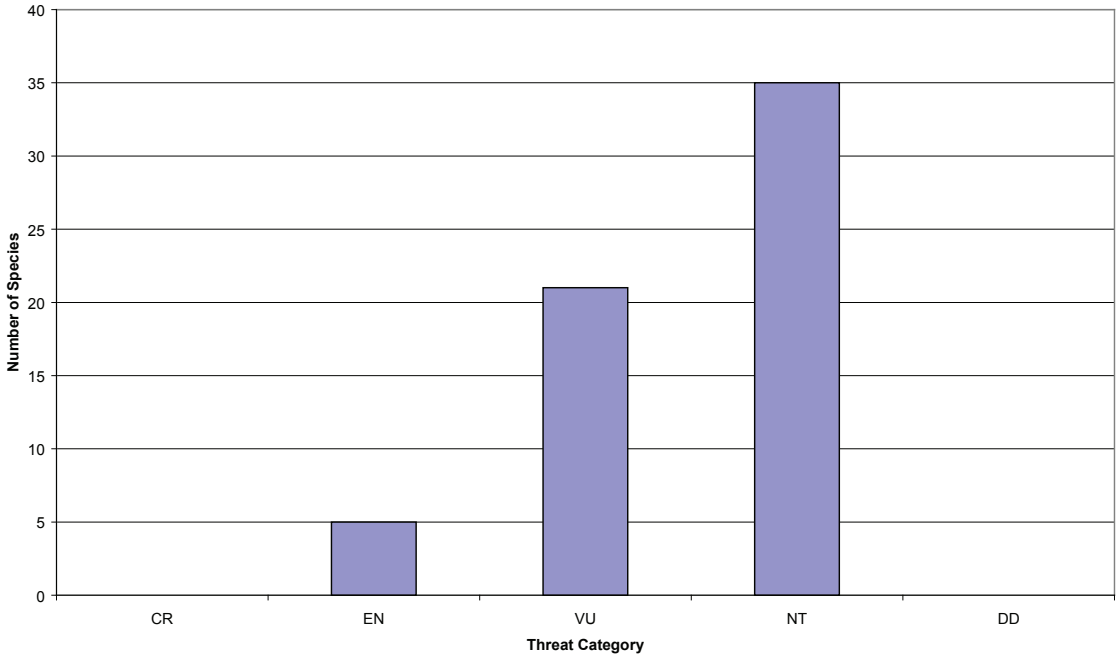

Figure 1. Number of bird species in each IUCN threat category. CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened and DD = Data Deficient.

Ninety-three species recorded within the Province are listed in the three Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES Convention). The only species listed under Appendix 1 of the CITES Convention that occurs within South Africa is the Peregrine Falcon *Falco peregrinus*.

PRIORITY SPECIES WITHIN THE WESTERN CAPE

Shaw (1995) carried out an analysis of the avifauna of the Western Cape in order to evaluate the conservation status of these bird species. Each species was scored according to a set of categories (five biological and six non-biological) and the species were ranked according to their total scores. The results of this analysis were used in the previous SOB report (Shaw 2002). The same analysis was carried out in 2004 by the author and a colleague (unpublished) using the updated taxonomic changes as indicated in Roberts VII (Hockey *et. al*. 2005) and any other additional information acquired since the initial analysis. In the revised analysis 26 species were identified as high priority species for conservation while 35 species were identified as being of intermediate priority species for conservation (Appendix 2). There was very little difference between the two analyses indicating little change in the threats to the priority species. The one new endemic species of the Western Cape was one of the three additions to the list. The other two species that moved up into the priority list were the Black Harrier *Circus maurus* and the Peregrine Falcon *Falco peregrinus* due to increased knowledge of the species.

THREATS TO AVIFAUNAL BIODIVERSITY

The threats to the Western Cape avifaunal biodiversity were adequately addressed in the previous State of Biodiversity Report (Shaw 2002). This section will deal briefly with some of the initiatives that have been put in place to address some of the threats facing avifaunal biodiversity in the Western Cape.

The Mallard Duck *Anas platyrhynchus* and the House Crow *Corvus splendens* are the only invasive species that are currently receiving attention. The removal of Mallards is receiving strong opposition from certain members of the public. This is cause for concern as Mallards are likely to pose substantial and increasing threats to local avifauna, particularly through hybridization with native *Anas spp*. as has been the case in other parts of the world where it has been introduced (Rhymer 2006 and Williams & Basse 2006). There have, however, been a number of success stories where the Mallards have been removed from waterbodies and have been replaced by captive-bred indigenous waterfowl.

The House Crow program has evolved into a national program under the auspices of the Working for Water program. Funding has become a lot more accessible and a House Crow eradication strategy has been developed, which will be implemented in 2007.

The loss and degradation of habitat continues to be the biggest threat to avian biodiversity in the province. The driving force behind this threat is the escalating human population growth within the Province and its associated impacts on the transformation of critical habitat. Furthermore, South Africa is a developing country which requires sustainable development to improve its economic growth. The regulated Environmental Impact Assessment (EIA) process has helped to reduce the negative impacts of development on the environment, either by preventing development within sensitive areas or by mitigating those aspects of the development that would seriously impact on the environment.

Powerlines pose a serious threat to birds either through birds colliding with the conductors or through electrocution, while landing, perching or taking off from Eskom structures. Eskom is fully aware of the impact that their structures have on South Africa's birdlife and have formed a partnership with the Endangered Wildlife Trust to monitor the problem and to develop and improve mitigation measures to reduce bird mortalities. A number of Eskom powerlines in the Western Cape are ending their lifespan and are been refurbished. This has allowed the correction of mistakes made in the past, by re-routing lines around sensitive areas and fitting mitigation devices to reduce the impacts that powerlines and associated infrastructures have on the environment. The erection of powerlines above 33kV is a listed

activity in terms of the environmental impact assessment regulations. The process makes provision for specialist input enabling measures to be taken to mitigate any negative impacts. On existing lines where monitoring or investigation reveals that the lines are causing mortalities, reactive fitment of mitigation devices is progressing well.

Shaw (1995) identified habitat loss and degradation as one of the biggest threats facing avifauna in the Western Cape. The Cape Action plan for the People and the Environment (CAPE) includes as one of its components, the Stewardship Programme, which is managed by CapeNature. The object of this programme is to promote the protection and proper management of conservation worthy pieces of private land for conservation. The new National Environmental Management Act (NEMA) Protected Areas Act No 57 of 2003 provides a number of categories for protection of these pieces of land and depending on the type of protection afforded land owners may obtain certain benefits. The Stewardship Program has however been concentrating on the Lowland fynbos area which is where the conservation priorities lie because as little as 2% of some vegetation types remain. While this process does aid bird conservation in the lowland fynbos areas the priority areas for bird conservation are the coastal areas and palustrine wetlands.

The other important bird habitat that has been degraded resulting in a loss or decline of species is indigenous forest. These areas were previously managed by the Department of Water Affairs and Forestry, which in the past had been selectively logged for indigenous wood. These areas have been placed under the management of the South African National Parks, providing the forests and their inhabitants with better statutory protection.

EFFECTIVENESS OF CURRENT CONSERVATION

The status of conservation measures has not changed much since the previous report. The much awaited for National Environmental Management: Biodiversity Act (NEMBA) No 10 of 2004 was promulgated, but did not achieve what most conservationists had hoped it would, the elimination or partial elimination of the discrepancies and inconsistencies between the suite of provincial conservation legislation. This legislation does, however, address South Africa's obligation to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The Act unfortunately provides better protection to CITES listed species (the majority of which are exotic species) and makes little provision for our own indigenous bird species. Despite numerous inputs from professional ornithologists and the provinces only 24 birds appear on the draft list of Schedule A: Threatened Species and none on Schedule B: Protected Species. The provinces and professional ornithologists recommended 64 bird species for Schedule A and 141 for Schedule B. The provinces will therefore have to accommodate these species and any other species that they think may require protection within the provincial ordinances and by the development of Biodiversity Management Plans in terms of the NEMBA. This may or may not result in ten (nine provinces and one national) different lists of protected species, which if it does happen will make legislation fairly complex and confusing within South Africa.

STATUS OF AVIFAUNAL KNOWLEDGE

The Western Cape is fortunate to have three tertiary institutions where research on bird related issues are undertaken. The most notable in this regard is the University of Cape Town, which has the Percy FitzPatrick Institute of African Ornithology (PFIAO) and the Avian Demography Unit (ADU). Furthermore

Birdlife South Africa has 32 registered branches, of which 6 occur in the Western Cape. In addition there are at least 7 bird clubs not affiliated to Birdlife South Africa scattered throughout the Province, all with active members. These "amateur ornithologists" contribute valuable information towards our understanding of *inter alia,* patterns of bird distributions, population dynamics and habitat use by, for example, conducting waterfowl counts at major wetlands in the Western Cape and bird surveys on many of the protected areas. In the past they played a crucial role in collecting information for the South African Bird Atlas Project, which culminated in a two-volume publication illustrating the distribution of South African birds per quarter degree square (Harrison *et. al*. 1997a and Harrison *et. al*. 1997b).

The fieldwork for the South African Bird Atlas began in 1987 and ended in 1992. The data acquired during this period is now effectively 14 years old. Bird distributions are constantly influenced by factors such as habitat alterations and climate change and the need to repeat the atlas exercise has been recognised by the birding community. Consequently it was decided to initiate the Second South African Bird Atlas Project (SABAP2) in 2007. This project will be a joint venture between the ADU, Birdlife South Africa and the South African National Biodiversity Institute (SANBI). The difference between the two projects is that data will be collected at a finer spatial resolution than the first Atlas project where data was collected per quarter degree square. Once completed, this project and its predecessor will provide an indication of how bird distributions have changed over the last few decades. This will no doubt pose many new questions resulting in a number of research projects, but will also provide essential information to guide conservation management and planning.

The Birds in Reserve Programme (BIRP) which flowed from the first SABAP project, has the main objective of determining which bird species are protected within the protected area network of South Africa. The data from the SABAP project and the BIRP project will enable ornithologists to evaluate the degree of protection for a species relative to its overall distribution allowing them to determine if a species is adequately protected and if not where reserves should be established to achieve this objective. The project has been running since the early 1990's and unfortunately has had limited success. Within the Western Cape there are 320 registered BIRP sites with the Project. These sites includes amongst others, the important bird areas, military areas and conservancies, some of which are not formally protected. Also some of the large sites e.g. the Cederberg Wilderness Area have been divided up into quarter degree squares and each square is then a registered site. No BIRP data forms have been submitted for 119 of these BIRP sites, while 213 (includes the 119 sites) have 10 or less data forms. Only 17 sites have more than 100 data forms with 405 data forms being the highest number of forms submitted for a BIRP site, the Paarl Bird Sanctuary. It is clear that a huge effort should be made to increase the number of forms submitted to BIRP and the role that the bird clubs and their members can play in this regard must be empahsised.

Lastly, the latest Roberts7 project undertaken by the PFIAO has taken all available knowledge of the bird species of southern Africa and synthesized it into one large volume titled Robert's Book of Birds of Southern Africa (Hockey *et. al*. 2005). This book is a semi-scientific publication that provides a full list of all references for each species up to the publication date and contains substantially more information on each species than most bird books available to "amateur ornithologists". This book will play a significant role in bringing information to these people and enlighten them on biological aspects that are otherwise not easily available to them.

RECOMMENDATIONS TOWARDS THE CONSERVATION OF AVIFAUNA

The transformation and loss of habitat still remains the biggest threat to conservation in the Western Cape. The province has become very popular as a tourist destination and numerous developments have being established along the coasts, resulting in the loss of coastal fynbos and the disruption of ecological processes. This phenomenon is slowly spreading to the mountainous areas where, until recently, little interest has been shown. In order to protect critical habitats, stewardship programs that facilitate the responsible management of conservation-worthy areas need to be implemented and expanded in a strategic manner.

Human-bird interactions are increasing and will continue to escalate with the increase in the human population within the Western Cape. The development and alteration of natural habitats associated with the increase in the human population will favour certain species, which naturally increase in number until they become a problem. This is already being experienced by the inhabitants of Cape Town with the Egyptian Geese, *Alopochen aegyptiacus* and the Pied Crow *Corvus albus*. There is a definite need for research into this aspect, specifically research into the development and testing of mitigation measure to reduce the impacts that the increase of these favoured species are having on the rest of the environment. If this is not done people will start taking things into their own hands and this could result in drastic and environmentally damaging measures like poisoning.

Lastly, information dissemination to the public via the media needs to improve. There is a need to inform the public on numerous conservation issues so that they have a better understanding of environmental issues. Within the avifaunal context, issues like Avian Flu and invasive species need to be clearly explained so that the general public do not act hastily and implement solutions that may cause more damage than good.

ACKNOWLEDGEMENTS

Acknowledgements are due to the Avian Demography Unit for the utilisation of the SABAP data which were used in the statistics for this chapter and to Tim Sutton and Andrew Turner for the developing the database and GIS routines that enabled the effortless analysis of the data. Thanks go also to Andrew Turner, Guy Palmer and Anton Wolfaardt for commenting on earlier drafts of this chapter.

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APPENDICES

Appendix 1: List of bird species known to occur or to have occurred in the Western Cape according to Robert's VIIth edition with South African and IUCN Red List status.

Family	Taxon	English name	SARDB Status	IUCN Status
Accipitridae	*Accipiter melanoleucus*	Black Sparrowhawk	Null	Null
Accipitridae	*Accipiter minullus*	Little Sparrowhawk	Null	Null
Accipitridae	*Accipiter rufiventris*	Rufous-chested Sparrowhawk	Null	Null
Accipitridae	*Accipiter tachiro*	African Goshawk	Null	Null
Accipitridae	*Aegypius tracheliotus*	Lappet-faced Vulture	Vulnerable (C1)	Vulnerable (C1)
Accipitridae	*Aquila nipalensis*	Steppe Eagle	Null	Null
Accipitridae	*Aquila pennatus*	Booted Eagle	Null	Null
Accipitridae	*Aquila rapax*	Tawny Eagle	Vulnerable (A1a+2b, C1)	Vulnerable (A1a+2b, C1)
Accipitridae	*Aquila verreauxii*	Verreaux's Eagle	Null	Null
Accipitridae	*Aquila wahlbergi*	Wahlberg's Eagle	Null	Null
Accipitridae	*Aviceda cuculoides*	African Cuckoo Hawk	Null	Null
Accipitridae	*Buteo rufofuscus*	Jackal Buzzard	Null	Null
Accipitridae	*Buteo trizonatus*	Forest Buzzard	Null	Null
Accipitridae	*Buteo vulpinus*	Steppe Buzzard	Null	Null
Accipitridae	*Circaetus cinereus*	Brown Snake-Eagle	Null	Null
Accipitridae	*Circaetus pectoralis*	Black-chested Snake-Eagle	Null	Null
Accipitridae	*Circus macrourus*	Pallid Harrier	NEAR Threatened (A1a)	Threatened (A1a)
Accipitridae	*Circus maurus*	Black Harrier	Near Threatened (D1)	Near Threatened (D1)
Accipitridae	*Circus pygargus*	Montagu's Harrier	Null	Null
Accipitridae	*Circus ranivorus*	African Marsh-Harrier	Vulnerable (A1c+2bc, C1)	Vulnerable (A1c+2bc, C1)
Accipitridae	*Elanus caeruleus*	Black-shouldered Kite	Null	Null
Accipitridae	*Gypaetus barbatus*	Bearded Vulture	Endangered (C2b)	Endangered (C2b)
Accipitridae	*Gypohierax angolensis*	Palm-nut Vulture	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Accipitridae	*Gyps coprotheres*	Cape Vulture	Vulnerable (A1acd+2bcd, C1+2b)	Vulnerable (A1acd+2bcd, C1+2b)
Accipitridae	*Haliaeetus vocifer*	African Fish-Eagle	Null	Null
Accipitridae	*Lophaetus occipitalis*	Long-crested Eagle	Null	Null
Accipitridae	*Melierax canorus*	Southern Pale Chanting Goshawk	Null	Null
Accipitridae	*Melierax gabar*	Gabar Goshawk	Null	Null
Accipitridae	*Milvus migrans parasitus*	Yellowbilled Kite	Null	Null
Accipitridae	*Neophron percnopterus*	Egyptian Vulture	Regionally Extinct	Regionally Extinct
Accipitridae	*Pandion haliaetus*	Osprey	Null	Null
Accipitridae	*Pernis apivorus*	European Honey-Buzzard	Null	Null
Accipitridae	*Polemaetus bellicosus*	Martial Eagle	Vulnerable (A1a, C1)	Vulnerable (A1a, C1)
Accipitridae	*Polyboroides typus*	African Harrier-Hawk	Null	Null
Accipitridae	*Stephanoaetus coronatus*	African Crowned Eagle	Threatened (A1c+2cd)	Threatened (A1c+2cd)
Alaudidae	*Calandrella cinerea*	Red-capped Lark	Null	Null
Alaudidae	*Calendulauda albescens*	Karoo Lark	Null	Null
Alaudidae	*Calendulauda burra*	Red Lark	Vulnerable (B1+2c, C2a)	Vulnerable (B1+2c, C2a)
Alaudidae	*Calendulauda sabota*	Sabota Lark	Null	Null
Alaudidae	*Certhilauda brevirostris*	Aghulas Long-billed Lrk	Null	Null
Alaudidae	*Certhilauda curvirostris*	Cape Long-billed Lark	Null	Null
Alaudidae	*Certhilauda subcoronata*	Karoo Long-billed Lark	Null	Null
Alaudidae	*Chersomanes albofasciata*	Spike-heeled Lark	Null	Null
Alaudidae	*Eremopterix australis*	Black-eared Sparrowlark	Null	Null
Alaudidae	*Eremopterix verticalis*	Grey-backed Sparrowlark	Null	Null
Alaudidae	*Galerida magnirostris*	Large-billed Lark	Null	Null
Alaudidae	*Mirafra apiata*	Cape Clapper Lark	Null	Null
Alaudidae	*Spizocorys sclateri*	Sclater's Lark	Threatened (C2a)	Threatened (C2a)
Alcedinidae	*Alcedo cristata*	Malachite Kingfisher	Null	Null
Alcedinidae	*Alcedo semitorquata*	Half-collared Kingfisher	Threatened (A1c+2c, B1+2bcde, C1)	Threatened (A1c+2c, B1+2bcde, C1)
Anatidae	*Alopochen aegyptiacus*	Egyptian Goose	Null	Null
Anatidae	*Anas capensis*	Cape Teal	Null	Null
Anatidae	*Anas clypeata*	Northern Shoveller	Null	Null
Anatidae	*Anas erythrorhyncha*	Red-billed Teal	Null	Null
Anatidae	*Anas hottentota*	Hottentot Teal	Null	Null
Anatidae	*Anas platyrhynchos*	Mallard Duck	Null	Null
Anatidae	*Anas smithii*	Cape Shoveler	Null	Null
Anatidae	*Anas sparsa*	African Black Duck	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Anatidae	*Anas undulata*	Yellow-billed Duck	Null	Null
Anatidae	*Cygnus olor*	Mute Swan	Null	Null
Anatidae	*Netta erythrophthalma*	Southern Pochard	Null	Null
Anatidae	*Oxyura maccoa*	Maccoa Duck	Null	Null
Anatidae	*Plectropterus gambensis*	Spur-winged Goose	Null	Null
Anatidae	*Tadorna cana*	South African Shelduck	Null	Null
Anhingidae	*Anhinga rufa*	African Darter	Null	Null
Apodidae	*Apus affinis*	Little Swift	Null	Null
Apodidae	*Apus apus*	Common Swift	Null	Null
Apodidae	*Apus barbatus*	African Black Swift	Null	Null
Apodidae	*Apus caffer*	White-rumped Swift	Null	Null
Apodidae	*Apus horus*	Horus Swift	Null	Null
Apodidae	*Cypsiurus parvus*	African Palm-swift	Null	Null
Apodidae	*Tachymarptis melba*	Alpine Swift	Null	Null
Ardeidae	*Ardea cinerea*	Grey Heron	Null	Null
Ardeidae	*Ardea goliath*	Goliath Heron	Null	Null
Ardeidae	*Ardea melanocephala*	Black-headed Heron	Null	Null
Ardeidae	*Ardea purpurea*	Purple Heron	Null	Null
Ardeidae	*Ardeola ralloides*	Squacco Heron	Null	Null
Ardeidae	*Botaurus stellaris*	Eurasian Bittern	Critically Endangered (A1c+2bc)	Critically Endangered (A1c+2bc)
Ardeidae	*Bubulcus ibis*	Cattle Egret	Null	Null
Ardeidae	*Butorides striata*	Green-backed Heron	Null	Null
Ardeidae	*Egretta alba*	Great Egret	Null	Null
Ardeidae	*Egretta caerulea*	Little Blue Heron	Null	Null
Ardeidae	*Egretta garzetta*	Little Egret	Null	Null
Ardeidae	*Egretta intermedia*	Yellow-billed Egret	Null	Null
Ardeidae	*Gorsachius leuconotus*	White-backed Night-heron	Vulnerable (F1)	Vulnerable (F1)
Ardeidae	*Ixobrychus minutus*	Little Bittern	Null	Null
Ardeidae	*Ixobrychus sturmii*	Dwarf Bittern	Null	Null
Ardeidae	*Nycticorax nycticorax*	Black-crowned Night-heron	Null	Null
Bucerotidae	*Tockus alboterminatus*	Crowned Hornbill	Null	Null
Burhinidae	*Burhinus capensis*	Spotted Thick-knee	Null	Null
Burhinidae	*Burhinus vermiculatus*	Water Thick-knee	Null	Null
Campephagidae	*Campephaga flava*	Black Cuckooshrike	Null	Null
Campephagidae	*Coracina caesia*	Grey Cuckooshrike	Null	Null
Caprimulgidae	*Caprimulgus europaeus*	European Nightjar	Null	Null
Caprimulgidae	*Caprimulgus pectoralis*	Fiery-necked Nightjar	Null	Null
Caprimulgidae	*Caprimulgus rufigena*	Rufous-cheecked Nightjar	Null	Null
Caprimulgidae	*Caprimulgus tristigma*	Freckled Nightjar	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Centropodiae	*Centropus burchellii*	Burchell's Coucal	Null	Null
Cerylidae	*Ceryle rudis*	Pied Kingfisher	Null	Null
Cerylidae	*Megaceryle maximus*	Giant Kingfisher	Null	Null
Chaetopidae	*Chaetops frenatus*	Cape Rock-jumper	Null	Null
Charadriidae	*Charadrius asiaticus*	Caspian Plover	Null	Null
Charadriidae	*Charadrius hiaticula*	Common Ringed Plover	Null	Null
Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover	Null	Null
Charadriidae	*Charadrius marginatus*	White-fronted Plover	Null	Null
Charadriidae	*Charadrius mongolus*	Lesser Sand Plover	Null	Null
Charadriidae	*Charadrius pallidus*	Chestnut-banded Plover	Threatened (B1+3ab)	Threatened (B1+3ab)
Charadriidae	*Charadrius pecuarius*	Kittlitzs's Plover	Null	Null
Charadriidae	*Charadrius tricollaris*	Three-banded Plover	Null	Null
Charadriidae	*Pluvialis dominica*	American Golden Plover	Null	Null
Charadriidae	*Pluvialis fulva*	Pacific Golden Plover	Null	Null
Charadriidae	*Pluvialis squatarola*	Grey Plover	Null	Null
Charadriidae	*Vanellus armatus*	Blacksmith Lapwing	Null	Null
Charadriidae	*Vanellus coronatus*	Crowned Lapwing	Null	Null
Charadriidae	*Vanellus melanopterus*	Black-winged Lapwing	Threatened (A2c)	Threatened (A2c)
Chionididae	*Chionis alba*	Greater Sheathbill	Null	Null
Ciconiidae	*Ciconia abdimii*	Abdim's Stork	Null	Null
Ciconiidae	*Ciconia ciconia*	White Stork	Null	Null
Ciconiidae	*Ciconia nigra*	Black Stork	Threatened (A2c)	Threatened (A2c)
Ciconiidae	*Leptoptilos crumeniferus*	Marabou Stork	Threatened (A2e)	Threatened (A2e)
Ciconiidae	*Mycteria ibis*	Yellow-billed Stork	Near Threatened (C1)	Near Threatened (C1)
Cisticolidae	*Apalis flavida*	Yellow-breasted Apalis	Null	Null
Cisticolidae	*Apalis thoracica*	Bar-throated Apalis	Null	Null
Cisticolidae	*Camaroptera brachyura*	Green-backed Camaroptera	Null	Null
Cisticolidae	*Cisticola aberrans*	Lazy Cisticola	Null	Null
Cisticolidae	*Cisticola aridulus*	Desert Cisticola	Null	Null
Cisticolidae	*Cisticola fulvicapilla*	Neddicky	Null	Null
Cisticolidae	*Cisticola juncidis*	Zitting Cisticola	Null	Null
Cisticolidae	*Cisticola lais*	Wailing Cisticola	Null	Null
Cisticolidae	*Cisticola subruficapilla*	Grey-backed Cisticola	Null	Null
Cisticolidae	*Cisticola textrix*	Cloud Cisticola	Null	Null
Cisticolidae	*Cisticola tinniens*	Levaillant's Cisticola	Null	Null
Cisticolidae	*Euryptila subcinnamomea*	Cinnamon-breasted Warbler	Null	Null
Cisticolidae	*Malcorus pectoralis*	Rufous-eared Warbler	Null	Null
Cisticolidae	*Phragmacia substriata*	Namaqua Warbler	Null	Null
Cisticolidae	*Prinia flavicans*	Black-chested Prinia	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Cisticolidae	*Prinia maculosa*	Karoo Prinia	Null	Null
Coliidae	*Colius colius*	White-backed Mousebird	Null	Null
Coliidae	*Colius striatus*	Speckled Mousebird	Null	Null
Coliidae	*Urocolius indicus*	Red-faced Mousebird	Null	Null
Columbidae	*Aplopelia larvata*	Lemon Dove	Null	Null
Columbidae	*Columba arquatrix*	African Olive-pigeon	Null	Null
Columbidae	*Columba guinea*	Speckled Pigeon	Null	Null
Columbidae	*Columba livia*	Rock Dove	Null	Null
Columbidae	*Oena capensis*	Namaqua Dove	Null	Null
Columbidae	*Streptopelia capicola*	Cape Turtle-dove	Null	Null
Columbidae	*Streptopelia semitorquata*	Red-eyed Dove	Null	Null
Columbidae	*Streptopelia senegalensis*	Laughing Dove	Null	Null
Columbidae	*Turtur chalcospilos*	Emerald-spotted Wood-dove	Null	Null
Columbidae	*Turtur tympanistria*	Tambourine Dove	Null	Null
Coraciidae	*Coracias caudatus*	Lilac-breasted Roller	Null	Null
Coraciidae	*Coracias garrulus*	European Roller	Null	Null
Corvidae	*Corvus albicollis*	White-necked Raven	Null	Null
Corvidae	*Corvus albus*	Pied Crow	Null	Null
Corvidae	*Corvus capensis*	Black Crow	Null	Null
Corvidae	*Corvus splendens*	House Crow	Null	Null
Cuculidae	*Chrysococcyx caprius*	Diderick Cuckoo	Null	Null
Cuculidae	*Chrysococcyx cupreus*	African Emerald Cuckoo	Null	Null
Cuculidae	*Chrysococcyx klaas*	Klaas's Cuckoo	Null	Null
Cuculidae	*Clamator glandarius*	Great Spotted Cuckoo	Null	Null
Cuculidae	*Clamator jacobinus*	Jacobin Cuckoo	Null	Null
Cuculidae	*Cuculus canorus*	Common Cuckoo	Null	Null
Cuculidae	*Cuculus clamosus*	Black Cuckoo	Null	Null
Cuculidae	*Cuculus solitarius*	Red-chested Cuckoo	Null	Null
Dacelonidae	*Halcyon albiventris*	Brown-hooded Kingfisher	Null	Null
Dacelonidae	*Halcyon leucocephala*	Grey-headed Kingfisher	Null	Null
Dendro-cygnidae	*Dendrocygna bicolor*	Fulvous Duck	Null	Null
Dendro-cygnidae	*Dendrocygna viduata*	White-faced Duck	Null	Null
Dendro-cygnidae	*Thalassornis leuconotus*	White-backed Duck	Null	Null
Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo	Null	Null
Diomedeidae	*Diomedea dabbenena*	Tristan Albatross	Null	Null
Diomedeidae	*Diomedea epomophora*	Southern Royal Albatross	Null	Null
Diomedeidae	*Diomedea exulans*	Wandering Albatross	Vulnerable (A1ad+2b)	Vulnerable (A1ad+2b)

Family	Taxon	English name	SARDB Status	IUCN Status
Diomedeidae	*Diomedea sanfordi*	Northern Royal Albatros	Null	Null
Diomedeidae	*Phoebetria fusca*	Sooty Albatross	Threatened (A2d)	Threatened (A2d)
Diomedeidae	*Phoebetria palpebrata*	Light-mantled Albatross	Threatened (A2d, C1)	Threatened (A2d, C1)
Diomedeidae	*Thalassarche bulleri*	Buller's Albatross	Null	Null
Diomedeidae	*Thalassarche carteri*	Indian Yellow-nosed Albatross	Null	Null
Diomedeidae	*Thalassarche cauta*	Shy Albatross	Vulnerable (A2d)	Vulnerable (A2d)
Diomedeidae	*Thalassarche chlororhynchos*	Atlantic Yellow-nosed Albatross	Threatened (A2d)	Threatened (A2d)
Diomedeidae	*Thalassarche chrysostoma*	Grey-headed Albatross	Vulnerable (A2d)	Vulnerable (A2d)
Diomedeidae	*Thalassarche melanophrys*	Black-browed Albatross	Threatened (A1a+2d)	Threatened (A1a+2d)
Diomedeidae	*Thalassarche salvini*	Salvin's Albatross	Null	Null
Dromadidae	*Dromas ardeola*	Crab Plover	Null	Null
Estrildidae	*Amadina erythrocephala*	Red-headed Finch	Null	Null
Estrildidae	*Coccopygia melanotis*	Swee Waxbill	Null	Null
Estrildidae	*Estrilda astrild*	Common Waxbill	Null	Null
Estrildidae	*Lagonosticta rubricata*	African Firefinch	Null	Null
Estrildidae	*Lagonosticta senegala*	Red-billed Firefinch	Null	Null
Estrildidae	*Ortygospiza atricollis*	African Quailfinch	Null	Null
Falconidae	*Falco amurensis*	Amur Falcon	Null	Null
Falconidae	*Falco biarmicus*	Lanner Falcon	Threatened (A1c+2c)	Threatened (A1c+2c)
Falconidae	*Falco naumanni*	Lesser Kestrel	Vulnerable (A1ace)	Vulnerable (A1ace)
Falconidae	*Falco peregrinus*	Peregrine Falcon	Threatened (C2a)	Threatened (C2a)
Falconidae	*Falco rupicoloides*	Greater Kestrel	Null	Null
Falconidae	*Falco rupicolus*	Rock Kestrel	Null	Null
Falconidae	*Falco subbuteo*	Eurasian Hobby	Null	Null
Fringillidae	*Crithagra albogularis*	White-throated Canary	Null	Null
Fringillidae	*Crithagra atrogularis*	Black-throated Canary	Null	Null
Fringillidae	*Crithagra flaviventris*	Yellow Canary	Null	Null
Fringillidae	*Crithagra gularis*	Streaky-headed Seedeater	Null	Null
Fringillidae	*Crithagra leucopterus*	Protea Seedeater	Null	Null
Fringillidae	*Crithagra mozambicus*	Yellow-fronted Canary	Null	Null
Fringillidae	*Crithagra scotops*	Forest Canary	Null	Null
Fringillidae	*Crithagra sulphuratus*	Brimstone Canary	Null	Null
Fringillidae	*Crithagra totta*	Cape Siskin	Null	Null
Fringillidae	*Emberiza capensis*	Cape Bunting	Null	Null
Fringillidae	*Emberiza flaviventris*	Golden-breasted Bunting	Null	Null
Fringillidae	*Emberiza impetuani*	Lark-like Bunting	Null	Null
Fringillidae	*Emberiza tahapisi*	Cinnamon-breasted Bunting	Null	Null
Fringillidae	*Fringilla coelebs*	Common Chaffinch	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Fringillidae	*Serinus alario*	Blackheaded Canary	Null	Null
Fringillidae	*Serinus canicollis*	Cape Canary	Null	Null
Glareolidae	*Cursorius rufus*	Burchell's Courser	Null	Null
Glareolidae	*Cursorius temminckii*	Temminck's Courser	Null	Null
Glareolidae	*Glareola nordmanni*	Black-winged Pratincole	Threatened (B2e+3ab)	Threatened (B2e+3ab)
Glareolidae	*Glareola pratincola*	Collared Pratincole	Threatened (A1ac+2c)	Threatened (A1ac+2c)
Glareolidae	*Rhinoptilus africanus*	Double-banded Courser	Null	Null
Gruidae	*Anthropoides paradiseus*	Blue Crane	Vulnerable (A1acde+2bc)	Vulnerable (A1acde+2bc)
Gruidae	*Balearica regulorum*	Grey Crowned Crane	Vulnerable (A1ac+2bc, C1)	Vulnerable (A1ac+2bc, C1)
Gruidae	*Bugeranus carunculatus*	Wattled Crane	Critically Endangered (A2c, C1+2a)	Critically Endangered (A2c, C1+2a)
Haemato-podidae	*Haematopus moquini*	African Black Oystercatcher	Threatened (A1c+2c, C1)	Threatened (A1c+2c, C1)
Haemato-podidae	*Haematopus ostralegus*	European Oystercatcher	Null	Null
Heliornithidae	*Podica senegalensis*	African Finfoot	Vulnerable (A2c, C1)	Vulnerable (A2c, C1)
Hirundinidae	*Delichon urbicum*	Common House-Martin	Null	Null
Hirundinidae	*Hirundo abyssinica*	Lesser Striped Swallow	Null	Null
Hirundinidae	*Hirundo albigularis*	White-throated Swallow	Null	Null
Hirundinidae	*Hirundo cucullata*	Greater Striped Swallow	Null	Null
Hirundinidae	*Hirundo dimidiata*	Pearl-breasted Swallow	Null	Null
Hirundinidae	*Hirundo fuligula*	Rock Martin	Null	Null
Hirundinidae	*Hirundo rustica*	Barn Swallow	Null	Null
Hirundinidae	*Hirundo spilodera*	South African Cliff-Swallow	Null	Null
Hirundinidae	*Psalidoprocne holomelaena*	Black Saw-wing	Null	Null
Hirundinidae	*Riparia cincta*	Banded Martin	Null	Null
Hirundinidae	*Riparia paludicola*	Brown-throated Martin	Null	Null
Hirundinidae	*Riparia riparia*	Sand Martin	Null	Null
Hydrobatidae	*Fregetta grallaria*	White-bellied Storm-Petrel	Null	Null
Hydrobatidae	*Fregetta tropica*	Black-bellied Storm-Petrel	Null	Null
Hydrobatidae	*Hydrobates pelagicus*	European Storm-Petrel	Null	Null
Hydrobatidae	*Oceanites oceanicus*	Wilson's Storm-Petrel	Null	Null
Hydrobatidae	*Oceanodroma leucorhoa*	Leach's Storm-Petrel	Null	Null
Hydrobatidae	*Pelagodroma marina*	White-faced Storm-Petrel	Null	Null
Indicatoridae	*Indicator indicator*	Greater Honeyguide	Null	Null
Indicatoridae	*Indicator minor*	Lesser Honeyguide	Null	Null
Indicatoridae	*Indicator variegatus*	Scaly-throated Honeyguide	Null	Null
Indicatoridae	*Prodotiscus regulus*	Brown-backed Honeybird	Null	Null
Jacanidae	*Actophilornis africanus*	African Jacana	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Laniidae	*Lanius collaris*	Common Fiscal	Null	Null
Laniidae	*Lanius collurio*	Red-backed Shrike	Null	Null
Laniidae	*Lanius minor*	Lesser Grey Shrike	Null	Null
Laridae	*Catharacta antarctica*	Subantarctic Skua	Null	Null
Laridae	*Catharacta maccormicki*	South Polar Skua	Null	Null
Laridae	*Chlidonias hybrida*	Whiskered Tern	Null	Null
Laridae	*Chlidonias leucopterus*	White-winged Tern	Null	Null
Laridae	*Chlidonias niger*	Black Tern	Null	Null
Laridae	*Larus cirrocephalus*	Grey-headed Gull	Null	Null
Laridae	*Larus dominicanus*	Kelp Gull	Null	Null
Laridae	*Larus fuscus*	Lesser Black-backed Gull	Null	Null
Laridae	*Larus hartlaubii*	Hartlaub's Gull	Null	Null
Laridae	*Larus pipixcan*	Franklin's Gull	Null	Null
Laridae	*Larus sabini*	Sabine's Gull	Null	Null
Laridae	*Rissa tridactyla*	Black-legged Kittiwake	Null	Null
Laridae	*Stercorarius longicaudus*	Long-tailed Jaeger	Null	Null
Laridae	*Stercorarius parasiticus*	Parasitic Jaeger	Null	Null
Laridae	*Stercorarius pomarinus*	Pomarine Jaeger	Null	Null
Laridae	*Sterna albifrons*	Little Tern	Null	Null
Laridae	*Sterna balaenarum*	Damara Tern	Endangered (A2c, C2a, D1)	Endangered (A2c, C2a, D1)
Laridae	*Sterna bergii*	Swift Tern	Null	Null
Laridae	*Sterna caspia*	Caspian Tern	Near Threatened (C1)	Near Threatened (C1)
Laridae	*Sterna dougallii*	Roseate Tern	Endangered (B1+3d, C2a)	Endangered (B1+3d, C2a)
Laridae	*Sterna hirundo*	Common Tern	Null	Null
Laridae	*Sterna paradisaea*	Arctic Tern	Null	Null
Laridae	*Sterna sandvicensis*	Sandwich Tern	Null	Null
Laridae	*Sterna vittata*	Antarctic Tern	Null	Null
Lybiidae	*Pogoniulus pusillus*	Red-fronted Tinkerbird	Null	Null
Lybiidae	*Trachyphonus vaillantii*	Crested Barbet	Null	Null
Lybiidae	*Tricholaema leucomelas*	Acacia Pied Barbet	Null	Null
Malaconotidae	*Batis capensis*	Cape Batis	Null	Null
Malaconotidae	*Batis pririt*	Pririt batis	Null	Null
Malaconotidae	*Dryoscopus cubla*	Black-backed Puffback	Null	Null
Malaconotidae	*Laniarius ferrugineus*	Southern Boubou	Null	Null
Malaconotidae	*Tchagra tchagra*	SouthernTchagra	Null	Null
Malaconotidae	*Telophorus olivaceus*	Olive Bush-Shrike	Null	Null
Malaconotidae	*Telophorus zeylonus*	Bokmakierie	Null	Null
Meropidae	*Merops apiaster*	European Bee-eater	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Meropidae	*Merops bullockoides*	White-fronted Bee-eater	Null	Null
Meropidae	*Merops nubicoides*	Southern Carmine Bee-eater	Null	Null
Meropidae	*Merops persicus*	Blue-cheecked Bee-eater	Null	Null
Monarchidae	*Terpsiphone viridis*	African Paradise-Flycatcher	Null	Null
Monarchidae	*Trochocercus cyanomelas*	Blue-mantled Crested Flycatcher	Null	Null
Motacillidae	*Anthus cinnamomeus*	African Pipit	Null	Null
Motacillidae	*Anthus crenatus*	African Rock Pipit	Null	Null
Motacillidae	*Anthus leucophrys*	Plain-backed Pipit	Null	Null
Motacillidae	*Anthus similis*	Long-billed Pipit	Null	Null
Motacillidae	*Anthus vaalensis*	Buffy Pipit	Null	Null
Motacillidae	*Macronyx capensis*	Cape Longclaw	Null	Null
Motacillidae	*Motacilla aguimp*	African Pied Wagtail	Null	Null
Motacillidae	*Motacilla capensis*	Cape Wagtail	Null	Null
Motacillidae	*Motacilla cinerea*	Grey Wagtail	Null	Null
Motacillidae	*Motacilla flava*	Yellow Wagtail	Null	Null
Muscicapidae	*Bradornis infuscatus*	Chat Flycatcher	Null	Null
Muscicapidae	*Cercomela familiaris*	Familiar Chat	Null	Null
Muscicapidae	*Cercomela schlegelii*	Karoo Chat	Null	Null
Muscicapidae	*Cercomela sinuata*	Sicklewinged Chat	Null	Null
Muscicapidae	*Cercomela tractrac*	Tractrac Chat	Null	Null
Muscicapidae	*Cercotrichas coryphaeus*	Karoo Scrub-Robin	Null	Null
Muscicapidae	*Cossypha caffra*	Cape Robin-Chat	Null	Null
Muscicapidae	*Cossypha dichroa*	Chorister Robin-Chat	Null	Null
Muscicapidae	*Monticola brevipes*	Short-toed Rock-Thrush	Null	Null
Muscicapidae	*Monticola explorator*	Sentinel Rock-Thrush	Null	Null
Muscicapidae	*Monticola rupestris*	Cape Rock-Thrush	Null	Null
Muscicapidae	*Muscicapa adusta*	African Dusky Flycatcher	Null	Null
Muscicapidae	*Muscicapa striata*	Spotted Flycatcher	Null	Null
Muscicapidae	*Myrmecocichla formicivora*	Anteating Chat	Null	Null
Muscicapidae	*Oenanthe monticola*	Mountain Wheatear	Null	Null
Muscicapidae	*Oenanthe pileata*	Capped Wheatear	Null	Null
Muscicapidae	*Pogonocichla stellata*	White-Starred Robin	Null	Null
Muscicapidae	*Saxicola torquata*	African Stonechat	Null	Null
Muscicapidae	*Sigelus silens*	Fiscal Flycatcher	Null	Null
Muscicapidae	*Thamnolaea cinnamomeiventris*	Mocking Cliff-Chat	Null	Null
Muscicapidae	*Turdus olivaceus*	Olive Thrush	Null	Null
Muscicapidae	*Turdus smithi*	Karoo Thrush	Null	Null
Musophagidae	*Tauraco corythaix*	Knysna Turaco	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Nectariniidae	*Anthobaphes violacea*	Orange-breasted Sunbird	Null	Null
Nectariniidae	*Chalcomitra amethystina*	Amethyst Sunbird	Null	Null
Nectariniidae	*Cinnyris afer*	Greater Double-collared Sunbird	Null	Null
Nectariniidae	*Cinnyris chalybeus*	Southern Double-collared Sunbird	Null	Null
Nectariniidae	*Cinnyris fuscus*	Dusky Sunbird	Null	Null
Nectariniidae	*Hedydipna collaris*	Collared Sunbird	Null	Null
Nectariniidae	*Nectarinia famosa*	Malachite Sunbird	Null	Null
Numididae	*Numida meleagris*	Helmeted Guineafowl	Null	Null
Oriolidae	*Oriolus larvatus*	Black-headed Oriole	Null	Null
Oriolidae	*Oriolus oriolus*	European Golden Oriole	Null	Null
Otididae	*Afrotis afra*	Southern Black Korhaan	Null	Null
Otididae	*Ardeotis kori*	Kori Bustard	Vulnerable (C1)	Vulnerable (C1)
Otididae	*Eupodotis caerulescens*	Blue Korhaan	Threatened (A2c)	Threatened (A2c)
Otididae	*Eupodotis vigorsii*	Karoo Korhaan	Null	Null
Otididae	*Neotis denhami*	Denham's Bustard	Vulnerable (A1ac+2bc, C1)	Vulnerable (A1ac+2bc, C1)
Otididae	*Neotis ludwigii*	Ludwig's Bustard	Vulnerable (A1a+2b)	Vulnerable (A1a+2b)
Paridae	*Anthoscopus minutus*	Cape Penduline-Tit	Null	Null
Paridae	*Parus afer*	Grey Tit	Null	Null
Passeridae	*Passer diffusus*	Southern Grey-headed Sparrow	Null	Null
Passeridae	*Passer domesticus*	House Sparrow	Null	Null
Passeridae	*Passer melanurus*	Cape Sparrow	Null	Null
Passeridae	*Petronia superciliaris*	Yellow-throated Petronia	Null	Null
Pelecanidae	*Pelecanus onocrotalus*	Great White Pelican	Threatened (A2c)	Threatened (A2c)
Phaethontidae	*Phaethon aethereus*	Red-billed Tropicbird	Null	Null
Phaethontidae	*Phaethon lepturus*	White-tailed Tropicbird	Null	Null
Phaethontidae	*Phaethon rubricauda*	Red-tailed Tropicbird	Null	Null
Phalacrocoracidae	*Phalacrocorax africanus*	Reed Cormorant	Null	Null
Phalacrocoracidae	*Phalacrocorax capensis*	Cape Cormorant	Threatened (A1a+2bc)	Threatened (A1a+2bc)
Phalacrocoracidae	*Phalacrocorax coronatus*	Crowned Cormorant	Near Threatened (C1, D1)	Near Threatened (C1, D1)
Phalacrocoracidae	*Phalacrocorax lucidus*	White-breasted Cormorant	Null	Null
Phalacrocoracidae	*Phalacrocorax neglectus*	Bank Cormorant	Vulnerable (A1a+2b, C1)	Vulnerable (A1a+2b, C1)
Phasianidae	*Alectoris chukar*	Chukar partridge	Null	Null
Phasianidae	*Coturnix coturnix*	Common Quail	Null	Null
Phasianidae	*Pavo cristatus*	Common Peacock	Null	Null
Phasianidae	*Pternistes afer*	Red-necked Spurfowl	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Phasianidae	*Pternistes capensis*	Cape Spurfowl	Null	Null
Phasianidae	*Scleroptila africanus*	Grey-winged Francolin	Null	Null
Phasianidae	*Scleroptila levaillantii*	Red-winged Francolin	Null	Null
Phoenicopteridae	*Phoenicopterus minor*	Lesser Flamingo	Threatened (A1a+2c)	Threatened (A1a+2c)
Phoenicopteridae	*Phoenicopterus ruber*	Greater Flamingo	Threatened (B3abcd)	Threatened (B3abcd)
Phoeniculidae	*Phoeniculus purpureus*	Green Wood-hoopoe	Null	Null
Picidae	*Campethera notata*	Knysna Woodpecker	Near Threatened (C1)	Near Threatened (C1)
Picidae	*Dendropicos fuscescens*	Cardinal Woodpecker	Null	Null
Picidae	*Dendropicos griseocephalus*	Olive Woodpecker	Null	Null
Picidae	*Geocolaptes olivaceus*	Ground Woodpecker	Null	Null
Ploceidae	*Amblyospiza albifrons*	Thick-billed Weaver	Null	Null
Ploceidae	*Euplectes afer*	Yellow-crowned Bishop	Null	Null
Ploceidae	*Euplectes capensis*	Yellow Bishop	Null	Null
Ploceidae	*Euplectes orix*	Southern Red Bishop	Null	Null
Ploceidae	*Plocepasser mahali*	White-browed Sparrow-Weaver	Null	Null
Ploceidae	*Ploceus capensis*	Cape Weaver	Null	Null
Ploceidae	*Ploceus velatus*	Southern Masked-Weaver	Null	Null
Ploceidae	*Quelea quelea*	Red-billed Quelea	Null	Null
Ploceidae	*Sporopipes squamifrons*	Scaly-feathered Finch	Null	Null
Podicipedidae	*Podiceps cristatus*	Great Crested Grebe	Null	Null
Podicipedidae	*Podiceps nigricollis*	Black-necked Grebe	Null	Null
Podicipedidae	*Tachybaptus ruficollis*	Little Grebe	Null	Null
Procellariidae	*Bulweria bulwerii*	Bulwer's Petrel	Null	Null
Procellariidae	*Calonectris diomedea*	Cory's Shearwater	Null	Null
Procellariidae	*Daption capense*	Pintado Petrel	Null	Null
Procellariidae	*Fulmarus glacialoides*	Southern Fulmar	Null	Null
Procellariidae	*Halobaena caerulea*	Blue Petrel	Null	Null
Procellariidae	*Lugensa brevirostris*	Kerguelen Petrel	Null	Null
Procellariidae	*Macronectes giganteus*	Southern Giant-Petrel	Threatened (A1ad)	Threatened (A1ad)
Procellariidae	*Macronectes halli*	Northern Giant-Petrel	Threatened (A2de)	Threatened (A2de)
Procellariidae	*Pachyptila belcheri*	Slender-billed Prion	Null	Null
Procellariidae	*Pachyptila desolata*	Antarctic Prion	Null	Null
Procellariidae	*Pachyptila salvini*	Salvin's Prion	Null	Null
Procellariidae	*Pachyptila turtur*	Fairy Prion	Null	Null
Procellariidae	*Pachyptila vittata*	Broad-billed Prion	Null	Null
Procellariidae	*Procellaria aequinoctialis*	White-chinned Petrel	Threatened (A1cde+2cde)	Threatened (A1cde+2cde)
Procellariidae	*Procellaria cinerea*	Grey Petrel	Threatened (A1d+2d)	Threatened (A1d+2d)

Family	Taxon	English name	SARDB Status	IUCN Status
Procellariidae	*Procellaria conspicillata*	Spectacled Petrel	Null	Null
Procellariidae	*Pterodroma incerta*	Atlantic Petrel	Null	Null
Procellariidae	*Pterodroma lessonii*	White-headed Petrel	Null	Null
Procellariidae	*Pterodroma macroptera*	Great-winged Petrel	Null	Null
Procellariidae	*Pterodroma mollis*	Soft-plumaged Petrel	Null	Null
Procellariidae	*Puffinus assimilis*	Little Shearwater	Null	Null
Procellariidae	*Puffinus carneipes*	Flesh-footed Shearwater	Null	Null
Procellariidae	*Puffinus gravis*	Great Shearwater	Null	Null
Procellariidae	*Puffinus griseus*	Sooty Shearwater	Null	Null
Procellariidae	*Puffinus mauretanicus*	Balearic Shearwater	Null	Null
Procellariidae	*Puffinus puffinus*	Manx Shearwater	Null	Null
Procellariidae	*Thalassoica antarctica*	Antartic Petrel	Null	Null
Promeropidae	*Promerops cafer*	Cape Sugarbird	Null	Null
Psittacidae	*Poicephalus robustus*	Cape Parrot	Endangered (A1a+2bc, B1+2c, C2a)	Endangered (A1a+2bc, B1+2c, C2a)
Pteroclidae	*Pterocles namaqua*	Namaqua Sandgrouse	Null	Null
Pyconotidae	*Andropadus importunus*	Sombre Greenbul	Null	Null
Pyconotidae	*Phyllastrephus terrestris*	Terrestrial Brownbul	Null	Null
Pyconotidae	*Pycnonotus capensis*	Cape Bulbul	Null	Null
Pyconotidae	*Pycnonotus nigricans*	African Red-eyed Bulbul	Null	Null
Rallidae	*Amaurornis flavirostris*	Black Crake	Null	Null
Rallidae	*Crecopsis egregia*	African Crake	Null	Null
Rallidae	*Fulica cristata*	Red-knobbed Coot	Null	Null
Rallidae	*Gallinula chloropus*	Common Moorhen	Null	Null
Rallidae	*Porphyrio alleni*	Allen's Gallinule	Null	Null
Rallidae	*Porphyrio madagascariensis*	African Purple Swamphen	Null	Null
Rallidae	*Porphyrio martinicus*	American Purple Gallinule	Null	Null
Rallidae	*Porzana pusilla*	Baillon's Crake	Null	Null
Rallidae	*Rallus caerulescens*	African Rail	Null	Null
Rallidae	*Sarothrura affinis*	Striped Flufftail	Vulnerable (A1c+2c, C1+2a)	Vulnerable (A1c+2c, C1+2a)
Rallidae	*Sarothrura elegans*	Buff-spotted Flufftail	Null	Null
Rallidae	*Sarothrura rufa*	Red-chested Flufftail	Null	Null
Recurviro-stridae	*Himantopus himantopus*	Black-winged Stilt	Null	Null
Recurviro-stridae	*Recurvirostra avosetta*	Pied Avocet	Null	Null
Rhinopo-masitdae	*Rhinopomastus cyanomelas*	Common Scimitarbill	Null	Null
Rostratulidae	*Rostratula benghalensis*	Greater Painted-snipe	Threatened (A1c+2c)	Threatened (A1c+2c)

Family	Taxon	English name	SARDB Status	IUCN Status
Sagittariidae	*Sagittarius serpentarius*	Secretary Bird	Threatened (A1c+2c)	Threatened (A1c+2c)
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	Null	Null
Scolopacidae	*Arenaria interpres*	Ruddy Turnstone	Null	Null
Scolopacidae	*Calidris alba*	Sanderling	Null	Null
Scolopacidae	*Calidris bairdii*	Baird's Sandpiper	Null	Null
Scolopacidae	*Calidris canutus*	Red Knot	Null	Null
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	Null	Null
Scolopacidae	*Calidris fuscicollis*	White-rumped Sandpiper	Null	Null
Scolopacidae	*Calidris melanotos*	Pectoral Sandpiper	Null	Null
Scolopacidae	*Calidris minuta*	Little Stint	Null	Null
Scolopacidae	*Calidris ruficollis*	Red-necked Stint	Null	Null
Scolopacidae	*Calidris tenuirostis*	Great Knot	Null	Null
Scolopacidae	*Gallinago nigripennis*	African Snipe	Null	Null
Scolopacidae	*Limicola falcinellus*	Broad-billed Sandpiper	Null	Null
Scolopacidae	*Limosa haemastica*	Hudsonian Godwit	Null	Null
Scolopacidae	*Limosa lapponica*	Bar-tailed Godwit	Null	Null
Scolopacidae	*Limosa limosa*	Black-tailed Godwit	Null	Null
Scolopacidae	*Numenius arquata*	Eurasian Curlew	Null	Null
Scolopacidae	*Numenius phaeopus*	Common Whimbrel	Null	Null
Scolopacidae	*Phalaropus fulicaria*	Red Phalarope	Null	Null
Scolopacidae	*Phalaropus lobatus*	Red-necked Phalarope	Null	Null
Scolopacidae	*Philomachus pugnax*	Ruff	Null	Null
Scolopacidae	*Steganopus tricolor*	Wilson's Phalarope	Null	Null
Scolopacidae	*Tringa flavipes*	Lesser Yellowlegs	Null	Null
Scolopacidae	*Tringa glareola*	Wood Sandpiper	Null	Null
Scolopacidae	*Tringa melanoleuca*	Greater Yellowlegs	Null	Null
Scolopacidae	*Tringa nebularia*	Common Greenshank	Null	Null
Scolopacidae	*Tringa ochropus*	Green Sandpiper	Null	Null
Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper	Null	Null
Scolopacidae	*Tringa totanus*	Redshank	Null	Null
Scolopacidae	*Tryngites subruficollis*	Buff-breasted Sandpiper	Null	Null
Scolopacidae	*Xenus cinereus*	Terek Sandpiper	Null	Null
Scopidae	*Scopus umbretta*	Hamerkop	Null	Null
Spheniscidae	*Aptenodytes patagonicus*	King Penguin	Null	Null
Spheniscidae	*Eudyptes chrysocome*	Rockhopper Penguin	Threatened (A1acde)	Threatened (A1acde)
Spheniscidae	*Eudyptes chrysolophus*	Macaroni Penguin	Threatened (A1cde)	Threatened (A1cde)
Spheniscidae	*Pygoscelis papua*	Gentoo Penguin	Null	Null
Spheniscidae	*Spheniscus demersus*	African Penguin	Vulnerable (A1acde+2bce)	Vulnerable (A1acde+2bce)
Strigidae	*Asio capensis*	Marsh Owl	Null	Null
Strigidae	*Bubo africanus*	Spotted Eagle-owl	Null	Null

Family	Taxon	English name	SARDB Status	IUCN Status
Strigidae	*Bubo capensis*	Cape Eagle-owl	Null	Null
Strigidae	*Bubo lacteus*	Verreaux's Eagle-owl	Null	Null
Strigidae	*Otus senegalensis*	African Scops-owl	Null	Null
Strigidae	*Strix woodfordii*	African Wood-owl	Null	Null
Struthionidae	*Struthio camelus*	Common Ostrich	Null	Null
Sturnidae	*Acridotheres tristis*	Common Myna	Null	Null
Sturnidae	*Creatophora cinerea*	Wattled Starling	Null	Null
Sturnidae	*Lamprotornis corruscus*	Black-bellied Glossy Starling	Null	Null
Sturnidae	*Lamprotornis nitens*	Cape Glossy Starling	Null	Null
Sturnidae	*Onychognathus morio*	Red-winged Starling	Null	Null
Sturnidae	*Onychognathus nabouroup*	Pale-winged Starling	Null	Null
Sturnidae	*Spreo bicolor*	Pied Starling	Null	Null
Sturnidae	*Sturnus vulgaris*	Common Starling	Null	Null
Sulidae	*Morus capensis*	Cape Gannet	Vulnerable (A2c, B1+3bd, D2)	Vulnerable (A2c, B1+3bd, D2)
Sulidae	*Morus serrator*	Australian Gannet	Null	Null
Sulidae	*Sula sula*	Red-footed Booby	Null	Null
Sylviidae	*Acrocephalus baeticatus*	African Reed-Warbler	Null	Null
Sylviidae	*Acrocephalus gracilirostris*	Lesser Swamp Warbler	Null	Null
Sylviidae	*Acrocephalus palustris*	Marsh Warbler	Null	Null
Sylviidae	*Acrocephalus schoenobaenus*	Sedge Warbler	Null	Null
Sylviidae	*Bradypterus baboecala*	Little Rush-Warbler	Null	Null
Sylviidae	*Bradypterus sylvaticus*	Knysna Warbler	Vulnerable (B1+2abcd, C2a)	Vulnerable (B1+2abcd, C2a)
Sylviidae	*Cryptillas victorini*	Victorin's Warbler	Null	Null
Sylviidae	*Eremomela gregalis*	Karoo Eremomela	Null	Null
Sylviidae	*Eremomela icteropygialis*	Yellow-bellied Eremomela	Null	Null
Sylviidae	*Hippolais icterina*	Icterine Warbler	Null	Null
Sylviidae	*Parisoma layardi*	Layard's Tit-Babbler	Null	Null
Sylviidae	*Parisoma subcaeruleum*	Chestnut-vented Tit-Babbler	Null	Null
Sylviidae	*Phylloscopus ruficapilla*	Yellow-throated Woodland-Warbler	Null	Null
Sylviidae	*Phylloscopus trochilus*	Willow Warbler	Null	Null
Sylviidae	*Sphenoeacus afer*	Cape Grassbird	Null	Null
Sylviidae	*Stenostira scita*	Fairy Flycatcher	Null	Null
Sylviidae	*Sylvietta rufescens*	Long-billed Crombec	Null	Null
Threskiornidae	*Bostrychia hagedash*	Hadeda Ibis	Null	Null
Threskiornidae	*Geronticus calvus*	Southern Bald Ibis	Vulnerable (A2c, C1+2b)	Vulnerable (A2c, C1+2b)

Family	Taxon	English name	SARDB Status	IUCN Status
Threskiornidae	*Platalea alba*	African Spoonbill	Null	Null
Threskiornidae	*Plegadis falcinellus*	Glossy Ibis	Null	Null
Threskiornidae	*Threskiornis aethiopicus*	African Sacred Ibis	Null	Null
Trogonidae	*Apaloderma narina*	Narina Trogon	Null	Null
Turnicidae	*Turnix hottentottus*	Hottentot Buttonquail	Endangered (C2a)	Endangered (C2a)
Turnicidae	*Turnix nanus*	Black-rumped Buttonquail	Null	Null
Tytonidae	*Tyto alba*	Barn Owl	Null	Null
Tytonidae	*Tyto capensis*	African Grass-owl	Vulnerable (A2c, C1)	Vulnerable (A2c, C1)
Upupidae	*Upupa africana*	African Hoopoe	Null	Null
Viduidae	*Vidua macroura*	Pin-tailed Whydah	Null	Null
Zosteropidae	*Zosterops pallidus*	Orange River White-eye	Null	Null
Zosteropidae	*Zosterops virens*	Cape White-eye	Null	Null

Appendix 2. List of high and intermediate conservation priority bird species occurring within the Western Cape Province using the same methodology as Shaw 1994 but using the latest taxonomical changes as reflected in the Roberts VIIth edition.

HIGH PRIORITY

African Penguin	*Spheniscus demersus*
Cape Vulture	*Gyps coprotheres*
Damara Tern	*Sterna balaenarum*
Bank Cormorant	*Phalacrocorax neglectus*
Lesser Flamingo	*Phoenicopterus minor*
Martial Eagle	*Polemaetus bellicosus*
Cape Gannet	*Morus capensis*
Crowned Cormorant	*Phalacrocorax coronatus*
African Black Oystercatcher	*Haematopus moquini*
African Grass Owl	*Tyto capensis*
African Crowned Eagle	*Stephanoaetus coronatus*
Hottentot Buttonquail	*Turnix hottentottus*
Ludwig's Bustard	*Neotis ludwigii*
Great White Pelican	*Pelecanus onocrotalus*
Greater Flamingo	*Phoenicopterus ruber*
Kori Bustard	*Ardeotis kori*
Denham's Bustard	*Neotis denhami*
Caspian Tern	*Sterna caspia*
Secretarybird	*Sagittarius serpentarius*
Striped Flufftail	*Sarothrura affinis*
Marsh Owl	*Asio capensis*
Cape Cormorant	*Phalacrocorax capensis*
Gabar Goshawk	*Melierax gabar*
Common Tern	*Sterna hirundo*
Knysna Turaco	*Tauraco corythaix*
Cape Eagle-Owl	*Bubo capensis*

INTERMEDIATE PRIORITY

White Stork (Breeding)	*Ciconia ciconia*
African Marsh-Harrier	*Circus ranivorus*
Blue Crane	*Anthropoides paradiseus*
Baillon's Crake	*Porzana pusilla*
African Jacana	*Actophilornis africanus*
Greater Painted-Snipe	*Rostratula benghalensis*
Chestnut-Banded Plover	*Charadrius pallidus*
Eurasian Curlew	*Numenius arquata*
Antarctic Tern	*Sterna vittata*
Narina Trogon	*Apaloderma narina*
Cape Rock-Jumper	*Chaetops frenatus*
Little Sparrowhawk	*Accipiter minullus*
Red Knot	*Calidris canutus*
Ruff	*Philomachus pugnax*
Whiskered Tern	*Chilodonias hybrida*
Half-Collared Kingfisher	*Alcedo semitorquatta*
Common House-Martin	*Delichon urbicum*
Victorin's Warbler	*Cryptillas victorini*
Namaqua Warbler	*Phragmacia substriata*
Cape Sugarbird	*Promerops cafer*
Black Stork	*Ciconia nigra*
Southern Pale Chanting Goshawk	*Melierax canorus*
Black Harrier	*Circus maurus*
Peregrine Falcon (Breeding)	*Falco peregrinus*
Peregrine Falcon (Non Breeding)	*Falco peregrinus*
Ruddy Turnstone	*Arenaria interpres*
African Snipe	*Gallinago nigripennis*
Jacobin Cuckoo	*Calamtor jacobinus*
African Emerald Cuckoo	*Chrysococcyx cupreus*
Green Wood-Hoopoe	*Phoeniculus purpureus*
Scaly-Throated Honeyguide	*Indicator variegatus*
Agulhas Long-Billed Lark	*Certhilauda brevirostris*
Starred Robin	*Pogonocichla stellata*
Green-Backed Camaroptera	*Camaroptera brachyura*

CHAPTER 8

FLORA & VEGETATION

A. le Roux[1], V. Bowie[1], F. Daniels[2], D.C. Raimondo[2], A.G. Rebelo[2], L. Mucina[3], M.C. Rutherford[2], L.W. Powrie[2], T.H. Arnold[2], C. de Wet[2], Y. Steenkamp[2], E.E. Snyman[2], H.M. Steyn[2], W.B. Foden[2], C. Geland[1] & B.B. Gysman[1]

[1]Scientific Services, CapeNature; [2]South African National Biodiversity Institute, [3]Botany Department, University of Stellenbosch

rouxa@cncjnk.pgwc.gov.za; afrobokkie@yahoo.com; daniels@sanbi.org; raimondo@sanbi.org; rebelo@sanbi.org; lm3@sun.ac.za; rutherford@sanbi.org; powrie@sanbi.org; arnold@sanbi.org; dewet@sanbi.org; steenkamp@sanbi.org; snymane@sanbi.org; steyn@sanbi.org; foden@sanbi.org; christabel@cncjnk.pgwc.gov.za; bridgette@cncjnk.pgwc.gov.za

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Executive Summary

The flora of the Western Cape Province (WCP) is paticularly rich, with 11 388 plant taxa (icluding infraspecific taxa) recorded in the WCP compared to 20 627 taxa recorded for the whole of South Africa (SA), excluding Lesotho & Swaziland and 66 142 taxa in Africa. This means that the WCP has 55% of SA's plant taxa in only 11% of SA's land area and 17% of Africa's plant taxa in 0.24% of Africa's land area. Of the plant taxa in the WCP, 10 916 (96%) are indigenous and 472 (4%) are naturalised (originally from outside the WCP). Of the naturalised taxa, 137 or 1% of the WCP flora, are invasive species. A high number of the flora is endemic (6 776 taxa or 60%) and 1 212 plant taxa, or 68% of SA's threatened species, are found in the WCP. Twenty seven species in the WCP are extinct (57% of SA's extinct species).

Of the 166 vegetation units found in the WCP, 110 (66%) are endemic to the WCP. Of these, 35 vegetation units presently have very little (0.1 to 5%) and 24 units have no area under protection. The areas under conservation of seven vegetation units improved by more than 10% between 2002 and 2006.

All District Municipalities in the WCP contain vegetation units that are endemic to their political boundary. All District Municipalities, except of the Central Karoo, are home to Critically Endangered, Endangered and Vulnerable vegetation units.

The large proportion of endemic and threatened flora and vegetation units in the WCP place an enormous responsibility on the governments of both SA and the WCP to ensure the survival of this unique flora. In the Fynbos or Cape Floristic Region the greatest threat to the plant taxa is agriculture (mainly on the lowlands).

INTRODUCTION

The Western Cape Province (WCP) is endowed with a world-renowned plant diversity and diversity of vegetation communities. This province hosts two of six, or 33%, of the world plant kingdoms, namely the Cape Floral Kingdom and the Palaeotropical Kingdom, two of the 34, or 6%, of the world's Biodiversity Hotspots (Mittermeier *et al.* 2004), six of the nine or, 66%, biomes found in SA (Mucina *et al.* 2005) and 166 of 437, or 38%, of the vegetation units of SA (Mucina *et al.* 2005). These classifications can be seen as representing vegetation at different spatial scales.

As with the high levels of plant diversity, the high number of endemic or near endemic vegetation units in the WCP (121 units, 73% of the units in the WCP and 26% of the units in SA) places enormous responsibility on the authorities and public to ensure these vegetation units survive.

This Province has a global responsibility to ensure that healthy, functioning ecosystems are achieved to maintain this biodiversity heritage and a healthy ecological environment, both of which encompass the social and economic environments in the Province through a complex set of relationships as described by the Provincial Government in the concept paper on sustainable development (DEA&DP & PDC, 2005). In essence, securing healthy, functioning ecosystems can be achieved in five ways: (1) through state owned protected areas, (2) privately owned contract nature reserves, (3) privately owned voluntary nature reserves (conservancies), (4) wise land use planning and (5) wise decision-making – all of which must strive to adequately address the requirements of the ecological environment so as to ultimately assist in achieving overall societal well-being in the Province.

In the last few years, the South African National Biodiversity Institute's (SANBI) plant database, PRECIS (PRECIS 2006), has been used extensively for conservation assessment. This database with its approximately

980 000 records together with the Threatened Plant Species database (Raimondo *et al.* 2006) and the new vegetation map with accompanying vegetation descriptions and conservation status (Mucina *et al.* 2006) form the basis for this report on the conservation status of the flora and vegetation units of the WCP.

Recently Born *et al.* (2007) redefined the Cape Floristic Kingdom to include the whole winter rainfall area in SA, which includes the Cape Floristic Region (CFR or fynbos) and the Succulent Karoo Biome, into the Greater Cape Floral Region (GCFR). Most of the WCP falls within the GCFR and covers about two-thirds of the entire GCFR.

Since the State of Biodiversity 2000 report (le Roux *et al.* 2002), the National Spatial Biodiversity Assessment (NSBA) (Driver *et al.* 2005) has been conducted. The NSBA listed at the protection status of vegetation units, as defined by Mucina *et al*. (2006). This chapter also aims to highlight the state of natural vegetation within the WCP's municipalities based on information from the NSBA. The information presented in this chapter is intended to highlight the uniqueness found within and between the political boundaries of the region and convey the responsibility that land use planners and decision-makers hold when it comes to making decisions that will impact on the ecological component of the environment.

METHODS

FLORA

Data on the plant taxa in the Western Cape Province were obtained from the SANBI. The list of taxa with their alien or endemic status, as evaluated in November 2006. The IUCN Red Data categories were obtained from the Threatened Plant Species database (Raimondo *et al.* 2006) and portray the suggested categories as evaluated in November 2006. Plant statistics for the African continent were obtained from the African Flowering Plants Database (see www.ville-ge.ch/cjb/bd/africa/index.php).

The results for the species of special concern (threatened and rare taxa) in the three Western Cape Conservation Categories (WCCC) of protected areas (see Chapter 9 for definitions) as well as the determination of the number of species of special concern in each vegetation unit according to Mucina *et. al.*, (2005) were based on data sets extracted from geo-encoded herbarium specimens in PRECIS, point locality observation data from the Custodians of Rare and Endangered Wildflowers(CREW), the Lowlands project (Von Hase *et al.* 2003), the Protea Atlas (Rebelo, 1991) and the Southern Cape/ Little Karoo project (Vlok, *et al.* 2005). Collectively these data amount to 72 358 plant locality records in the CFR, for 2 219 taxa. Each point locality record was buffered based on the locality resolution determined by degree of locality resolution. The buffered points were intersected with the vegetation units of the CFR from the vegetation map of South Africa (Mucina *et al.*, 2005). A threshold of 80% of the buffered area was used to classify a record as confined to a vegetation unit. Only records assigned to a single vegetation type were subsequently used. The number of species of special concern occurring in vegetation units with different ecosystem statuses was calculated. Species of special concern are species listed as Extinct (there are extant species erroneously listed in this category), Critically Endangered, Endangered, Vulnerable, Data Deficient, Near Threatened or Rare, while threatened species are species listed as Critically Endangered, Endangered or Vulnerable according to the IUCN categories and criteria version 3.1.

VEGETATION

For the vegetation analyses, the new vegetation map of SA (Mucina *et al.* 2005) was used for the biome and vegetation units. The Biodiversity Analysis Toolkit developed by Andrew Turner and Tim Sutton were used to calculate areas and percentage cover.

The NSBA is the first ever, comprehensive spatial assessment of biodiversity throughout the country. It used vegetation units as a surrogate for terrestrial biodiversity, based on the Vegetation Map for South Africa, Lesotho and Swaziland (Mucina *et al.* 2005). Information from the NSBA was used to determine the number of threatened, Least Threatened, endemic and near endemic vegetation units in the entire WCP and for each municipality within the WCP. This was determined using GIS: the Vegetation Map of South Africa, Lesotho and Swaziland (Mucina *et al.* 2005) was intersected with the WCP boundary as well as each district and local municipality to create a unique profile for each municipality containing the NSBA and endemism information. The extent of each vegetation unit per municipality was used to determine which vegetation units are endemic or near endemic to the municipality in which they occur. We have defined endemic and near endemic as follows:

For the municipal analysis:

ENDEMIC: More than 90% of the original extent of the vegetation unit occurs within the specified area.

NEAR ENDEMIC: Between 80% and 90% of original extent of the vegetation unit occurs within the specified area.

These figures were based on the practical level at which it is expected a municipality should consider the vegetation type to be its sole responsibility.

For the provincial analysis:

ENDEMIC: More than 95% of the original extent of the vegetation unit occurs within the WCP. Any unit with 95% or more of its total cover in the WCP is considered endemic, taking into consideration that there can be a 5% error due to classification and mapping inaccuracies.

NEAR ENDEMIC: From 75% to 95% of the original extent of the vegetation unit occurs within the WCP.

Note: The NSBA based its analysis on the 1996 National Land Cover Data, which is the most recent transformation layer available for the entire WCP.

FLORA

NUMBER OF PLANT TAXA

The flora found in the WCP is especially rich, with 11 388 plant taxa (including infraspecific taxa) in the WCP (Appendix 1) compared to 20 627 taxa in SA (excluding Lesotho & Swaziland) and 66 142 taxa in Africa. This means that the WCP has 55% of SA's plant taxa in 11% of SA's surface area and 17% of Africa's plant taxa in 0.24% of Africa's surface area (Table 1).

Table 1. The area and number of plant taxa (including infraspecific taxa) in the WCP compared to SA and Africa.

	Area (ha)	% WCP (ha)	No. taxa	% WCP (taxa)
Africa	5 422 486 592	0.24%	66 142	17.22%
SA (excluding Lesotho & Swaziland)	122 925 229	10.53%	20 627	55.21%
WCP	12 945 760		11 388	

CONSERVATION STATUS OF PLANT TAXA

The knowledge of the status of the flora of the Western Cape has undergone a huge forward leap in the last two years with the revised Red Data List to be completed in mid 2007 (statistics used in this report are based on the state of knowledge as at November 2006). This concerted effort by the Threatened Species Programme of the SANBI has emphasized the importance of, and threats to the flora of the WCP. The reclassification by means of the new 2001 IUCN Red List Categories & Criteria V3.1, is considered to provide a more objective approach with clear guidance and brings about consistency to facilitate comparisons. All plant taxa will be assessed and placed in one of the following categories: Extinct; Extinct in the Wild; Critically Endangered; Endangered; Vulnerable (these categories together constitute threatened taxa), Near Threatened, Data Deficient and Least Concern. A number of taxa still needed to be assessed as of November 2006. It is acknowledged that the status of the taxa will continuously change due to changes in the threats to the species and habitat, and as more knowledge becomes available on the species, their population dynamics and habitat requirements.

An indication of the knowledge gained from the last 2 years of intensive conservation assessment is shown in the change in status of the plant taxa in the Cape Floristic Region (CFR, not GCFR). The percentage of threatened species has increased from 4.5% to 10.2%. On the other hand, with more intensive surveys in the last few years, a number of species thought to be extinct, were rediscovered.

The WCP contains 55% of the total flora found in SA (Table 1). When comparing the 1 212 globally threatened plant taxa in the WCP to that of SA (1 793), 67.6% are found in the WCP (Table 2). Twenty seven species in the WCP are extinct (57% of SA's extinct species). A further four species in the WCP (out of the eight species in SA) are already extinct in the wild (Table 4). This places an enormous responsibility on the government of the WCP for the conservation of this flora.

Table 2. **T**he numbers of WCP plant taxa and percentages of South African totals in each of the IUCN Red List Categories. The first five categories are considered threatened.

	SA Global IUCN status	SA National IUCN status	WCP Global IUCN status	WCP National IUCN status	% WCP of SA National Total
EXTINCT (EX)	39	39	23	23	58.97%
EXTINCT IN THE WILD (EW)	8	8	4	4	50%
CRITICALLY ENDANGERED (CR)	279	279	225	225	80.65%
ENDANGERED (EN)	463	456	344	336	73.68%
VULNERABLE (VU)	1 004	1 027	616	621	60.47%
NEAR THREATENED (NT)	326	332	181	165	49.70%
DATA DEFICIENT (DD)	2 474	2 475	1 502	1 505	60.81%
LEAST CONCERNED (LC)	15 239	15 219	7 479	7 495	49.25%
STILL TO BE ASSESSED	795	792	1 014	1 014	128.03%*
TOTAL TAXA	**20 627**	**20 627**	**11 388**	**11 388**	**55.21%**

For the WCP, the number of threatened and rare taxa conserved in WCCC1 protected areas (areas with strong legislative security, see Chapter 9) has increased by 45 taxa from 983 to 1 028 in the last 5 years. The number of threatened taxa conserved in WCCC2 protected areas have however has decreased by 220 taxa in the last 5 years. * The values for the WCP exceed national values due to inconsistancies in national vs provincial figures due to name changes and newly described taxa.

Table 3. Number of threatened and rare taxa within the Western Cape Conservation Categories protected areas for the WCP.

	No. of taxa in WCCC1		No. of taxa in WCCC2		No. of taxa in WCCC3		TOTAL	
	2002	2006	2002	2006	2002	2006	2002	2006
Number of threatened taxa within protected areas	983	1 028	764	760	556	588	2 303	2 376

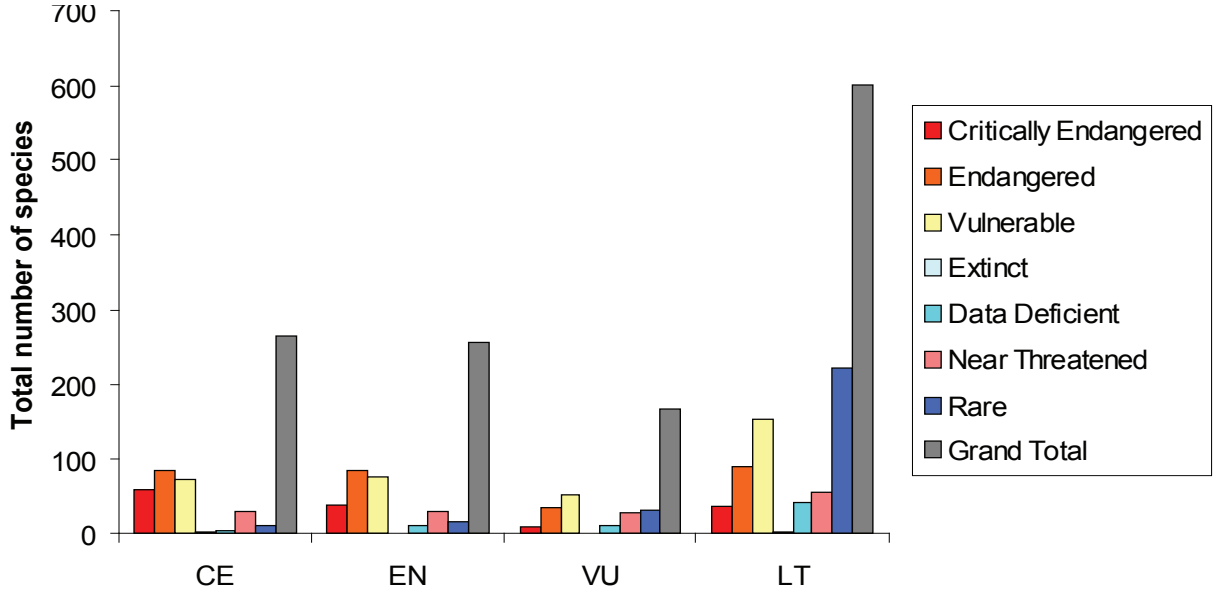

Figure 1: Number of species of special concern in ecosystems with different ecosystem conservation statusses in the CFR

DISTRIBUTION

Of the plant taxa in the WCP, 10 916 (96%) are indigenous and 472 (4%) are naturalised (originally from outside the WCP). Of the naturalised taxa, 137 or 29% of the naturalised flora, are invasive species. A very high number (6 776 taxa or 60%) of the indigenous flora is endemic. Of these, 1 212 plant taxa (11%) are threatened in the WCP. The large proportion of endemic and threatened flora in the WCP place an enormous responsibility on the governments of both SA and the WCP to ensure the survival of this unique flora.

Table 4. The distribution of plant taxa in the WCP

	No. of Taxa	% of WCP taxa
Total taxa	11388	
Indigenous taxa	10916	95.86
Endemic taxa	6776	59.50
Naturalised taxa	472	4.14
Invasive taxa	137	1.20

CONSERVATION OF VEGETATION

The Western Cape Province hosts two of the six of the world's plant kingdoms, the Cape Floral Kingdom and the Palaeotropical Kingdom (Figure 2). Within the CFR we also have two of the 34, of the world's Biodiversity Hotspots (Mittermeier *et al.* 2004) (Figure 3). Of the nine biomes found in SA (Mucina *et al.* 2005), six are found in the WCP (Figure 4). One hundred and sixty six of the 438 of the vegetation units (38%) found in South Africa are represented in the WCP. These classifications can be seen as representing ecosystem diversity on different geographical scales and show that the WCP is biologically diverse across all these scales.

The conservation status of these vegetation units are assessed by the contribution of the area covered by protected areas in the Western Cape Conservation Category 1 (WCCC1), or areas with strong legislative security (see Chapter 9 for the definitions of WCCC).

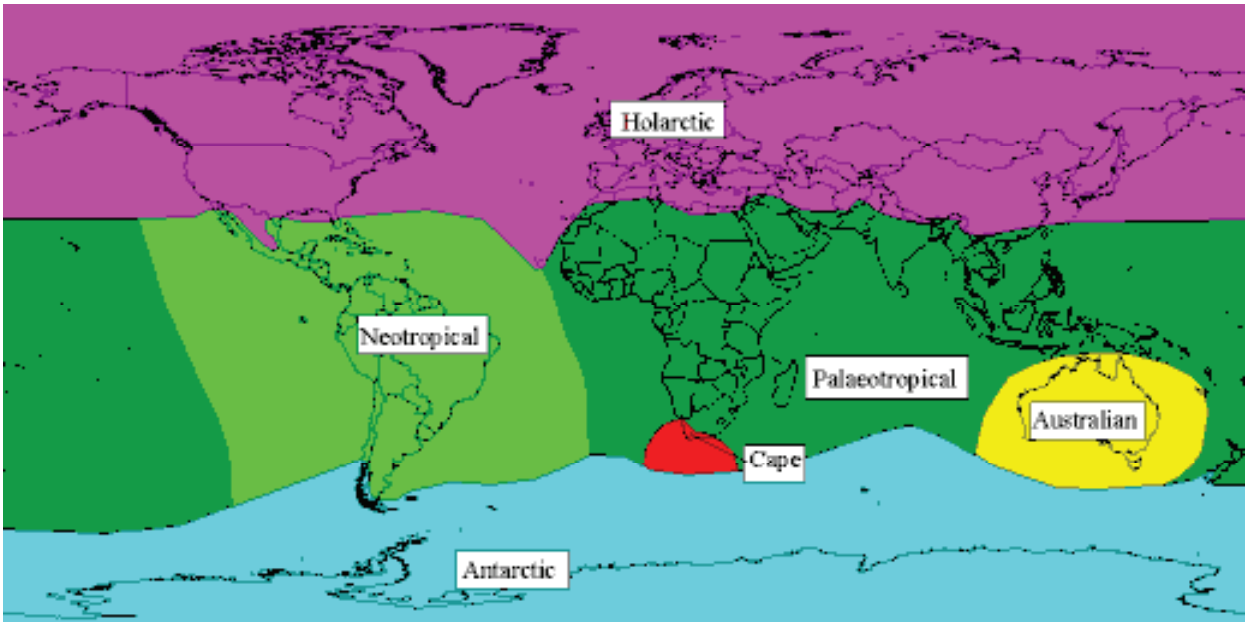

Figure 2. Map of the Floral Kingdoms of the world.

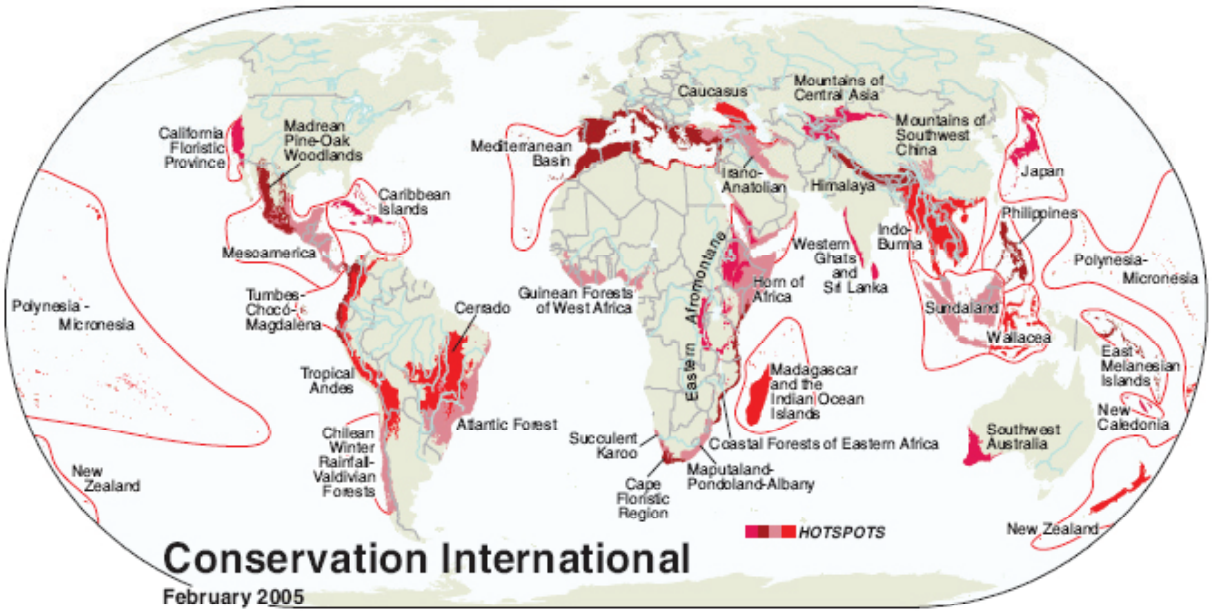

Figure 3. Map indicating the 34 Biodiversity Hotpots of the world (from www.biodiversityhotspots.org).

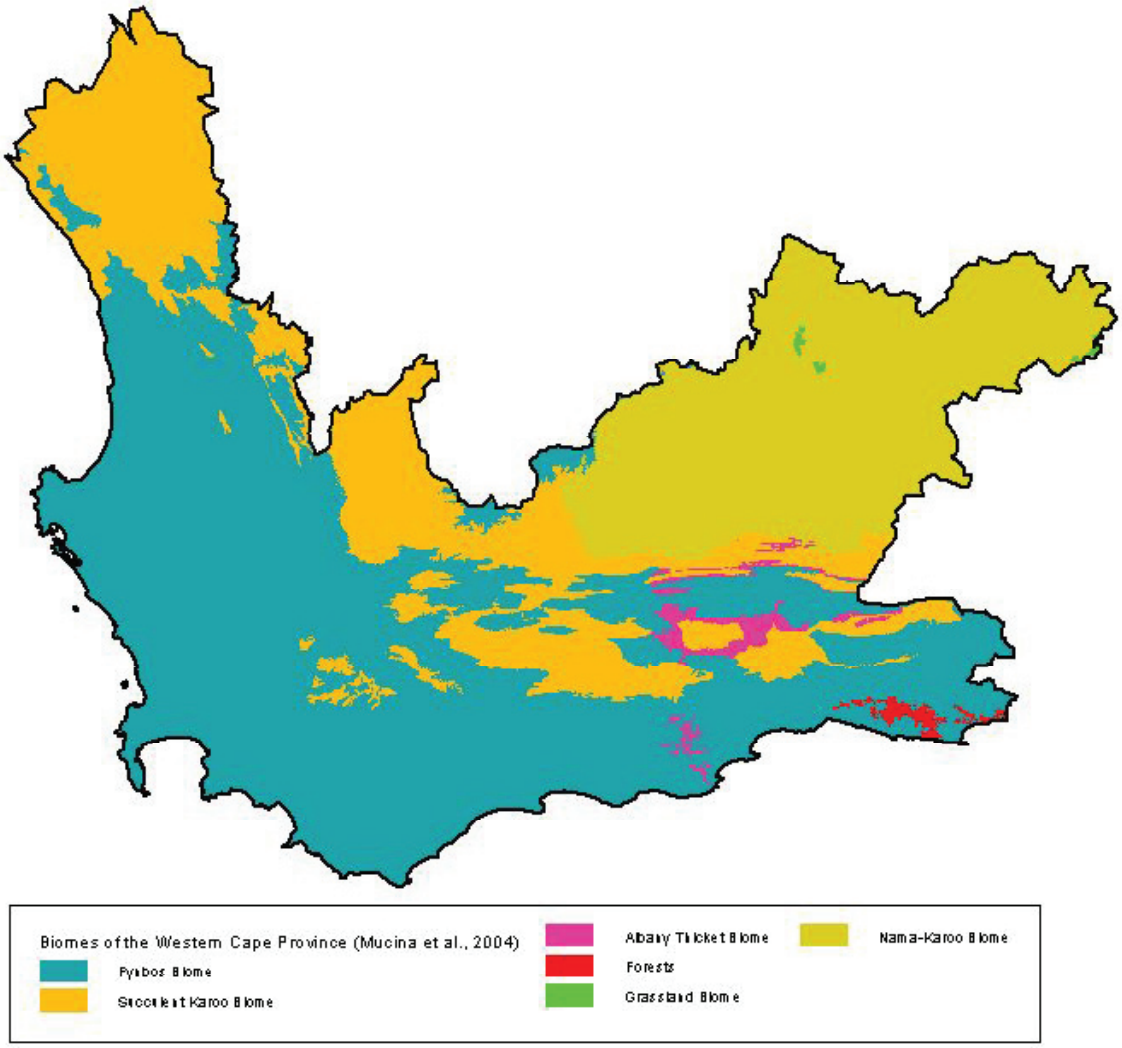

Figure 4. Map of the biomes of the Western Cape Province (from Mucina et al. 2005).

BIOMES

Nine biomes are represented in SA and six are found in the WCP with three biomes greatly represented in the WCP; the Fynbos Biome (79% of SA), Forest Biome (52% of SA) and the Succulent Karoo Biome (35% of SA) (Table 5). The area under conservation of the Fynbos Biome (near endemic to the WCP) has increased by 1% in the last five years. It appears to achieve the target of 10% of land area conserved (not taking the protected areas in the Eastern Cape into consideration) if all three categories of WCCC are taken into account. However, this overestimates the amount of conserved area as most of the Fynbos Biome is conserved in the mountainous parts and the lowland parts are not only inadequately conserved, but also very little remains that can be conserved and that areas under the third WCCC category are not necessarily secure. The conservation status of the Forest Biome has improved a great deal in the last five years with the Garden Route National Park now conserving almost 30% of the SA Forest Biome. The conservation status of the Succulent Karoo Biome in the WCP still needs to be improved.

Table 5. Percentages of biomes (Mucina *et al*. 2005) found in SA and the WCP with percentages conserved by the different Western Cape Conservation Categories in the Western Cape. Calculations done in Lambert projection.

Biome	Total ha in South Africa	% of Biome WCP	% of Biome in SA in WCCC1 protected areas in WCP		% of Biome in SA in WCCC2 protected areas in WCP		% of Biome in SA in WCCC3 protected areas in WCP	
			2002	2006	2002	2006	2002	2006
Albany Thicket Biome	3 148 335	5.46	0.4	0.4	0.1	0.1	0.3	0.4
Desert Biome	739 712	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Forest Biome	96 890	51.58	0.5	29.7	0.6	0.6	0.1	0.6
Fynbos Biome	8 523 722	79.01	8.1	9.2	8.1	8.1	7.6	8.3
Grassland Biome	36 257 950	0.04	0.0	0.0	0.0	0.0	0.0	0.0
Indian Ocean Coastal Belt	1 661 655	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Nama-Karoo Biome	26 072 180	11.26	0.3	0.3	0.0	0.0	0.4	0.5
Savanna Biome	42 472 362	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Succulent Karoo Biome	8 706 386	34.90	0.7	1.0	0.4	0.4	1.1	1.3

VEGETATION

Acocks originally described the Veld Types of SA in 1953 and revised it in 1975 (Acocks, 1953 and 1975). It was used extensively in SA to define broad habitat, climate and vegetation units as well as to measure the representivity of protected areas in SA. However, an updated, more detailed vegetation map of SA has recently been published (Mucina *et al.* 2005), and will become the measure of achievements of conservation targets for ecosystems through protected areas.

Rebelo & Daniels (2007) recommend a minimum of 50 Red Data List plant taxa (excluding Vulnerable (VU) D2) for upgrading ecosystems to Critically Endangered (CR), 20 for Endangered (EN) and 10 for VU. Based on these criteria, one additional veld type becomes CR, seven veld types are upgraded to EN and 20 are upgraded to VU. All of these are within the Fynbos Biome. This results in 16 of the 23 Critically Endangered (70%); 17 of the 22 Endangered (77%) and 16 of the 41 Vulnerable (39%) national vegetation types are in the WCP

No vegetation units (and thus ecosystems) are known outside of the Fynbos Biome with over 10 Red Data List plant taxa.

Of the 166 vegetation units found in the WCP, 110 (66%) are endemic to the WCP (Table 6). Of the endemic vegetation units, only 40 units have more than 10% of their area in WCCC1 protected area. Eighteen units, all in mountainous areas except for the Langebaan Dune Strandveld, have more than 30% of their area conserved by WCCC1 protected areas. Although not adequately conserved by WCCC1 protected areas, there are a number of the endemic vegetation units well covered by WCCC2 & WCCC3 protected areas, however it must be borne in mind that these two categories cannot guarantee long-term protection. There are 11 near endemic vegetation units of which three units are conserved by more than 10% in WCCC1 protected areas. With 121 endemic or near endemic vegetation units (73% of the units in the WCP), the WCP is indeed a unique area in need of conservation. Of these, 35 vegetation units presently have very little (0.1 to 5%) and 24 units have no area under protection.

Table 6. Percentages of vegetation units (Mucina *et al.* 2005) found in the Western Cape with percentages conserved of the different Western Cape Conservation Categories in the Western Cape. Calculations done in Lambert projection.

Biome Vegetation Unit	Total ha in South Africa	% of Vege-tation Unit in WCP	% of Vegetation Unit in WCCC1		% of Vegetation Unit in WCCC2		% of Vegetation Unit in WCCC3	
			2002	2006	2002	2006	2002	2006
Swartberg Altimontane Sandstone Fynbos	5 082	100.0	87.4	87.4	12.6	12.6	0.0	0.0
Fynbos Riparian Vegetation	1 688	100.0	81.0	78.7	18.7	18.7	0.0	0.0
Central Inland Shale Band Vegetation	9 850	100.0	68.4	68.4	22.5	22.5	1.6	1.6
North Kammanassie Sandstone Fynbos	33 252	100.0	66.3	66.3	13.0	13.0	0.0	0.0
Hawequas Sandstone Fynbos	105 101	100.0	51.6	53.8	34.1	34.1	5.0	5.0
Potberg Sandstone Fynbos	10 739	100.0	49.1	49.1	2.0	2.0	48.8	34.7
Western Coastal Shale Band Vegetation	13 468	100.0	41.5	42.7	30.0	29.9	8.0	10.4
South Sonderend Sandstone Fynbos	38 081	100.0	35.6	38.6	42.5	39.5	0.9	10.2
South Rooiberg Sandstone Fynbos	38 828	100.0	34.2	34.2	10.2	10.2	19.5	22.0
Western Altimontane Sandstone Fynbos	3 751	100.0	33.6	33.9	65.9	65.9	0.0	0.0
North Rooiberg Sandstone Fynbos	31 867	100.0	33.1	33.1	24.9	24.9	8.1	8.1
Matjiesfontein Shale Fynbos	10 650	100.0	28.9	28.9	0.2	0.2	0.0	0.0
De Hoop Limestone Fynbos	68 681	100.0	26.6	28.7	0.8	0.8	1.1	1.1
North Hex Sandstone Fynbos	39 404	100.0	24.6	24.6	55.7	55.7	0.0	0.0
Olifants Sandstone Fynbos	105 831	100.0	23.0	22.6	42.2	42.2	9.8	9.8
Winterhoek Sandstone Fynbos	118 967	100.0	22.1	22.1	60.4	60.4	0.0	0.0
South Langeberg Sandstone Fynbos	122 355	100.0	21.7	21.1	55.1	55.1	1.5	1.6

Biome Vegetation Unit	Total ha in South Africa	% of Vege-tation Unit in WCP	% of Vegetation Unit in WCCC1		% of Vegetation Unit in WCCC2		% of Vegetation Unit in WCCC3	
			2002	2006	2002	2006	2002	2006
North Sonderend Sandstone Fynbos	51 324	100.0	19.4	19.3	53.0	53.0	0.0	0.0
Cederberg Sandstone Fynbos	244 819	100.0	17.1	17.1	29.2	29.2	20.1	20.1
Knersvlakte Quartz Vygieveld	121 222	100.0	5.1	17.1	0.0	0.0	0.0	0.0
Northern Inland Shale Band Vegetation	26 428	100.0	16.8	16.8	61.9	61.9	9.5	9.5
South Hex Sandstone Fynbos	32 063	100.0	16.0	16.1	74.8	74.8	0.0	0.0
Elgin Shale Fynbos	27 950	100.0	14.4	14.4	7.6	7.6	56.0	56.0
Central Knersvlakte Vygieveld	29 252	100.0	0.0	14.0	0.0	0.0	0.0	0.0
South Kammanassie Sandstone Fynbos	30 413	100.0	12.8	12.8	56.9	56.9	0.0	0.0
Agulhas Limestone Fynbos	29 463	100.0	4.8	8.8	4.3	4.3	12.7	12.7
Swartberg Shale Fynbos	7 511	100.0	8.6	8.6	2.5	2.5	0.0	35.5
Western Little Karoo	420 060	100.0	7.1	8.5	0.8	0.8	0.1	0.4
Agulhas Sand Fynbos	23 071	100.0	0.7	7.6	0.6	0.6	0.0	0.0
North Outeniqua Sandstone Fynbos	87 873	100.0	10.7	6.5	0.0	0.0	2.1	9.9
Namaqualand Spinescent Grassland	52 244	100.0	3.9	6.5	0.0	0.0	0.0	0.0
Potberg Ferricrete Fynbos	4 050	100.0	5.5	5.5	0.0	0.0	94.5	51.0
Breede Shale Fynbos	31 840	100.0	5.2	5.2	24.7	24.7	1.0	1.0
Matjiesfontein Quartzite Fynbos	126 782	100.0	4.9	5.1	3.9	3.9	0.0	0.0
Kango Conglomerate Fynbos	40 570	100.0	5.1	5.1	6.7	6.7	4.3	4.3
Matjiesfontein Shale Renosterveld	212 541	100.0	4.6	4.9	5.9	5.9	0.0	0.0
Elim Ferricrete Fynbos	66 584	100.0	2.9	4.6	0.5	0.5	2.4	8.1
Little Karoo Quartz Vygieveld	11 492	100.0	1.7	4.6	6.8	6.8	0.0	0.0
Swellendam Silcrete Fynbos	86 852	100.0	4.4	4.2	0.3	0.3	5.2	5.4
Robertson Granite Fynbos	1 699	100.0	2.4	2.5	38.8	38.8	0.0	0.0
Kango Limestone Renosterveld	50 190	100.0	2.4	2.4	0.7	0.7	13.4	13.4
Atlantis Sand Fynbos	69 785	100.0	2.1	2.1	4.1	4.1	58.4	58.4
Montagu Shale Renosterveld	163 755	100.0	1.8	2.0	6.4	6.4	0.6	1.7
Hopefield Sand Fynbos	179 703	100.0	0.4	1.8	2.3	2.3	53.3	53.3
Swartland Alluvium Fynbos	46 976	100.0	1.8	1.8	6.7	6.7	6.1	6.1
Western Gwarrieveld	75 951	100.0	0.0	1.8	4.0	4.0	25.5	27.1

Biome Vegetation Unit	Total ha in South Africa	% of Vege-tation Unit in WCP	% of Vegetation Unit in WCCC1		% of Vegetation Unit in WCCC2		% of Vegetation Unit in WCCC3	
			2002	2006	2002	2006	2002	2006
Breede Sand Fynbos	9 277	100.0	0.0	1.5	1.5	1.5	0.0	0.0
Cape Lowland Alluvial Vegetation	35 847	100.0	1.0	1.1	0.3	0.3	4.9	3.5
Greyton Shale Fynbos	26 896	100.0	0.8	0.7	5.9	6.0	1.4	26.9
Robertson Karoo	61 294	100.0	0.5	0.5	1.2	1.2	0.0	0.0
Central Rûens Shale Renosterveld	201 222	100.0	0.2	0.4	0.0	0.0	0.1	1.1
Montagu Shale Fynbos	18 673	100.0	0.4	0.4	3.6	3.6	0.0	0.0
Cape Flats Sand Fynbos	54 558	100.0	0.3	0.3	0.5	0.5	18.8	18.8
Swartland Silcrete Renosterveld	9 982	100.0	0.3	0.3	0.7	0.7	6.8	6.8
Eastern Rûens Shale Renosterveld	277 150	100.0	0.2	0.2	0.1	0.1	7.2	1.6
Swartland Granite Renosterveld	94 726	100.0	0.2	0.2	2.5	2.5	37.9	38.4
Lourensford Alluvium Fynbos	5 528	100.0	0.2	0.2	2.9	2.9	0.0	0.0
Breede Alluvium Fynbos	51 044	100.0	0.2	0.2	3.0	3.0	7.6	7.6
Swartland Shale Renosterveld	494 451	100.0	0.1	0.1	0.9	0.9	5.2	5.3
Breede Alluvium Renosterveld	49 828	100.0	0.1	0.1	0.9	0.9	0.0	0.0
Ceres Shale Renosterveld	49 162	100.0	0.1	0.1	0.8	0.8	0.6	0.6
Breede Quartzite Fynbos	9 814	100.0	0.1	0.1	8.7	8.7	0.0	0.0
Eastern Little Karoo	155 526	100.0	0.1	0.1	0.6	0.6	0.5	0.5
Mossel Bay Shale Renosterveld	79 649	100.0	0.0	0.0	0.2	0.2	0.0	0.0
Western Rûens Shale Renosterveld	119 053	100.0	0.0	0.0	1.0	1.0	8.1	10.6
Robertson Granite Renosterveld	1 923	100.0	0.0	0.0	28.6	28.6	0.0	0.0
Kouebokkeveld Shale Fynbos	42 788	100.0	0.0	0.0	18.0	18.0	0.9	0.9
Citrusdal Vygieveld	12 661	100.0	0.0	0.0	4.3	4.3	35.4	35.4
Piketberg Sandstone Fynbos	46 022	100.0	0.0	0.0	4.3	4.3	0.0	0.0
Canca Limestone Fynbos	112 319	100.0	0.0	0.0	3.8	3.8	2.7	2.7
Kouebokkeveld Alluvium Fynbos	18 000	100.0	0.0	0.0	1.4	1.4	1.2	1.2
Southern Cape Valley Thicket	17 746	100.0	0.0	0.0	1.0	1.0	0.0	0.0
Saldanha Limestone Strandveld	3 564	100.0	0.0	0.0	0.7	0.7	99.3	99.3
Muscadel Riviere	42 254	100.0	0.0	0.0	0.3	0.3	0.1	0.1
Rûens Silcrete Renosterveld	20 988	100.0	0.0	0.0	0.2	0.2	11.9	3.1

Biome Vegetation Unit	Total ha in South Africa	% of Vege-tation Unit in WCP	% of Vegetation Unit in WCCC1		% of Vegetation Unit in WCCC2		% of Vegetation Unit in WCCC3	
			2002	2006	2002	2006	2002	2006
Graafwater Sandstone Fynbos	125 351	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Klawer Sandy Shrubland	12 571	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Knersvlakte Dolomite Vygieveld	5 797	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Piketberg Quartz Succulent Shrubland	240	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Swartland Alluvium Renosterveld	6 248	100.0	0.0	0.0	0.0	0.0	1.5	1.5
North Langeberg Sandstone Fynbos	103 142	100.0	12.9	12.9	44.9	44.9	0.0	0.4
Albertinia Sand Fynbos	70 836	100.0	5.1	5.0	3.3	3.3	3.4	3.1
Overberg Sandstone Fynbos	116 989	100.0	3.4	4.6	3.5	3.5	12.0	16.9
Kogelberg Sandstone Fynbos	91 538	100.0	57.0	57.2	18.3	18.3	20.2	20.4
South Outeniqua Sandstone Fynbos	157 403	100.0	20.1	39.9	0.3	0.3	0.9	1.8
Knysna Sand Fynbos	15 370	100.0	1.2	2.8	1.0	1.0	0.0	2.3
Garden Route Granite Fynbos	43 178	100.0	0.1	1.2	0.2	0.2	1.6	2.3
Lamberts Bay Strandveld	45 121	99.9	1.4	1.4	8.2	8.2	0.0	0.0
Saldanha Flats Strandveld	76 000	99.9	11.0	15.0	0.1	0.1	83.9	83.9
Groot Brak Dune Strandveld	20 288	99.9	0.0	0.0	0.7	0.5	7.9	8.9
Peninsula Sandstone Fynbos	23 256	99.8	90.6	90.8	3.6	3.6	0.0	0.3
Cape Winelands Shale Fynbos	8 569	99.8	12.8	12.8	26.2	26.2	5.3	12.9
Cape Flats Dune Strandveld	42 405	99.7	6.3	5.8	5.7	5.7	26.0	26.3
Saldanha Granite Strandveld	23 469	99.7	8.9	9.0	1.3	1.3	89.2	89.2
Hangklip Sand Fynbos	8 121	99.6	15.4	15.6	7.0	7.0	42.6	54.0
Peninsula Shale Renosterveld	2 970	99.6	18.6	18.5	0.0	0.0	0.0	0.0
Overberg Dune Strandveld	39 413	99.5	30.9	36.5	10.8	10.8	4.8	4.2
Langebaan Dune Strandveld	43 756	99.5	29.7	31.3	1.6	1.6	43.5	43.5
Blombos Strandveld	6 013	99.4	19.8	19.1	20.0	20.0	2.0	2.0
Vanrhynsdorp Gannabosveld	97 159	99.2	0.0	0.0	0.0	0.0	0.0	0.0
Swartruggens Quartzite Fynbos	164 577	99.2	3.7	3.7	3.1	3.1	52.6	52.6
Peninsula Granite Fynbos	8 863	99.1	39.3	40.1	0.4	0.4	0.0	1.3
Cape Lowland Freshwater Wetlands	7 199	97.6	7.0	26.0	2.1	2.1	7.8	8.2
South Swartberg Sandstone Fynbos	108 454	97.1	47.1	47.3	35.0	35.0	0.1	0.1

Biome Vegetation Unit	Total ha in South Africa	% of Vege-tation Unit in WCP	% of Vegetation Unit in WCCC1		% of Vegetation Unit in WCCC2		% of Vegetation Unit in WCCC3	
			2002	2006	2002	2006	2002	2006
Cape Vernal Pools	20	95.0	0.0	0.0	0.0	0.0	0.0	0.0
Doringrivier Quartzite Karoo	47 198	94.4	0.0	0.0	0.0	0.0	8.6	8.6
North Swartberg Sandstone Fynbos	86 412	93.3	69.5	70.9	5.2	5.2	0.0	5.5
Garden Route Shale Fynbos	56 644	93.2	1.8	2.4	1.2	1.2	2.7	3.8
Cape Inland Salt Pans	8 466	93.1	19.6	23.5	0.0	0.0	5.7	5.6
Gamka Karoo	2 031 976	89.3	1.9	2.1	0.2	0.2	0.0	0.0
Swartberg Shale Renosterveld	27 632	86.7	8.2	8.2	1.3	1.3	0.0	31.4
Vanrhynsdorp Shale Renosterveld	23 984	85.5	0.0	0.0	0.0	0.0	0.0	0.0
Knersvlakte Shale Vygieveld	88 564	84.9	0.0	0.0	1.1	1.1	0.0	0.0
Southern Afrotemperate Forest	79 978	79.5	3.5	44.4	1.2	1.3	0.6	1.5
Northern Knersvlakte Vygieveld	151 533	77.9	0.0	0.2	0.0	0.0	0.0	0.0
Koedoesberge-Moordenaars Karoo	471 313	77.0	0.3	0.3	0.4	0.4	0.0	0.0
Langkloof Shale Renosterveld	20 706	72.1	0.0	0.0	0.0	0.0	0.6	1.1
Namaqualand Arid Grassland	70 501	69.7	0.0	0.0	0.0	0.0	0.0	0.0
Cape Coastal Lagoons	4 638	68.4	1.7	2.4	1.6	1.6	34.1	34.7
Agter-Sederberg Shrubland	90 594	68.2	0.9	0.9	0.0	0.0	31.6	31.6
Central Mountain Shale Renosterveld	123 616	64.2	0.0	0.0	0.0	0.0	0.0	0.0
Prince Albert Succulent Karoo	258 213	62.3	2.2	2.2	0.8	0.8	0.0	4.0
Arid Estuarine Salt Marshes	5 678	60.8	0.0	0.0	0.0	0.0	23.5	23.5
Cape Estuarine Salt Marshes	10 212	54.4	19.2	20.2	0.2	0.2	25.0	25.6
Tanqua Wash Riviere	212 965	54.2	4.5	4.6	2.2	2.2	0.4	0.4
Uniondale Shale Renosterveld	134 061	53.0	0.0	0.0	0.0	0.0	0.0	4.6
Swartruggens Quartzite Karoo	55 924	51.4	5.5	5.5	2.9	2.9	27.0	27.0
Tanqua Karoo	698 736	47.6	0.1	0.1	2.7	2.7	1.1	1.1
Southern Cape Dune Fynbos	18 628	47.2	16.1	13.9	1.5	1.5	0.0	0.8
Namaqualand Sand Fynbos	94 044	41.7	0.0	0.0	0.0	0.0	0.1	0.1
Bokkeveld Sandstone Fynbos	136 166	38.6	0.0	0.0	0.3	0.3	0.0	0.0
Southern Karoo Riviere	529 824	37.6	0.1	0.1	0.0	0.0	0.0	0.0
Namaqualand Strandveld	392 298	36.8	0.0	0.0	0.2	0.2	2.8	2.8

Biome Vegetation Unit	Total ha in South Africa	% of Vegetation Unit in WCP	% of Vegetation Unit in WCCC1		% of Vegetation Unit in WCCC2		% of Vegetation Unit in WCCC3	
			2002	2006	2002	2006	2002	2006
Tsitsikamma Sandstone Fynbos	227 906	33.7	0.0	14.2	0.0	0.0	0.0	1.3
Upper Karoo Hardeveld	1 173 981	30.7	2.9	3.5	0.0	0.0	1.7	1.7
Namaqualand Klipkoppe Shrubland	1 095 698	29.0	0.1	0.1	0.0	0.0	0.0	0.0
Namaqualand Riviere	85 548	25.8	0.1	0.3	0.0	0.0	0.1	0.1
Freshwater Lakes	15 937	23.3	8.0	13.2	0.0	0.0	0.5	0.5
Willowmore Gwarrieveld	231 017	18.6	0.1	0.1	0.1	0.1	0.0	1.8
Cape Seashore Vegetation	22 724	18.3	2.2	3.1	1.3	1.3	3.5	3.9
Kamiesberg Mountains Shrubland	42 592	18.1	0.0	0.0	0.1	0.1	0.0	0.0
Eastern Coastal Shale Band Vegetation	7 816	18.0	0.0	11.3	0.1	0.1	0.9	0.9
Namaqualand Blomveld	381 784	13.3	0.0	0.0	0.0	0.0	0.0	0.0
Namaqualand Seashore Vegetation	6 773	11.4	0.0	0.0	0.0	0.0	0.0	0.0
Southern Coastal Forest	16 544	10.5	0.9	0.9	0.3	0.3	1.7	1.8
Eastern Upper Karoo	4 984 853	9.9	0.0	0.0	0.0	0.0	1.7	1.8
Tanqua Escarpment Shrubland	132 123	7.3	0.8	0.7	0.0	0.0	0.0	0.0
Namaqualand Heuweltjieveld	254 116	6.9	0.0	0.0	0.0	0.0	0.0	0.0
Grootrivier Quartzite Fynbos	56 461	6.3	0.0	0.0	0.0	0.0	0.0	2.3
Eastern Inland Shale Band Vegetation	10 887	6.1	1.1	1.1	0.4	0.4	0.0	3.9
Kouga Grassy Sandstone Fynbos	413 607	4.8	0.0	0.0	0.0	0.0	0.0	0.1
Eastern Lower Karoo	831 901	4.1	0.0	0.0	0.0	0.0	0.0	0.0
Roggeveld Shale Renosterveld	291 639	3.8	0.0	0.0	0.0	0.0	0.0	0.0
Western Upper Karoo	1 715 579	2.7	0.0	0.0	0.0	0.0	0.8	0.8
Namaqualand Salt Pans	9 983	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Karoo Escarpment Grassland	837 908	1.8	0.3	0.3	0.0	0.0	0.0	0.0
Roggeveld Karoo	565 549	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Bushmanland Vloere	471 513	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Platbakkies Succulent Shrubland	98 031	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Hantam Karoo	746 924	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The areas under conservation of seven vegetation units improved by more than 10% between 2002 and 2006. These are: Southern Afrotemperate Forest (41%), South Outeniqua Sandstone Fynbos (20%), Cape Lowland Freshwater Wetlands 19%, Tsitsikamma Sandstone Fynbos (14%), Central Knersvlakte Vygieveld (14%), Knersvlakte Quartz Vygieveld (12%) and Eastern Coastal Shale Band Vegetation (11%). Fourteen units have increased their area under conservation by 1 to 10%.

VEGETATION BY MUNICIPALITY

All District Municipalities in the WCP contain vegetation units that are endemic to their political boundary i.e. vegetation units that do not extend beyond the boundaries of the municipality and thus occur nowhere else in the world (Table 7, Figure 5). With the exception of the Central Karoo, all District Municipalities are home to Critically Endangered, Endangered and Vulnerable ecosystems (together these are known as threatened ecosystems) (Table 7; Figure 6). The status of each municipality will be discussed in further detail below.

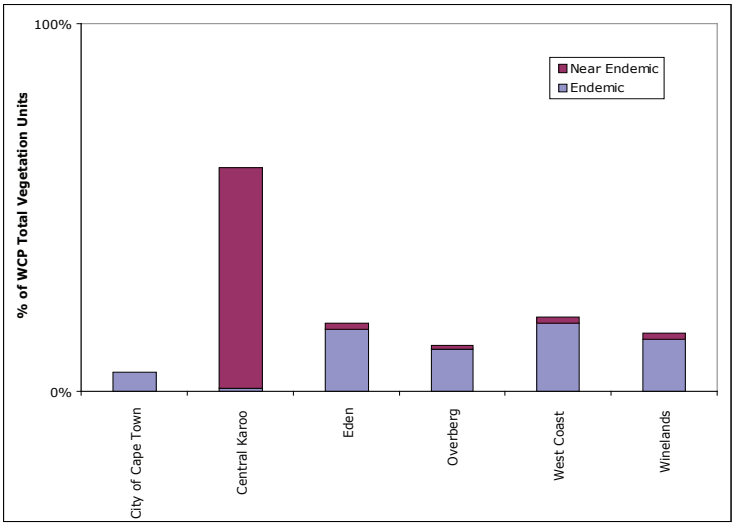

Figure 5: Number of the vegetation units occurring within the Western Cape Province, City of Cape Town and in each district municipality that are considered endemic or near endemic.

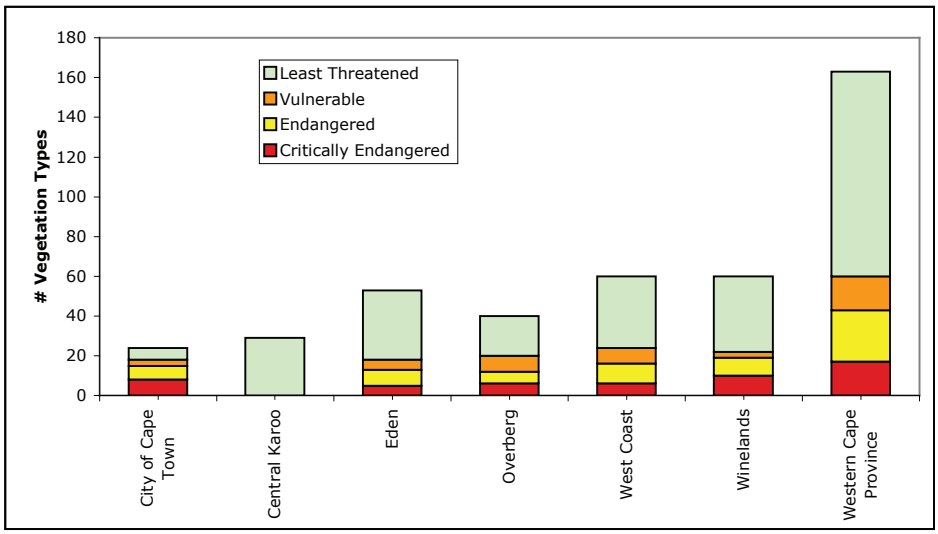

Figure 6: Number of the vegetation units occurring within the Western Cape Province, City of Cape Town and in each district municipality that are Critically Endangered, Endangered, Vulnerable and Least Threatened.

CITY OF CAPE TOWN (COCT)

Approximately 23% (6) of the vegetation units found in the CoCT are endemic to the city boundaries (Table 7, Figure 5). Of the 26 vegetation units found in the CoCT, 31% are considered Critically Endangered, 27% Endangered and 12% Vulnerable. This equates to a huge 69% of the vegetation units in the CoCT being threatened (Table 7; Figure 6).

The CoCT covers the smallest area when compared to other District Municipalities, but it contains the highest percentage of threatened habitats. This is expected since it is an urban environment, but it does not justify the current and future transformation of important natural vegetation. The CoCT is probably the most advanced in terms of identifying important habitat for biodiversity conservation through its biodiversity network. This is a network of natural remnants that have been identified as important for effective ecological functioning and biodiversity conservation in the City. It is however not clear whether this information is used to inform all land use planning and decision-making.

The major threats to biodiversity within the CoCT are loss of natural vegetation and freshwater ecosystems through expansion into the biodiversity network. The major threatening activities include urban expansion, mining, cultivation, incorrect fire regimes and alien plant invasion.

CENTRAL KAROO DISTRICT MUNICIPALITY

One vegetation unit is endemic to this municipality, whilst three are considered near endemic (Table 7; Figure 5). The Central Karoo District Municipality is home to 29 vegetation units which are all considered to be Least Threatened (Table 7; Figure 6). According to the NSBA, this municipality is doing very well with regards to its vegetation status. However, information on the state of ecosystems within this municipality must be treated with caution as the extent of over-grazing and veld degradation is unknown in this region and was not used to determine threat status. Over-abstraction of groundwater may also be negatively impacting on biodiversity.

Results for the local municpalities within the Central Karoo District Municpality are shown in Figures 7, Figure 8 and Table 7.

Beaufort West Local Municipality

No endemic or threatened vegetation units occur.

Laingsburg Local Municipality

One vegetation unit is considered endemic and no threatened vegetation units occur.

Prince Albert Local Municipality

One near endemic vegetation units occurs here, whilst no threatened vegetation units are found in the area.

WCDMA05

This area contains neither endemic nor threatened vegetation units.

EDEN DISTRICT MUNICIPALITY

A large 35% of vegetation units occurring within this Municipality are considered endemic (Table 7, Figure 5). Of the 55 vegetation units occurring here, 9% are Critically Endangered, 15% Endangered and 9% Vulnerable (Table 7, Figure 6).

With such a high number of endemic vegetation units and with one third of the vegetation units being threatened, this Municipality needs to pay special attention to landuse planning that incorporates a protected area network that will consolidate the natural vegetation. With the exception of Kannaland and Outdshoorn, all local municipalities should be extremely concerned with the high levels of endemism, coupled with the high threat status of the vegetation units occurring within their boundaries.

The major threats to biodiversity within Eden are loss of natural vegetation as a result of urban expansion and coastal ribbon development, mining, incorrect fire regimes and alien plant invasion. Cultivation is a factor that also needs to be considered.

Results for the local municpalities within the Eden District Municpality are shown in Figures 7, Figure 8 and Table 7.

George Local Municipality

As much as 71% (10) of the vegetation units occurring here are considered threatened, with 21% being Critically Endangered, 29% being Endangered and 21% being Vulnerable. No endemic or near-endemic vegetation units occur in this municipality.

Kannaland Local Municipality

Of the 17 vegetation units occurring in this municipality, only one is considered threatened. Two near endemic vegetation units are found here.

Knsyna Local Municipality

This is home to seven threatened vegetation units: two Critically Endangered and Endangered, and three Vulnerable. One near endemic vegetation unit is found with its boundaries.

Langeberg Local Municipality

Of the 27 vegetation units found within the Langeberg, 41% are considered threatened: 11% (3) are Critically Endangered, 19% (5) Endangered and 11% (3) Vulnerable. Two vegetation units are considered endemic and one near-endemic to the municipality.

Mossel Bay Local Municipality

Half of the vegetation units within this municipality are threatened: one Critically Endangered, five Endangered and three Vulnerable. One near endemic vegetation unit is present.

Oudtshoorn Local Municipality

Only three of the 23 (13%) vegetation units within the Oudtshoorn Municipality are considered threatened (this excludes vegetation units that are degraded/overgrazed). One is Endangered and two are Vulnerable. No endemic vegetation units are present.

Bitou Local Municipality

A large 75% (9) of the vegetation units are considered to be threatened, with 17% (2) being Critically Endangered, 25% (3) being Endangered and 33% (4) being Vulnerable. No endemic or near endemic vegetation units are present.

WCDMA04

Four of the 19 (21%) vegetation units are threatened: two are Endangered and two are Vulnerable. One near-endemic vegetation unit is found.

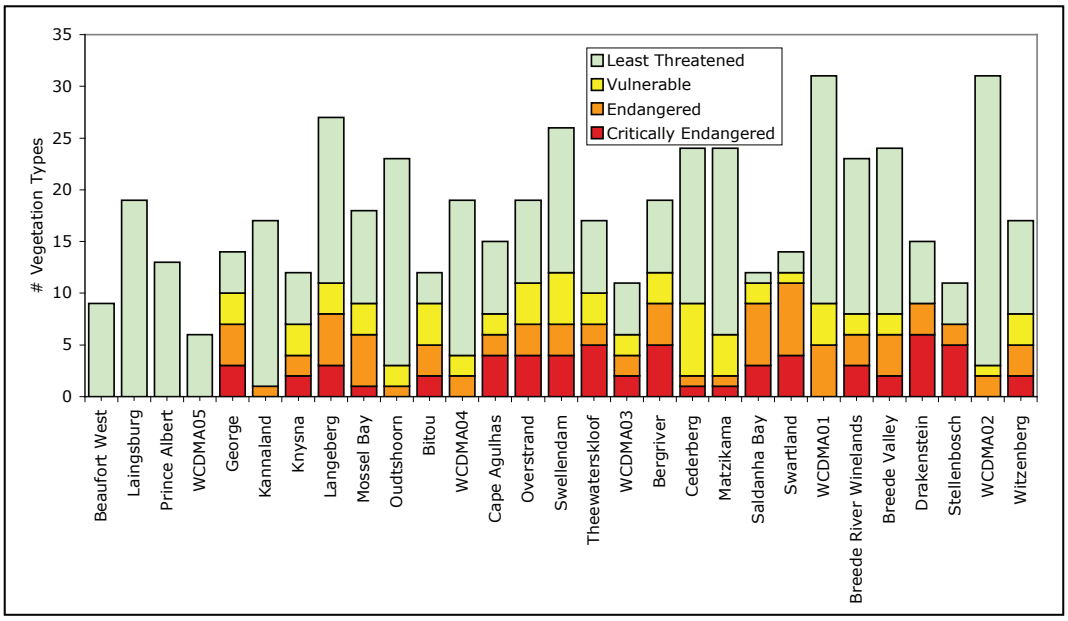

Figure 7: Number of the vegetation units occurring in each local municipality that are Critically Endangered, Endangered, Vulnerable and Least Threatened.

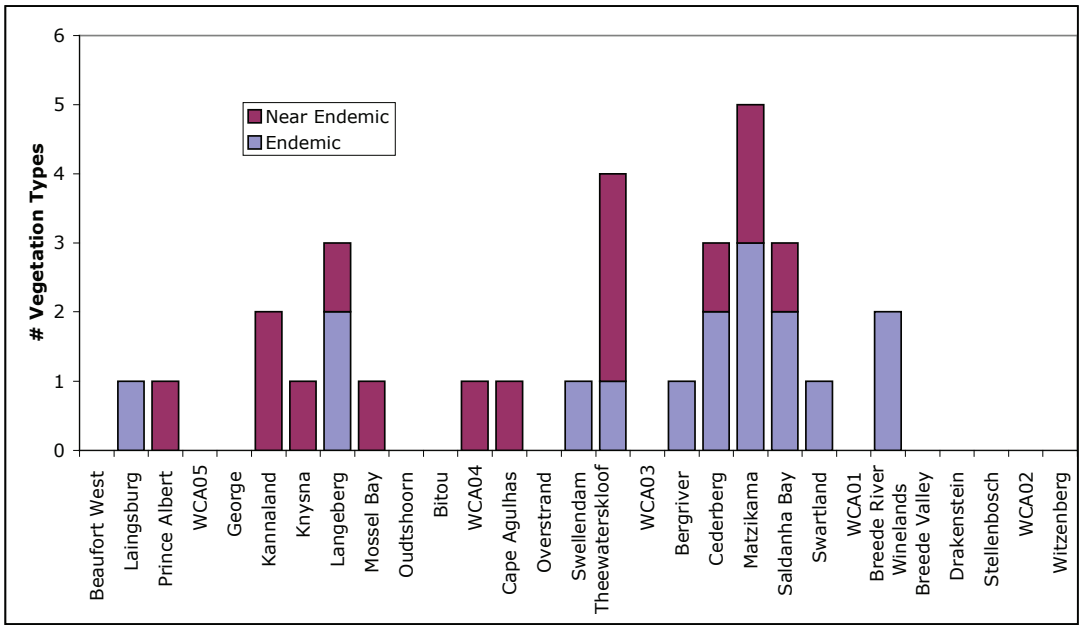

Figure 8: Number of the vegetation units occurring within the local municipalities that are considered endemic or near-endemic.

OVERBERG DISTRICT MUNICIPALITY

Almost half (48%) of the 42 vegetation units occurring in this municipality are threatened (Table 7; Figure 6). While a large 31% are endemic (Table 7, Figure 5). Swellendam and Theewaterskloof local municipalities both contain vegetation that is unique to each of their boundaries.

As is the case with Eden District Municipality, the Overberg has a high number of endemic and threatened vegetation units. Its local municipalities also carry the responsibility of having a large number of threatened vegetation units. The major threats to biodiversity within the Overberg are loss of natural vegetation as a result of urban expansion, coastal ribbon development, incorrect fire regimes, cultivation and alien plant invasion. Mining activities are also present, but to a lesser degree.

Results for the local municipalities within the Overberg District Municipality are shown in Figure 7, Figure 8 and Table 7.

Cape Agulhas Local Municipality

Of the 15 vegetation types occurring in this municipality, 53% (8) are considered to be threatened. One near-endemic vegetation type is present.

Overstrand Local Municipality

Almost 58% (11) of the vegetation types in this municipality are threatened. No endemic or near-endemic vegetation units are found here.

Swellendam Local Municipality

Of the 26 vegetation units within this municipality, 46% (12) fall within the threatened category. There is one endemic vegetation unit within this municipality.

Theewaterskloof Local Municipality

Of the 17 vegetation units present, almost 59% (10) are considered threatened, with a huge 29% (5) being critically endangered. One endemic and three near-endemic are found here.

WCDMA03

Almost 54% (6) of the vegetation units in this municipality are considered threatened (Table 7, Figure 6). There are no endemic or near-endemic vegetation units present.

WEST COAST DISTRICT MUNICIPALITY

This municipality contains the largest absolute number of threatened vegetation units (24), which makes up 40% of the 62 vegetation units occurring within its boundaries (Table 7, Figure 6). It also contains the highest number of endemic vegetation units (21) out of all the District Municipalities (Table 7, Figure 5). Endemic vegetation units occur within most of the local municipalities.

The West Coast is similar to both Eden and the Overberg in terms of endemism and threat status. The major threats to biodiversity within the West Coast are loss of natural vegetation as a result of urban expansion, coastal ribbon development, cultivation, mining, incorrect fire regimes and alien plant invasion.

One vegetation unit (Piketberg Quartz Succulent Shrubland) is considered extinct as no further natural remnants have been identified by the NSBA. According to the NSBA, only one remnant was previously present about 20km northeast of Piketberg, but it is not clear at this stage whether this is a matter to be concerned with as information is not available to determine what distinguished this vegetation unit from neighbouring vegetation units in the area.

Results for the local municipalities within the West Coast District Municipality are shown in Figure 7, Figure 8 and Table 7.

Bergriver Local Municipality

Of the 19 vegetation units falling within this municipality, 63% (12) are considered threatened. A huge 26% (5) fall within the critically endangered category, 21% (4) are considered endangered and 16% (3) vulnerable. One vegetation unit is endemic to the municipality.

Cederberg Local Municipality

This is home to 24 vegetation units, of which almost 38% (9) are considered threatened. Two endemic and one near-endemic vegetation units are found here.

Matzikama Local Municipality

Almost 25% (6) of the vegetation units found here are threatened. There are three endemic and two near-endemic vegetation units present.

Saldanha Bay Local Municipality

Of the 12 vegetation units present, a huge 91% (11) are threatened. Two endemic and one near-endemic vegetation types occur within the municipal boundaries.

WINELANDS DISTRICT MUNICIPALITY

Approximately 37% of the vegetation units in this municipality are threatened: 17% are Critically Endangered, 15% Endangered and 5% Vulnerable (Table 7, Figure 6). There are 16 endemic and two near endemic vegetation units overall (Table 7, Figure 5). The Breede River Winelands local municipality has two vegetation units endemic to its boundaries.

This District Municipality has high levels of endemism and threat status, with the major threats to biodiversity being urban expansion, cultivation, incorrect fire regimes, mining and alien plant invasion.

Results for the local municipalities within the West Coast District Municipality are shown in Figure 7, Figure 8 and Table 7.

Results for the local municipalities within the Winelands District Municipality are shown in Figure 7, Figure 8 and Table 7.

Breede River Winelands Local Municipality

Of the 23 vegetation units falling within this municipality, almost 35% (8) are considered threatened. Two endemic vegetation units are found here.

Breede Valley Local Municipality

One third of the 24 vegetation units present are threatened. No endemic or near-endemic vegetation units are present.

Drakenstein Local Municipality

This is home to 15 vegetation units, of which 60% (9) are threatened. A large 40% (6) are critically endangered. No endemic or near-endemic vegetation units are found here.

Stellenbosch Local Municipality

Of the 11 vegetation units within this municipality, almost 64% are threatened, with 45% (5) being critically endangered. No endemic or near-endemic vegetation units are found here.

WCDMA02

Only 9% (3) of the 31 vegetation units within this municipality are considered threatened. There are no critically endangered, endemic or near-endemic vegetation types present.

Witzenberg Local Municipality

Of the 17 vegetation units present, 47% (8) are threatened. No endemic or near-endemic vegetation units are found here.

Table 7: Number of threatened, Least Threatened, endemic and near endemic vegetation units per municipal area in the WCP. See Appendix 1 for complete list of vegetation units, and their conservation status for each municipality. Critically Endangered (CE), Endangered (E) and Vulnerable (V) ecosystems are collectively termed threatened ecosystems.

Municipal Area	Total	Threatened			Least Threatened	Endemic	Near Endemic
		CR	E	V			
City of Cape Town	24	8	7	3	6	6	0
Central Karoo DM	29	0	0	0	29	1	3
- Beaufort West LM	9	0	0	0	9	0	0
- Laingsburg LM	19	0	0	0	19	1	0
- Prince Albert LM	13	0	0	0	13	0	1
- WCDMA05	6	0	0	0	6	0	0
Eden DM	53	5	8	5	35	19	2
- George LM	14	3	4	3	4	0	0
- Kannaland LM	17	0	1	0	16	0	2
- Knysna LM	12	2	2	3	5	0	1
- Langeberg LM	27	3	5	3	16	2	1
- Mossel Bay LM	18	1	5	3	9	0	1
- Oudtshoorn LM	23	0	1	2	20	0	0
- Bitou LM	12	2	3	4	3	0	0
- WCDMA04	19	0	2	2	15	0	1
Overberg DM	40	6	6	8	20	13	1
- Cape Agulhas LM	15	4	2	2	7	0	1
- Overstrand LM	19	4	3	4	8	0	0
- Swellendam LM	26	4	3	5	14	1	0
- Theewaterskloof LM	17	5	2	3	7	1	3
- WCDMA03	11	2	2	2	5	0	0
West Coast DM	60	6	10	8	36	21	2
- Bergriver LM	19	5	4	3	7	1	0
- Cederberg LM	24	1	1	7	15	2	1
- Matzikama LM	24	1	1	4	18	3	2
- Saldanha Bay LM	12	3	6	2	1	2	1
Winelands DM	60	10	9	3	38	16	2
- Breede River Winelands LM	23	3	3	2	15	2	0
- Breede Valley LM	24	2	4	2	16	0	0
- Drakenstein LM	15	6	3	0	6	0	0
- Stellenbosch LM	11	5	2	0	4	0	0
- WCDMA02	31	0	2	1	28	0	0
- Witzenberg LM	17	2	3	3	9	0	0

** Piketberg Quartz Succulent Shrubland is considered extinct as no further natural remnants have been identified by the NSBA.

THREATS

In the Fynbos or CFR the greatest threat to the plant taxa is agriculture (mainly on the lowlands). South Africa's new National Environmental Management: Biodiversity Act (NEMBA) Act 10 of 2004 stipulates that species may only be listed as threatened if they are threatened by activities listed in chapter 4 of the Act. Threats, such as agriculture, are not listed as restricted activities even though this is one of main threats to biodiversity in the CFR. In Figure 9 it is clearly shown that agriculture is the greatest threat to the plant taxa in the CFR. Consequently, a large proportion of the Red Listed taxa in the Western Cape are not listed on the Department of Environmental Affairs and Tourism's (DEAT) national list of threatened species.

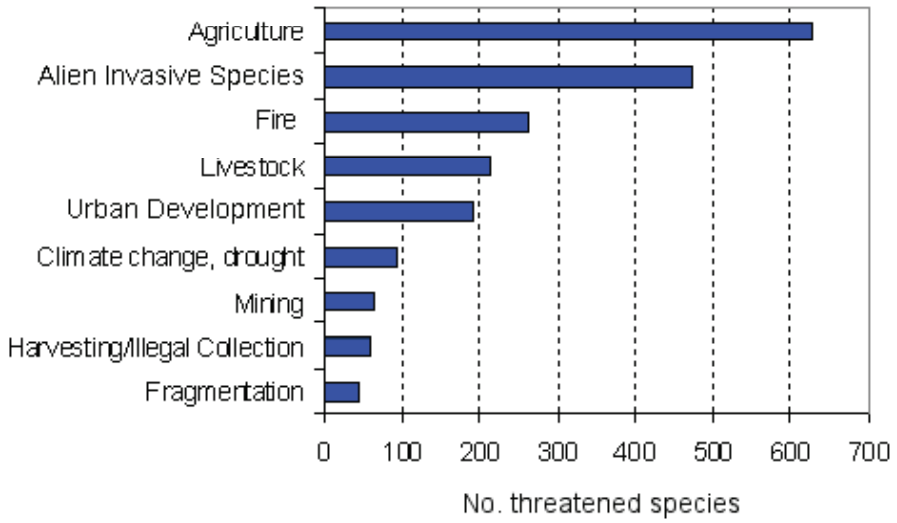

Figure 9. Main threats to the threatened plant taxa within the CFR according to activities listed in the Threatened Plant Species database.

The National Environmental Management Act (Act No. 107 of 1998) contains legalisation relevant to agricultural expansion. According to this legislation, the transformation or removal of indigenous vegetation of 3 hectares or more requires environmental authorisation and an environmental assessment must be conducted to inform the decision. It is concerning that many important remnants of threatened ecosystems fall below this threshold. To deal with this issue the legislation also states that the removal of indigenous vegetation of any size in Critically Endangered or Endangered ecosystems listed in terms of Section 52 of the National Environmental Management: Biodiversity Act (NEMBA), 2004 (Act 10 of 2004) requires environmental authorisation. The listing of ecosystems as Threatened or Protected is conceptually appealing, especially in cases where an entire ecosystem is threatened. However, the listing of threatened and protected ecosystems may be difficult in practice as many threatened ecosystems are often highly fragmented. An additional concern is that many threatened species do not occur in threatened ecosystems (Figure 1). Unfortunately, the ecosystem listing process has not yet been finalised

NEMBA offers a further provision for the protection of species that are not listed as Threatened or Protected species in that Act: Biodiversity Action plans may be drawn up for individual species or suites of species that prescribe certain actions for the continued existence of such species. The legislative strength of these plans remains to be tested.

Agriculture outside of the fynbos in the WCP is much less of a threat. When looking at other threats in the CFR, such as alien infestation, fire, urban development, climate change and habitat fragmentation, only alien infestation, fire and livestock overgrazing can be controlled to some extent but at almost prohibitive monitory expense while for urban development and climate change very little mitigation is possible to

ensure the survival of the threatened species. Although threats such as mining and harvesting can be legally mitigated, for economical reasons, this is seldom done.

CONCLUSIONS AND RECOMMENDATIONS

Although a great deal of data on both the flora and vegetation have been gathered over many years, it has only really been synthesised into a useable format in the last five years, enabling accurate analyses of the conservation status.

The high number of endemic or near endemic vegetation units in the WCP (121 units, 73% of the units in the WCP and 26% of the units in SA) places enormous responsibility on the authorities and public in making sure this vegetation survives. The 35 endemic or near endemic vegetation units with very little area under protection (0.1 to 5%) and the 24 units with no area under protection need urgent conservation attention. The Stewardship Program should urgently address the conservation status of these vegetation units.

The WCP has not only a national, but also a global responsibility with 38% of South Africa's vegetation units occurring in this province. Over one quarter of these are considered endemic to the province and 36% are threatened. This is indicative of ineffective past policies and land use activities. With the exception of the Central Karoo District Municipality, all Districts have extremely high levels of vegetation endemism and this is a critical element that needs to be understood and considered when developing land use strategies. The province is striving to improve policies and planning through strategic initatives such as the development of a Provincial Spatial Development Framework (PSDF) and regular reporting on the State of the Environment (SoER). The WCP is in a unique position in that the status of its ecosystems has recently become readily available through the NSBA to aid in effective land use planning and decision-making. This includes accommodating human settlement, agricultural and mining expansion etc. as well as identifying and consolidating an effective network of protected areas across the province needed to conserve a representative proportion of its unique biodiversity, and to assist in maintaining healthy functioning ecosystems.

The current arrangement of protected areas in the WCP does not adequately protect a representative sample of the phenomenal biodiversity of the Western Cape. A large proportion of our biodiversity falls on privately owned land and it is essential that conservation strategies include the protection of biodiversity on privately owned land and sometimes very productive land. At this stage biodiversity loss or gain as a result of land-use planning and decision-making and the various conservation initiatives that are underway is not adequately monitored, and it is difficult to measure the state of management of ecosystems outside of protected areas. CapeNature is aware of sites that require some level of intervention, however insufficient capacity hampers adequate action on the ground.

Given CapeNature's capacity constraints, the Stewardship Programme is being implemented in such a way so as to maximize return for minimum effort. CapeNature largely focuses its Stewardship Programme on privately owned land in important areas that are highly Vulnerable to habitat transformation, usually where many rare and threatened ecosystems and species exist.

This is not to say that remaining, unprotected tracts of natural vegetation that do not qualify for participation in the Stewardship Programme are not important. A large component of unprotected land in the WCP, largely the Least Threatened mountainous regions, is essential for ecosystem services such as water production. Given the nature of the terrain, these areas are not likely to be used intensively by humans. Under the correct management conditions (fire and alien plant control) they are still able represent the original biodiversity of the area. In these instances, incentives must be provided to encourage land

owners to manage this land for conservation purposes. These areas generally have a low irreplaceability and a low vulnerability and are thus not facing any immediate threats. They are however considered critical for biodiversity conservation, but given the low threat status, they are not considered a priority for conservation authorities to focus attention on. Landowners are usually eager to be involved in some type of conservation initiative and it is here were municipalities can intervene and offer incentives/ strategies to the willing landowners to protect the land (which provides ecosystem services such as water production and purification, pollination, carbon sequestration etc).

No information is available to determine how much natural vegetation is lost to development activities, and no mechanism is in place to begin capturing this type of information. On the other hand, data is being captured through CapeNature's Stewardship Programme to determine how much privately owned land is being secured for conservation purposes.

Municipalities in the WCP face unique challenges in terms of biodiversity conservation. Not all vegetation units in the WCP are under threat, and some even require little or no intervention, however there are those threatened ecosystems that do require intervention and immediate attention. Municipalities must not only be concerned with endemic vegetation units, but also threatened vegetation units that they may or may not share with neighbouring municipalities. With the exception of the Central Karoo, all district municipalities in the WCP contain Critically Endangered, Endangered and Vulnerable ecosystems. They also all contain vegetation units that are endemic within their political boundary (i.e. vegetation units that do not extend beyond the boundaries of the municipality). Urgent intervention is needed that will supplement the Stewardship Programme to assist in preventing further loss of biodiversity. A consolidated network of protected areas, owned both privately and by the state to achieve biodiversity conservation goals would assist in achieving this goal.

While current conservation planning products are useful tools to inform land-use decisions, it is important to understand their limitations with regards to the scale of information provided and the intended purpose of the conservation plans. Essentially, the conservation planning products currently available are useful for decision-making in those areas that are highly irreplaceable, but are not useful for areas of low irreplaceability, where you have a choice of where to conserve. In contrast, these plans are very useful for land-use planning at as you can select the areas that are easier to work in because you have options in the low irreplaceability habitats.

Indicators to monitor the State of Biodiversity in general were identified in the WCP State of Environment Report (DEA&DP, 2005). Trend data is not yet available to track changes for the state of ecosystems, and as far as we are aware, no system has been developed and implement to carry out this function. A key concern is that the most up-to-date information on transformation for the entire province is the 1996 National Land Cover data used by the NSBA.

Information on habitat transformation needs to be updated at least every 5 years to adequately understand trends in habitat transformation in the Province. This could then be used to monitor the following types of indicators for land outside of protected areas:

1 Habitat transformation due to cultivation, over-grazing, mining, urban expansion and human settlements.
2 Amount of natural vegetation lost relative to NSBA biodiversity targets.
3 Amount of natural vegetation lost in areas identified by fine-scale conservation planning as important for biodiversity conservation.
4 Amount of natural vegetation degraded by over-grazing.
5 Amount of natural vegetation invaded by alien vegetation.

It would also be important to determine the amount of natural vegetation on privately owned land secured for protection through the Stewardship Programme.

ACKNOWLEDGEMENTS

The South African National Biodiversity Institute is thanked for the use of their data. The checklist of Western Cape Province plants with their alien and endemic status (Appendix 1) was extracted from PRECIS and the National Herbarium, Pretoria. The conservation status of the taxa was obtained from the Threatened Plant Species database. Therese Forsyth and Helen de Klerk of CapeNature for providing GIS data and support; the Museum of Vertebrate Zoology, University of California Berkeley, for use of computers, office space and GIS software.

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APPENDICES

Appendix 1 is only available in digital format due to its very large size.

CHAPTER 9

LAND & PROTECTED AREAS

A. le Roux, V. Bowie, P. H. Lloyd, A.A.Turner and H. de Klerk

rouxa@cncjnk.pgwc.gov.za
afrobokkie@yahoo.com
lloydp@cncjnk.pgwc.gov.za
aaturner@cncjnk.pgwc.gov.za
hdeklerk@cncjnk.pgwc.gov.za

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Executive Summary

The Western Cape Province (WCP) is host to an exceptional biodiversity. Much of this biodiversity occurs in the threatened and highly transformed lowlands. Protected areas do not represent these lowlands sufficiently as protected areas are concentrated in the mountainous regions where they support crucial ecosystem functioning. The remaining natural areas in the lowlands fall primarily on privately-owned land. The Stewardship Programme is a joint venture between these private land-owners and the Western Cape Nature Conservation Board (CapeNature) to promote the conservation of these threatened natural resources.

There are several large conservation planning initiatives currently in progress in the WCP: Cape Action for People & Environment, Succulent Karoo Environmental Programme and Succulent Thicket Ecosystem Programme. These initiatives include several fine-scale planning programmes which will identify exactly which land parcels are in need of conservation measures.

Protected areas are proclaimed under several different sets of legislation and hence do not all provide the same level of protection and security. To address this, we have classified protected areas into three Western Cape Conservation Categories (WCCC): from WCCC1 with the strongest legislation to WCCC3 with the weakest legislation. The land under WCCC1 as a percentage of the WCP is 8.4%, WCCC2 is 5.8%, WCCC3 is 12.3%.

INTRODUCTION

Two Biodiversity Hotspots (Mittermeier *et al.* 2004) fall within the Greater Cape Floral Region (GCFR) as defined by Born *et al.* (2007). Born *et al.* (2007) redefined the Cape Floristic Kingdom to include the whole winter rainfall area in South Africa which includes the Cape Floristic Region (fynbos) and the Succulent Karoo Biome. Almost all of the Western Cape province (WCP) falls within the GCFR and covers about two-thirds of the entire GCFR. In a world context, the WCP is responsible to ensure the persistence of this biodiversity heritage. Securing healthy, functioning ecosystems can be achieved through: (1) state owned protected areas, (2) privately owned contract nature reserves, (3) privately owned voluntary nature reserves (conservancies), (4) wise land-use planning and (5) wise decision-making to address the requirements of the environment to ultimately assist in achieving overall societal well-being in the WCP.

Protected areas worldwide are established for a variety of reasons, including the need to set aside representative examples of natural ecosystems as benchmarks against which the effects of development can be measured. In maintaining these conserved examples of natural ecosystems it is important to recognise not only the species naturally occurring here, but also the relationships between these species (the biota) and their physical and climatic environments (the abiotic elements). These complex relationships, which support life and provide ecosystem services, consist of a variety of intertwined ecological processes, ranging from pedogenesis to pollination. In conserving these examples of natural ecosystems, it is important to ensure that the processes are also maintained/conserved, so that both biotic species and ecological processes are allowed to evolve under natural conditions, *i.e.* the natural selective pressures must be allowed to continue to maintain evolutionary processes.

As a result of the historic selection of protected areas, a significant amount of the WCP biodiversity occurs on privately owned land. Large tracts of land important for biodiversity have therefore been lost to activities such as cultivation, human settlement expansion, degradation and mining, as well as the

invasion of alien plant species. Information extracted from the National Spatial Biodiversity Assessment (NSBA) (Driver *et al*., 2005) indicates that as much as 10% of the vegetation types in the WCP are Critically Endangered, 16% Endangered and 10% Vulnerable. Very few threatened vegetation types are adequately conserved (Driver *et al*. 2005). This is, however, based on habitat transformation information which is 10 years old and is thus an underestimate of the current situation.

The WCP is now striving to achieve adequate protection of its ecological environment through biome-wide programmes *viz.*: Cape Action for People & Environment (CAPE), the Succulent Karoo Environmental Programme (SKEP) and Succulent Thicket Ecosystem Programme (STEP). These programmes have identified those areas important for global biodiversity conservation. Methods for the selection of these important areas have changed and improved in the last decade and systematic, scientifically defensible approaches now dominate conservation planning in South Africa. In the last 5 years, several fine scale conservation planning programmes have been launched to make sure that the remaining natural veld will receive protection, not only through legislation, but also by voluntary conservation by local authorities or private individuals. These plans, which form part of the biome-wide programmes, strategically coincide with and link to implementation initiatives such as Stewardship, LandCare Area-wide Planning, Putting Biodiveristy Plans to Work and the mega-corridor initiatives. These initiatives also aim to raise awareness and interest in the importance of biodiversity and mainstream it into land-use planning and decision-making. They also aim to expand the existing protected area network through Stewardship mechanisms. It is essential to determine how (and if) these plans are influencing land-use planning and decision-making at all spheres of government and within all departments.

These planning areas cover a large proportion of the WCP (Figure 1) and will go a long way to ensure the long-term persistence of natural ecosystems within the WCP. These areas include:

- Knersvlakte
- Nieuwoudtville
- North West Sandveld
- Greater Cederberg Biodiversity Corridor
- Saldanha Peninsula
- West Coast
- Swartland Renosterveld
- Cape Flats
- Upper Breede River Valley
- Overberg
- Agulhas Biodiversity Initiative
- Riversdale Plain
- Gouritz Initiateve
- Garden Route Initiative

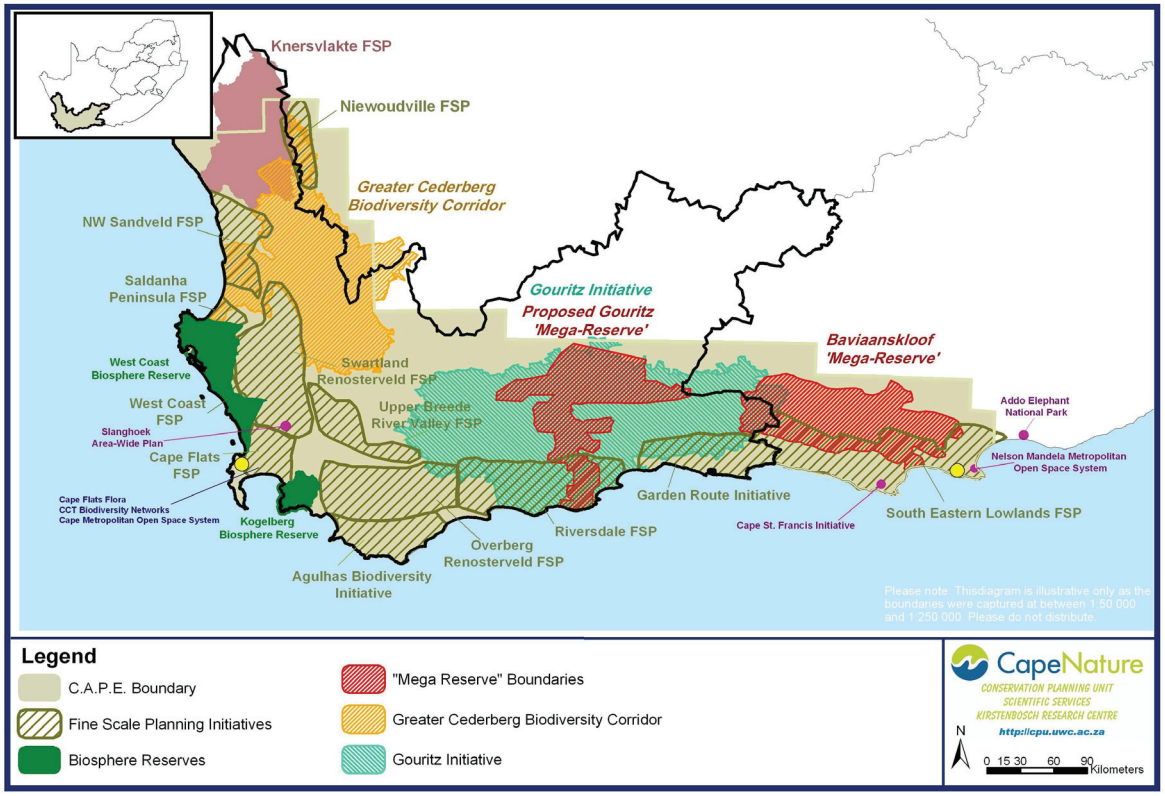

Figure 1. Map indicating present and proposed conservation planning projects in the WCP. Biosphere reserves have had some planning but not to the extent of the other projects.

Although it is generally accepted that a minimum of 10% of terrestrial ecosystems should be protected in order to preserve natural ecosystems (*e.g.* IUCN *et al.* 1991), the remaining 90% must also be considered to achieve conservation goals. Conservation concepts that are inclusive of humans and their activities such as private nature reserves, conservancies, stewardship sites and biosphere reserves also aid the achievement of conservation objectives. A greater conservation awareness and ethic in the Western Cape has considerably increased the percentage of privately conserved areas in the last few years. With programmes such as CAPE, SKEP and STEP initiatives and the Stewardship Programme covering the largest part of the province, this positive trend should continue.

Other reasons for the conservation of such areas include the need to conserve threatened species, to maintain processes beneficial to humans and other biota, to provide areas for recreation and spiritual well being.

In this chapter, only the actual cover of land in hectares and as a percentage of the WCP is evaluated. The conservation status of flora and vegetation-based ecosystems is found in Chapter 8.

METHODS

The GIS software package ArcView was used to map (in geographic projection) and analyse (in Lambert projection) the protected areas. The layers used in the 2002 assessment were used again for comparison with the present 2006 GIS layers updated to November 2006. The 2002 data were categorised according to the Western Cape Province Conservation Categories (WCCC) to enable comparisons. Small discrepancies between the 2002 and 2006 hectare values for specific protected areas are most likely due to better GIS

information (refinement of reserve boundaries as well as provincial boundaries). Where there were very obvious digitising errors such as where it was known that the boundaries have not changed between 2002 and 2006, the 2002 layer was corrected.

During 2006 the Western Cape nature Conservation Board (WCNCB) went through an intensive process to update and confirm boundaries and proclamation information for the various types of protected areas within the Western Cape Province. Note that this updating process was only conducted for those protected areas proclaimed under WCNCB legislation. National Parks information was obtained from SANParks.

The sizes of the protected areas were derived from the GIS layers in Lambert projection.

RAMSAR sites were not classified into Western Cape Conservation Categories, as these sites do not confer formal protection.

In 2002 only the Marine Protected Areas managed by WCNCB were provided. In 2006 all the Marine Protected Areas in the Western Cape have been included.

CLASSIFICATION OF PROTECTED AREAS

In the 2002 State of Biodiversity Report (Le Roux *et al.* 2002), the conservation categories used were: Statutory Conserved Areas (World Heritage Sites, Wilderness Areas, National Parks, Provincial Nature Reserves, State Forest Reserves, Marine Protected Areas, Local Authority Nature Reserves and Mountain Catchment Areas) and Private Conserved Areas (Private Nature Reserves, Conservancies, SA Natural Heritage Sites and Biosphere Reserves). In the last five years, however, there have been considerable conservation planning actions and programmes as well as new legislation *viz*. National Environmental Management: Protected Areas Act.Act No 57 of 2003 and its ammendment of 2004 (Anon. 2003 and Anon 2004), resulting in the reclassification of the conservation categories of protected areas.

Different conservation categories have been used by different sources in the last few years, including conservation categories used by different national conservation initiatives which do not correspond with one another. These were compared and evaluated and the protected areas classified according to these sources (Table 1). It was decided to use our own system that reflects the conservation status of protected areas specifically for the WCP. The Western Cape Conservation Categories (WCCC) are based on the criterion of ensured future protection through legislation as the deciding factor for classifying the protected areas in the Western Cape Province (see Appendix I). These are the categories decided upon:

Western Cape Conservation Category 1 (WCCC 1)
Protected areas with strong legislative security.

- World Heritage Sites
- Wilderness Areas
- National Parks
- Provincial Nature Reserves
- State Forest Nature Reserves
- Marine Protected Areas

Note: some areas classified here have, e.g. WCCC 2 areas within them (Red Hill & Eagles Rest Private Nature Reserves and Klawer Valley Natural Heritage Site within the Table Mountain National Park. Any calculations (either ha coverage or percantage coverage) of WCCC 1 areas include these properties of lesser (WCCC 2) status and are not included in the WCCC 2 analysis.

Western Cape Conservation Category 2 (WCCC 2)
Protected areas with some legislative security.

- Local Authority Nature Reserves
- Mountain Catchment Areas
- Private Nature Reserves
- Natural Heritage Sites

Note: some sites have more than one conservation category status, *e.g.* the proclaimed Groenfontein Private Nature Reserve is also registered as a SA Natural Heritage Site. They will be analysed only once in the coverage figures.

Western Cape Conservation Category 3 (WCCC 3)
These are properties that have little or no legislative security. These are voluntary agreements.

- Conservancies
- Biosphere Reserves

Note: some of the areas classified here have WCCC 1 & WCCC 2 areas within their greater boundaries. Any calculations (either ha coverage or percentage coverage) referring to this category have not included these higher categories as their figures were included in the two higher categories (WCCC 1 & 2).

Table 1. Comparison of protected area status categories used to define types of protected areas in the Western Cape Province.

	Western Cape State of Biodiversity 2000 Report (Le Roux et al. 2002)	National Strategic Biodiversity Assessment (Driver et al. 2005)	Proposed IUCN Protected Area Management Categories (IUCN et al. 1991)	Protected Areas Act (no 57 of 2003) & Protected Areas Act amendment (no31 of 2004)	Kumleben Commission (1998)	This report
World Heritage Sites	Statutory		Category X	B	Category II	WCCC 1
Wilderness Areas	Statutory		Category I	A	Category Ib	WCCC 1
National Parks	Statutory	Type 1	Category II	A	Category II	WCCC 1
Provincial Nature Reserves	Statutory	Type 1	Category II	A	Category II	WCCC 1
State Forests Nature Reserve	Statutory	Type 1	Category II	A	Category II	WCCC 1
Contractual Nature Reserves	Statutory	Type 1	Category II	A	Category II	WCCC 1
Island Reserves	Statutory	Type 1	Category III	A	Category II	WCCC 1
Marine Protected Areas	Statutory		Category II	C	Category II	WCCC 1
Local Authority Nature Reserves	Statutory	Type 1	Category VI	A	Category II	WCCC 2
Mountain Catchment Areas (only private land)	Statutory	Type 2	Category IV	E	Category IV	WCCC 2
Natural Heritage Sites	Private	Type 2	Category III	A	Category III	WCCC 2
Private Nature Reserve	Private	Type 2	Category VI	A	Category II	WCCC 2
Biosphere Reserves (excluding core zones which are WCCC1 Category)	Private		Category IX or V	A	Category V	WCCC 3
Conservancies	Private	Type 3	Category VI		Category V	WCCC 3

STATUS OF PROTECTED AREAS

Currently 8.4 % of the WCP is in legislatively secure protected areas, or WCCC 1 (Table 2). There has been an increase of 22 % within this category in the last 5 years, increasing the total percentage cover of WCCC1 from 6.9 % to 8.4 %. The greatest increase was in National Parks, with two parks greatly increased through concerted action plans *viz.* Garden Route NationalPark, Western Cape Section, increased by 2 484 % and the Agulhas National Park increased by 116% (see Appendix II).

Table 2. A comparison between 2002 and 2006 of the sizes (in ha) of Western Cape Conservation Categories and protected area types.

Western Cape Conservation Category	Reserve Type	2002 (Ha)	2006 (Ha)	% Change	2002 % of WCP	2006 % of WCP
WCCC1	Wilderness Areas	131,540	130,570	-0.74%	1.016%	1.009%
WCCC1	South African National Parks	156,923	290,631	85.21%	1.212%	2.245%
WCCC1	Provincial Nature Reserves	152,794	189,474	24.01%	1.180%	1.464%
WCCC1	State Forest Nature Reserves	408,597	408,906	0.08%	3.156%	3.159%
WCCC1	Marine Protected Areas	41,784	68,338	63.55%		
WCCC1	Island Reserves	296	296	0.00%		
Total WCCC1		**891,935**	**1,088,216**	**22.01%**	**6.890%**	**8.406%**
WCCC2	Local Authority Nature Reserves	25,580	26,085	1.98%	0.198%	0.201%
WCCC2	Mountain Catchment Areas	558,962	557,889	-0.19%	4.318%	4.309%
WCCC2	Private Nature Reserves	122,824	135,431	10.26%	0.949%	1.046%
WCCC2	South African Natural Heritage Sites	31,954	31,551	-1.26%	0.247%	0.244%
Total WCCC2		**739,320**	**750,956**	**1.57%**	**5.711%**	**5.801%**
WCCC3	Biosphere Reserves (only ha not already in WCCC1 & WCCC2)	320,186	321,071	0.28%	2.473%	2.480%
WCCC3	Conservancies (only ha not already in WCCC1 & WCCC2)	1,186,216	1,277,129	7.66%	9.163%	9.865%
Total WCCC3		**1,506,402**	**1,598,200**	**6.09%**	**11.636%**	**12.345%**

Another form of very secure legislative protection is that of World Heritage Site status. In the WCP the Serial World Heritage Site comprises eight sites in the Cape Floral Kingdom (Table 3). These sites are included in the above figures as they consist of Wilderness Areas, National Parks, Provincial Nature Reserves or State Forest Nature Reserves.

Table 3. Names and sizes in ha of the components in the Cape Floral Kingdom Serial World Heritage Site.

Component	Ha
Grootvadersbosch (Boosmansbos) Wilderness Area	14 729.03
Grootwinterhoek Wilderness Area	26 787.66
Cederberg Wilderness Area	64 364.30
Baviaanskloof Wilderness Area	178 118.02
De Hoop Nature Reserve	32 473.18
Hottentots-Holland Complex	113 311.53
Swartberg Complex	111 791.91

Currently 5.8% of the WCP is in protected areas that have some legislative protection (WCCC 2) (Table 2). There has been an increase of 1.6% ha within this category in the last 5 years, increasing the total percentage cover of WCCC 2 from 5.7% to 5.8%. In the next 5 years this figure should increase with the implementation of the Stewardship Program.

Currently 12.3% of the WCP is in voluntary protected areas (WCCC 3) (Table 2). There has been an increase of 6.1% within this category in the last 5 years, increasing the total percentage cover of WCCC 3 from 11.6% to 12.3%.

Note: There are a number of instances where different categories of conservation areas overlap. In these cases the calculations only used the higher status.

STEWARDSHIP

As mentioned above much valuable biodiversity is represented on private land. Recognition of this fact led the WCNCB to initiate its Stewardship programme in 2003. This programme aims to facilitate conservation on privately owned land by setting up agreements between the landowners and WCNCB. The landowners undertake to protect and manage their properties or parts of their properties according to sound conservation management principles and CapeNature undertakes to support this management by providing advice, management plans and assistance in planning alien invasive species clearing and fire management schedules. These agreements may take the form of one of three categories with differing levels of obligation.

1. Conservation Area: this is the most flexible option, does not require a contract and does not operate over a fixed period.
2. Biodiversity Agreement: this requires a legally binding agreement to be drawn up between the landowner and WCNCB that sets out certain requirements.
3. Contractual Reserve: this option requires a legal contract to protect the biodiversity in an area over a long period

Table 4. Number and sizes of properties in each of the Stewardship categories.

Stewardship Category	Number	Ha
Conservation Area	69	60 7123
Biodiversity Agreement	5	960
Contract Reserve	14	17 602
Total	88	625 685

DISCUSSIONS AND RECOMMENDATIONS

Overall the Western Cape Province has 8% of its land area secured for conservation by legislation. However, the arrangement of these areas is skewed towards a higher concentration in the mountainous areas (mostly in Wilderness Areas and State Forest Nature Reserves) with very little conserved in the lowlands. The lowland areas have also been almost totally transformed by agriculture and human development and demand immediate attention. It is critical that as many as possible of remaining natural vegetation patches in this area are conserved.

The recommendation that at least 10% of an area needs to be conserved in protected areas derives from the generalisation of MacArthur & Wilson's (1967) theory of island biogeography which states that on average the number of species approximately doubles with every tenfold increase in area when looking

at islands. The converse of this is that if one conserves 10% of an area, 50% of the species will go extinct. It must be remembered that this is just a general rule of thumb and that many ecological processes necessary for sustaining biodiversity, and indeed life itself, occur over very large geographical extents. This means that the remaining 90% cannot be ignored once the 10% mark is achieved (which has still not been achieved in the WCP). An effective conservation network is not purely dependent on surface area protected but on many complex interactions which are only recently becoming incorporated in conservation planning. This emphasizes the importance of the contribution of mountain catchment areas, local authority nature reserves, private nature reserves, conservancies and biosphere reserves (WCCC 2 & 3) towards sustaining the other 50 % of the biodiversity. Figure 2 indicates that a network of protected areas of different categories is in fact being built in the WCP ensuring connectivity between areas so that ecosystem processes can function.

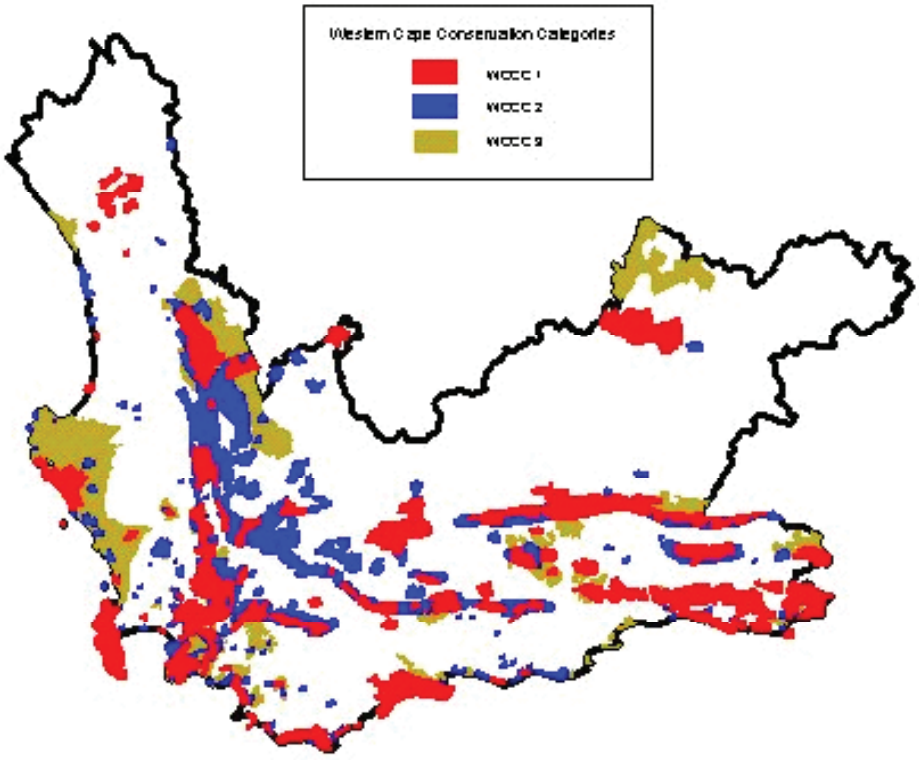

Figure 2. The network of conservation categories of protected areas in the WCP for 2006.

There is an urgent need for the nature reserves managed by the WCNCB to be legislatively consolidated and proclaimed as provincial nature reserves. There is a really complex situation at the moment with state forest nature reserves, provincial nature reserves and even areas bought for reserves but not officially proclaimed. One contiguous area, managed as a unit, can be made up of all of these types of area. Within such a unit there are different legislative responsibilities which might not all be addressed. This situation also results in the officially proclaimed reserve names being different from the name being used by management and the public. This creates confusion both within and outside the WCNCB.

The status of management of all the local authority nature reserves should be investigated. Since the municipalities have not received subsidies from the province to manage these reserves, a number of them have received no attention. These reserves should be assessed for their conservation value and attention given to their management. They may need to be re-proclaimed under different categories.

The status of all the private nature reserves should be re-evaluated. A number of them have probably changed status and this is not reflected in the current WCNCB database and GIS layer. Uncertainties include whether they are still private nature reserves if they are within the boundaries of national parks

and also, if the land has changed ownership, is the land still being managed as a private nature reserve? The GIS layer of the private nature reserves should also be refined and corrected. The GIS layers for 2002 and 2006 are spatially different for almost all of the reserves.

A number of the boundaries of the natural heritage sites are also incorrect. They should all be re-evaluated regarding boundaries and also the status of the site. These areas have received no follow-up visits after their registration and a number of them are most likely obsolete.

With the new Stewardship Program and associated legislation, a number of natural heritage sites as well as local authority and private nature reserves could possibly qualify for the Stewardship Programme and should be investigated. This will in effect mean that the reserves in the WCCC 2 category should all be assessed for conservation value and the status of the management these areas receive.

ACKNOWLEDGEMENTS

We thank Kenneth Kirsten for checking spatial and legal attributes of protected areas in the WCNCB Reserves database and Tim Sutton for the developing the GIS routines that enabled the effortless analysis of the data.

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APPENDICES

Appendix 1. Detailed descriptions of Western Cape Province conservation categories.

WESTERN CAPE CONSERVATION CATEGORY 1 (WCCC 1)

Protected areas with strong legislative security.

WORLD HERITAGE SITES

World Heritage Sites are "natural properties" (as opposed to "cultural properties") which can be considered for inclusion in the World Heritage list. They have to be evaluated by the IUCN after initial nomination by any given State. This evaluation is then presented to the World Heritage Committee, established under the Convention concerning the Protection of the World Cultural and Natural Heritage, which was adopted by the Member States of UNESCO in 1972, for a (final) decision. The minimum requirements for registration are that they must fulfil at least one of four criteria concerning natural features. Sites nominated should therefore:

- be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features; or
- be outstanding examples representing on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals; or
- contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance; or
- contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

Note: In the WCP the only "natural" World Heritage Site is the Cape floral Region Protected Areas which is a constellation of sites, all either National Parks or Wilderness Areas. The only "cultural" World Heritage Site in the Western Cape is Robben Island and not discussed in this document.

WILDERNESS AREAS

Wilderness Areas are proclaimed under the Forest Act (Act 122 of 1984) and have the highest status of the various conservation categories. Wilderness areas have scientific and conservation value as natural ecosystems which have been left virtually untouched by development; which have aesthetic worth as landscapes undamaged by development; which offer physical and spiritual recreational opportunities. In addition, such areas should be undeveloped and uninhabited by humans; they should create the impression that only natural forces have shaped them; and they should be large enough, at least 1 000 ha in size, to provide visitors with a feeling of isolation. Wilderness areas, as well as nature reserves proclaimed under the Forest Act, may neither be deproclaimed nor have their boundaries altered, except with the approval of Parliament (from: Report of the Planning Committee of the President's Council on nature conservation in South Africa, 1984). Wilderness areas may only be proclaimed on demarcated State Forest land to which the Forest Act is applicable.

NATIONAL PARKS

The characteristics of a national park are, according to the International Union for the Conservation of Nature and of Natural Resources (IUCN), "relatively large and outstanding examples of natural landscapes in which the fauna and flora endemic to those specific regions are preserved by means of enduring legislation for the inspiration, education, cultural and recreational use of man". The legislation under which national parks in this country fall, is the National Parks Act (Act 57 of 1976) and the body which manages and administers most national parks at present is South African National Parks. According to Notice 449 of 1994 (See Appendix 1) the criteria for selection and management are that: "These areas are managed by either the (then) National Parks Board (now South African National Parks) or a competent nationally recognized authority".

PROVINCIAL NATURE RESERVES

These nature reserves are established in terms of the Nature and Environmental Conservation Ordinance, 1974 (Ord. 19 of 1974). Western Cape Nature Conservation Board strives to establish and manage reserves which are representative of each ecological region within the Western Cape. Provincial nature reserves, as relatively undisturbed nature areas, contribute to sustaining society by maintaining essential ecological processes and life-support systems; conserving biological diversity; providing spiritual, intellectual, social, economic, recreational and tourism opportunities, while simultaneously taking into account prevailing social and economic factors.

MARINE PROTECTED AREAS

The Marine Living Resources Act 18 of 1998 (MLRA) seeks to preserve marine biodiversity. The MLRA also recognises the need to protect the marine ecosystem as a whole, including protecting particular species that are not targeted for exploitation. It also articulates the need to apply a precautionary approach to the management and development of marine living resources. With respect to protected area management, the MLRA provides for fisheries management areas, which can be "any area of the South African waters", and marine protected areas. Marine protected areas may be declared for three specific purposes, (a) for the protection of fauna and flora or particular species thereof and the physical features on which they depend; (b) to facilitate fishery management by protecting spawning stock, allowing stock recovery, enhancing stock abundance in adjacent areas, and providing pristine communities for research; or (c) to diminish any conflict that may arise from competing uses in the area. Regulations promulgated under the MLRA aim to protect biodiversity by the use of different control measures, such as imposition of closed seasons, species restrictions and areas closed to fishing.

WESTERN CAPE CONSERVTION CATEGORY 2 (WCCC 2)

Protected areas with some legislative security.

LOCAL AUTHORITY NATURE RESERVES

Local Authorities such as Metropolitan Councils, Regional District Services Councils, Municipalities, *etc.* may establish nature reserves on land which they control or manage. These reserves are proclaimed by the Premier by way of a notice in the Provincial Gazette in accordance with Article 7 of the Nature and Environmental Conservation Ordinance, 1974 (Ordinance 19 of 1974) (Appendix 2). The aim of local nature reserves is to encourage local authorities to protect significant species, ecosystems or physical features of the local environment.

MOUNTAIN CATCHMENT AREAS

Mountain catchment areas are set aside under the Mountain Catchment Areas Act 63 of 1970 with several objectives. They include water and soil conservation, and appropriate management of alien invasive vegetation. This act provides for the conservation, use, management and control of land situated in mountain catchment areas. Previously they were declared at the national level but since 1995 the administration of the Act is assigned to the provinces. A number of mountain catchment areas also fall within the protected areas. The Act provides for biodiversity protection within mountain catchment areas by different measures. One of these is the establishment of fire protection committees and the preparation of fire protection plans, to ensure that a proper management regime regulates the activity of preparing and maintaining firebreaks within mountain catchment areas. The National Veld and Forest Fire Act provides that a fire protection committee established under the Mountain Catchment Areas Act may be recognised and registered as a fire protection association ("FPA") under the former Act. The Act also empowers the provincial authority responsible for administering it to prescribe management measures for catchment areas. The competent national or provincial authority may give binding directives to owners and occupiers of land situated within these areas in order to achieve the Act's objectives. The directives may relate among other things to the prevention of soil erosion and the protection of natural vegetation within the area.

Unregulated development of 4x4 trails and ploughing in declared Mountain Catchment Areas on privately owned land hampers biodiversity conservation as well as water catchment properties.

PRIVATE NATURE RESERVES

Private landowners may apply to the Provincial Administration to establish a private nature reserve on their land or on parts of their land (Article 12 of Ordinance 19 of 1974) (Appendix 2). In order to qualify, the land needs to be of viable size and should already be managed for conservation purposes. The main advantage for the landowner is the elevated conservation status that is associated with that of a proclaimed nature reserves.

SA NATURAL HERITAGE SITES

The South African Natural Heritage Programme was launched nationally by the Chief Directorate: Nature Conservation, of what is now the Department of Environment Affairs and Tourism. The purpose of the project is to provide assistance to private or public landowners in preserving natural areas, no matter how small, because of their scientific, aesthetic and/ or cultural value.

WESTERN CAPE CONSERVATION CATEGORY 3 (WCCC 3)

These are properties that have little or no legislative security. These are voluntary agreements.

CONSERVANCIES

This conservation category is recognised throughout the country, but is not covered by any legislation. A conservancy consists of a group of landowners (normally with neighbouring properties) who jointly manage the land they own in such a way that predetermined conservation objectives can be achieved. The areas have no legal conservation status and are managed and financed by the landowners themselves. Conservancies are, however, registered and recognised by CapeNature as a viable conservation initiative.

BIOSPHERE RESERVES

Biosphere Reserves are areas of land or marine ecosystems, incorporating formally conserved land and adjacent areas with compatible landuse and development practices which form part of the international Man and the Biosphere programme (MAB) coordinated by UNESCO, which is the organization which decides whether registration is approved or not.

Appendix 2. Areas of statutory conservation areas in the Western Cape Province.

Western Cape Conservation Category	Reserve Type	Management Authority		Reserve Name	2002 Area of Wcc1 (Ha)	2006 Area of Wccc1 (Ha)	% Change in WCCC1	Reason For Change
WCCC1	Wilderness Areas	Western Cape Nature Conservation Board	1	Baviaanskloof Wilderness Area (only Western Cape Section) (also part of Cape Flora Region World Heritage Site)	15,319	15,297	-0.14%	Could be attributed to a more accurate Western Cape Province boundary in 2006
			2	Boosmansbos Wilderness Area (also part of Cape Flora Region World Heritage Site)	15,203	14,654	-3.61%	In 2002 Grootvadersbos Nature Reserve was incorporated here. Also another piece of State Forest that was not transfered to WCNCB
			3	Cederberg Wilderness Area (also part of Cape Flora Region World Heritage Site)	65,619	65,203	-0.63%	In 2002 a section leading to Algeria was incorrectly inserted
			4	Doringrivier Wilderness Area	9,519	9,523	0.04%	
			5	Grootwinterhoek Wilderness Area (also part of Cape Flora Region World Heritage Site)	25,881	25,893	0.05%	
					131,540	**130,570**	**-0.74%**	
WCCC1	South African National Parks	South African National Parks Board	1	Agulhas National Park	7,943	17,149	115.92%	Park extention
			2	Bontebok National Park	3,384	3,384	0.00%	
			3	Garden Route National Park (Western Cape Section)	4,308	111,321	2484.16%	In 2002 Knysna National Park (1914.46 ha) + Wilderness National Park (2393.37). Now greatly extended and consolidated
			4	Karoo National Park	76,776	88,122	14.78%	Park consolidation

Western Cape Conservation Category	Reserve Type	Management Authority		Reserve Name	2002 Area of Wcc1 (Ha)	2006 Area of Wccc1 (Ha)	% Change in WCCC1	Reason For Change
			5	Table Mountain National Park (also part of Cape Flora Region World Heritage Site)	28,721	28,756	0.12%	2002 called Cape Peninsula National Park. This national park includes Eagles Rest & Red Hill Private Nature Reserves as well as Klawer Natural Heritage Site and which areas are included in the WCCC area
			6	Tankwa Karoo National Park (only Western Cape Section)	11,397	11,452	0.49%	
			8	West Coast National Park	24,395	30,445	24.80%	Park extention
					156,923	**290,631**	**85.21%**	
WCCC1	Provincial Nature Reserves	Western Cape Nature Conservation Board	1	Anysberg Nature Reserve	62,767	66,952	6.67%	Private property in the middel of the reserve included as part of the reserve because it is managed as a unit
			2	Assegaaibosch Nature Reserve	198	198	-0.02%	
			3	Blaauwberg Nature Reserve	718	425	-40.82%	Boundaries redefined
			4	Brodie Link Nature Reserve	93	115	23.62%	Unexplained
			5	Brodie/Kogelberg WWF-land (Proposed Reserve)		250	100.00%	New Reserve
			6	De Hoop Nature Reserve (also part of Cape Flora Region World Heritage Site)	32,284	34,010	5.34%	Unsure if the extention is true
			7	Driftsands Nature Reserve	435	435	0.00%	
			8	Gamkaberg Nature Reserve	9,592	9,590	-0.02%	
			9	Gamkapoort Nature Reserve	9,177	9,174	-0.03%	
			10	Gamkaskloof (Die Hel) Nature Reserve		4,390	100.00%	2002 this was included in Groot Swartberg Nature Reserve
			11	Geelkrans Nature Reserve	525	227	-56.83%	In 2002 Stilbaai Oos Nature Reserve was included in Geelkrans. Listed seperately in 2006
			12	Goukamma Nature Reserve	2,283	2,284	0.06%	
			13	Groenefontein Nature	5,213	5,225	0.25%	
			14	Grootvadersbosch (Thornhill)-WWF land (Proposed Reserve)		4,617	100.00%	New Reserve

Western Cape Conservation Category	Reserve Type	Management Authority		Reserve Name	2002 Area of Wcc1 (Ha)	2006 Area of Wccc1 (Ha)	% Change in WCCC1	Reason For Change
			15	Harmony Flats Nature Reserve	10	10	0.01%	
			16	JN Briers Louw Nature Reserve	29	29	0.01%	
			17	Keurboomsrivier - Seemeeu Broeikolonie	39	39	-0.01%	
			18	Keurboomsrivier Nature Reserve	909	905	-0.49%	
			19	Kogelberg Sonchem Link	394	394	0.00%	
			20	Kruisrivier (Broomvlei) Nature Reserve	183	183	0.01%	
			21	Maanschynkop Nature Reserve	785	785	0.03%	
			22	Matjiesrivier Nature Reserve	12,800	12,794	-0.05%	
			23	Moedverloren/(Knersvlakte) Nature Reserve	7,495	28,241	276.79%	Reserve extention
			24	Pela Nature Reserve	600	600	0.00%	
			25	Riverlands Nature Reserve	1,112	1,112	0.00%	
			26	Robberg Nature Reserve	191	184	-3.81%	
			27	Rocherpan Nature Reserve	929	930	0.04%	
			28	Rooisand (Botrivier) Nature Reserve	273	273	0.00%	
			29	SAS Saldahna Nature Reserve	933	927	-0.64%	
			30	Vaalhoek Nature Reserve (Gamkaberg)		1,337	100.00%	New reserve
			31	Voëlvlei Nature Reserve	862	877	1.77%	
			32	Vrolijkheid Nature Reserve	1,966	1,963	-0.17%	
					152,794	**189,474**	**24.01%**	
WCCC1	State Forest Nature Reserves	Western Cape Nature Conservation Board	1	Babilonstoring Nature Reserve	778	778	0.00%	
			2	Ben-Etive Nature Reserve	5,095	5,095	0.00%	
			3	Blomboschfontein Nature Reserve	265	265	-0.11%	
			4	Bokkeriviere Nature Reserve	6,953	6,962	0.12%	
			5	Brandvlei Nature Reserve		2,531	100.00%	Not previously included as being managed by WCNCB
			6	De Mond Nature Reserve	928	929	0.05%	
			7	Elandsbaai Nature Reserve	613	613	-0.05%	
			8	Fonteintjiesberg Nature Reserve	3,997	3,997	0.00%	
			9	Garcia Nature Reserve	6,473	6,461	-0.19%	
			10	Gatplaats Nature Reserve	54	54	0.00%	
			11	Groenberg Nature Reserve	129	129	0.00%	

Western Cape Conservation Category	Reserve Type	Management Authority		Reserve Name	2002 Area of Wcc1 (Ha)	2006 Area of Wccc1 (Ha)	% Change in WCCC1	Reason For Change
			12	Groenlandberg Nature Reserve (also part of Cape Flora Region World Heritage Site)	5,122	5,123	0.01%	
			13	Groot Swartberg Nature Reserve (also part of Cape Flora Region World Heritage Site)	83,849	79,731	-4.91%	In 2002 Gamkaskloof (Die Hel) Nature Reserve was included in this reserve
			14	Grootvadersbosch Nature Reserve		338	100.00%	In 2002 placed as part of Boosmanbos Wilderness Area
			15	Grootwinterhoek Nature Reserve	1,612	1,610	-0.14%	
			16	Haweqwa Nature Reserve (also part of Cape Flora Region World Heritage Site)	42,695	42,157	-1.26%	In 2002 a section was incorrectly incorporated here that belonged to Theewaters Nature Reserve
			17	Helderberg Nature Reserve	218	218	0.00%	
			18	Hexberg Nature Reserve	1,679	1,674	-0.34%	
			19	Hottentots-Holland Nature Reserve (also part of Cape Flora Region World Heritage Site)	27,038	13,150	-51.36%	In 2006 Jonkershoek Nature Reserve was placed as a seperate reserve
			20	Houwhoek Nature Reserve (also part of Cape Flora Region World Heritage Site)	3,258	3,257	-0.02%	
			21	Jonkershoek Nature Reserve (also part of Cape Flora Region World Heritage Site)		13,844	100.00%	In 2002 placed as part of Hottentots-Holland Nature Reserve
			22	Kammanassie Nature Reserve	27,058	27,449	1.45%	Unexplained difference, most likely GIS related
			23	Kapel Conservation Area	185	185	0.01%	
			24	Kasteelberg Nature Reserve	394	395	0.34%	
			25	Kleinjongensfontein Nature Reserve	583	582	-0.18%	
			26	Kogelberg Nature Reserve (also part of Cape Flora Region World Heritage Site)	19,412	19,412	0.00%	
			27	Lutzville Conservation Area	1,619	1,619	0.00%	
			28	Marloth Nature Reserve	11,237	11,233	-0.04%	
			29	Millwood Nature Reserve	4,503	4,503	-0.01%	
			30	Mt Hebron Nature Reserve (also part of Cape Flora Region World Heritage Site)	757	743	-1.80%	

Western Cape Conservation Category	Reserve Type	Management Authority		Reserve Name	2002 Area of Wcc1 (Ha)	2006 Area of Wccc1 (Ha)	% Change in WCCC1	Reason For Change
			31	Paardeberg Nature Reserve	559	559	0.00%	
			32	Paardenberg Nature Reserve	1,522	1,522	0.00%	
			33	Pearly Beach Nature Reserve	631	628	-0.47%	
			34	Quoin Point Nature Reserve	1,150	1,150	0.00%	
			35	Riviersonderend Nature Reserve	24,789	25,848	4.27%	Incorrect boundary in 2002
			37	Rooiberg Nature Reserve	12,839	12,840	0.01%	
			38	Ruitersbos Nature Reserve	17,852	18,133	1.58%	There is a boundary query here
			39	Salmonsdam Nature Reserve	840	839	-0.04%	
			29	Simonsberg Nature Reserve	463	463	0.00%	
			40	Soetendalsvlei Nature Reserve	415	415	0.00%	
			41	Soetfontein Nature Reserve	54	54	-0.01%	
			42	Spioenkop Nature Reserve	1,256	1,257	0.02%	
			43	Stilbaai Oos Nature Reserve		210	100.00%	In 2002 this was considered as part of Geelkrans Nature Reserve
			44	Swartberg East Nature Reserve (also part of Cape Flora Region World Heritage Site)	18,766	18,747	-0.10%	
			45	Theewaters Nature Reserve (also part of Cape Flora Region World Heritage Site)	14,182	14,789	4.28%	In 2002 a section of this reserve was incorrectly incorporated into Haweqwa Nature Reserve
			46	Towerkop Nature Reserve	18,992	18,981	-0.05%	
			47	Twistniet Nature Reserve	1,183	1,183	0.00%	
			48	Tygerberg Nature Reserve	3,564	2,772	-22.23%	Incorrect boundary in 2002
			49	Uilkraalsmond Nature Reserve	806	806	0.00%	
			50	Waenhuiskrans Nature Reserve	267	264	-1.03%	
			51	Walker Bay Nature Reserve	3,588	3,588	0.00%	
			52	Warmwaterberg Nature Reserve	2,693	2,693	0.00%	
			53	Waterval Nature Reserve	6,835	6,834	-0.01%	
			54	Witbosrivier Nature Reserve	504	504	0.00%	
			55	Witfontein Nature Reserve	13,891	14,323	3.11%	Incorrect boundary in 2002

Western Cape Conservation Category	Reserve Type	Management Authority		Reserve Name	2002 Area of Wcc1 (Ha)	2006 Area of Wccc1 (Ha)	% Change in WCCC1	Reason For Change
			56	Wittebrug Nature Reseserve	1,583	1,601	1.13%	
			57	Witzenberg Nature Reserve	1,637	1,635	-0.10%	
			58	Zuurberg Nature Reserve	1,232	1,232	0.00%	
					408,597	**408,906**	**0.08%**	
WCCC1	Island Reserves	Western Cape Nature Conservation Board	1	Bird Island Reserve	4	4	-0.02%	
			2	Dassen Island Reserve	231	231	0.00%	
			3	Dyer Island Reserve	16	16	-0.01%	
			4	Elephant Rock Island Reserve	1	1	-0.09%	
			5	False Bay Seal Island Reserve	3	3	0.01%	
			6	Geyser Island Reserve	2	2	0.02%	
			7	Jacob's Rock Island Reserve	1	1	0.10%	
			8	Mossel Bay Seal Island Reserve	3	3	0.01%	
			9	Paternoster Rock Island Reserve	19	19	0.00%	
			10	Quoin Rock Island Reserve	0	0	0.05%	
			11	Seal Ledges Island Reserve	1	1	-0.02%	
			12	Voëlklip Nature Reserve	0	0	0.04%	
			13	Vondeling Island Reserve	16	16	0.01%	
					296	**296**	**0.00%**	
WCCC1	Marine Protected Areas	Western Cape Nature Conservation Board	1	Betty's Bay Marine Protected Area		2,167	100.00%	No data for 2002
			2	De Hoop Marine Reserve	31,843	31,843	0.00%	
			3	Dyer & Geyser Island Marine Reserve	215	215	0.01%	
			4	Goukamma Marine Reserve	2,900	3,198	10.27%	
			5	Helderberg Marine Protected Area		231	100.00%	No data for 2002
			6	Robberg Marine Reserve	1,898	1,919	1.11%	
			7	Rocherpan Marine Reserve	896	893	-0.33%	
			8	West Coast National Park Marine Protected Areas (around Jutten, Malagas & Marcus Islands, also Sixteen Mile Beach & Langebaan Lagoon)	4,032	8,504	110.93%	In 2002 only the Langebaan Lagoon was acknowledged
			9	Table Mountain National Park (Marine Section)		19,368	100.00%	No data for 2002
					41,784	**68,338**	**63.55%**	
				TOTAL WCCC1	**891,935**	**1,088,216**	**22.01%**	

CHAPTER 10

STATUS OF RIVER HEALTH

N.D. Impson[1], E. Herdien[1] & A. Belcher[2]

[1]Scientific Services, CapeNature [2] Department of Water Affairs and Forestry

impsond@cncjnk.pgwc.gov.za
earl@cncjnk.pgwc.gov.za
belchea@dwaf.gov.za

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Executive Summary

The River Health Programme (RHP) has been actively implemented in the Western Cape since 2001 through a partnership between CapeNature, the Department of Water Affairs and the CSIR. The province now has over 200 monitoring sites on rivers throughout the province covering all four Water Management Areas (Berg, Breede, Gourits, Olifants-Doring).

Monitoring aquatic ecosystem health is a requirement in terms of the National Water Act (Act 36 of 1998). The RHP assesses the biological and habitat integrity of rivers by focusing on selected indicator groups that represent the larger ecosystem and are feasible to measure and report on. The indices used are: the South African Scoring System (SASS5) that focuses on aquatic macro-invertebrates, Freshwater Fish Index, Riparian Vegetation Index, Geomorphological Index and an Index of Habitat Integrity.

The aim of this chapter is to analyze recently collected river health data for Western Cape rivers to establish a benchmark of the ecological state of these rivers. We wanted to collectively determine the percentage of rivers that are in natural, good, fair or poor condition. To do this, each of the indices used to measure river health was assessed, as well as ecological integrity (when the indices are combined to yield an overall result).

The results were varied, although the general finding was that few rivers in the province are in a natural to good condition. The main reasons for this were: the intensive nature of agricultural development in the province, the huge impact of alien trees and fishes, and the over–abstraction of water from rivers in summer when river flow is naturally at its lowest.

The ecological health of rivers in the province was perhaps best reflected by the ecological integrity of river sites in the assessed areas. Of the 25 sites on rivers in the Berg catchment, 12% were natural, 16% were good, 44% were fair, and 28% were in a poor condition. Of the 48 sites on rivers in the Greater Cape Town area, 8% were natural, 25% were good, 44% were fair and 23% were in a poor condition. Of the 40 sites on rivers in the Olifants/Doorn catchment, 5% were natural, 45% were good, 45% were fair and 5% were in a poor condition. Of the 28 sites on rivers in the Overberg, 7% were natural, 7% were good, 76% were fair and 10% were in a poor condition. Of the 11 sites on rivers in the Goukou/ Duiwenhoks catchments, none were natural, 27% were good, 55% were fair and 18% were in a poor condition. Combining these results gives an overall picture for the rivers assessed in the Western Cape as follows: 7% are still in a natural condition, 26% in a good condition, 51% in a fair condition and 16% are in a poor condition. This summary indicates that most of the province's rivers have been largely modified and few are un-impacted.

The most important management steps that need to be implemented to improve the future health of our rivers are the following:

- Establishment, capacitation and effective functioning of Catchment Management Agencies for the four WMA's in the province.
- Eradication of alien vegetation from riparian zones of rivers
- Establishment of no-development buffer areas that are at least 35m wide along each bank of the province's rivers.
- Eradication of alien fishes from river areas regarded as priorities for indigenous fish conservation and where such eradication is deemed feasible.
- Implementation of environmental flow requirements from instream dams across the province, but focusing on priority sites first.
- Establishment of river sanctuaries for our most ecologically and economically valuable rivers, preferably within formally protected areas.

- Improvement of water quality in rivers, especially urban rivers, by improved management of waste-water treatment plants and stormwater systems.
- Stopping new summer abstractions from rivers, and encouraging riparian landowners not to abstract water from rivers during the drier months (November to March) when flow in the rivers is low.
- Improving awareness amongst key stakeholders of river ecosystem functioning and the goods and services that healthy rivers provide.

INTRODUCTION

South Africa is a water-limited country that is committed to provide water to all its people. The principles of water sustainability and equity form the cornerstone for South Africa's water policy. The protection of aquatic ecosystems is recognized as an essential priority not only for the maintenance of biodiversity but also to sustain freshwater resources, as water resources are unevenly distributed over the country, both in quantity and in quality. These steps were taken by government to reduce or reverse the effect of human induced disturbances and unsustainable management practices that have taken their toll on South Africa's water resources over the past century.

The official custodian of the nation's freshwater resources is the Department of Water Affairs and Forestry (DWAF). The National Water (Act 36 of 1998) is the principle legal instrument for the management and control of our water resources. A key component of this Act, from an environmental perspective, is the Water Resource Quality objectives that provide relevant information on the desired ecological health of freshwater resources to guide their future management. The River Health Programme (RHP) is a monitoring initiative established in 1994 to provide valuable information on the ecological health of the country's rivers, and more recently, on the country's wetlands and estuaries as well (Strydom *et al.* 2006).

The purpose of this report is to undertake a preliminary determination of the overall ecological condition of rivers in various catchment areas in the Western Cape Province (WCP) that have been assessed in State of River reports and technical reports. These reports are key deliverables of the RHP. With this approach, RHP data can reveal spatial and temporal trends in the ecological health of our province's rivers.

These trends should be valuable in showing river managers where to focus their scarce operational resources. It should be acknowledged that the RHP monitors status and trends in overall river health and is not aimed at measuring biodiversity *per se*. However, it can be used as a tool to provide an indication of biodiversity, as less transformed sites are predicted to have a greater likelihood of intact biodiversity pattern and process.

THE RIVER HEALTH PROGRAMME

The RHP was initiated in 1994 by DWAF, the Water Resource Commission (WRC) and the Department of Environmental Affairs and Tourism (DEAT). Monitoring aquatic ecosystem health is a requirement in terms of the National Water Act and findings of surveys guide our application of the National Environmental Management Act. The RHP assesses the biological and habitat integrity of rivers by focusing on selected indicator groups that represent the larger ecosystem and are feasible to measure. State of River reporting

uses river health indices to present data in a format that is easy to understand. The indices used are: the South African Scoring System (SASS5) that focuses on aquatic macro-invertebrates, Freshwater fish Index, Riparian Vegetation Index, Geomorphological Index and an Index of Habitat Integrity (Table 1).

Table 1. The indices used to determine river health in South Africa's River Health Programme

Index of River Health	Reason for measurement
South African Scoring System (SASS5)	Aquatic invertebrates require specific aquatic habitats and water quality conditions. They are good indicators of recent localised conditions in a river. The index is relatively simple and based upon invertebrate families found at a site.
Riparian Vegetation Index (RVI)	Healthy riparian zones help to maintain the form of river channels and serve as filters for sediments, nutrients and light. Plant material from the riparian zone is a vital source of food for aquatic fauna. The index is a measure of modification of riparian vegetation from its natural state.
Index of Habitat Integrity (IHI)	The availability and diversity of habitats are major determinants of the aquatic biota that are present. The index assesses the impact of human disturbance on riparian and in-stream habitats.
Fish Index (FI)	Fish are good indicators of long-term influences on general habitat conditions in a river area. This index assesses the degree to which a fish assemblage deviates from an undisturbed condition.
Geomorphological Index (GI)	Geomorphological processes determine the size and shape of river channels which in turn defines the type of habitat. The index reflects the condition and stability of the channel.
Water Quality	Water quality indicates the suitability of water for aquatic ecosystems. We assessed the total phosphate, nitrogen, ammonia and dissolved oxygen present at a site.

Each of the indices in Table 1 is assessed when river sites are comprehensively surveyed. These indices are allocated a river health category based on the ecological state of the river during the time of the survey, as shown in Table 2. The overall ecological integrity status of a river site is the result of combining the ecosystem drivers (hydrology, water quality and geomorphology) with the ecological response components (fish, macro-invertebrates and riparian vegetation. This is calculated by determining an average of the habitat integrity (which includes the IHI, GI and WQI scores), the in-stream biotic integrity (SASS5 and FI scores) and the riparian zone integrity (RVI) scores.

Table 2. Categories of river health in South Africa's River Health Programme.

River Health Category	Ecological perspective	Management perspective
Natural (N)	No or negligible modification from natural.	Relatively little human impact.
Good (G)	Biodiversity and integrity largely intact.	Some human-induced disturbance but ecosystems essentially in a good state.
Fair (F)	Sensitive species may be lost; tolerant or opportunistic species (usually alien) dominate.	Multiple disturbances associated with the need for socio-economic development.
Poor (P)	Mostly tolerant species; more alien invasion, disrupted population dynamics, diseased organisms.	High human densities or extensive resource exploitation.

River Health assessments enable reports on the ecological state of rivers to be produced in an objective, understandable and scientifically sound manner. RHP information is presented to various stakeholders via Ecological Status reporting on a national level, State of River and Environment reporting on a provincial level, and by awareness building on a local level (State of River posters, pamphlets, activity books and activity days). Information from the RHP is vital in that it reflects the effectiveness of existing river management policies, strategies and actions and helps identify areas where unacceptable ecological deterioration is taking place.

The RHP is implemented at provincial level by stakeholders involved in river management, and is guided by a provincial "champion". The Western Cape has arguably South Africa's most successful RHP with over 200 river sites actively monitored across the province (Figure 1). This is mostly as a result of the strong role the regional office of DWAF has played in championing the RHP and providing generous resources for river work. A key ingredient for its success was the formal partnership signed between DWAF and CapeNature in 2003 which culminated in the formulation of the River Conservation Unit (RCU) at CapeNature. Substantial funds were provided by DWAF for the appointment of CapeNature as an implementing agent of the RHP in the Western Cape. This allowed four additional aquatic ecologists to be appointed to support existing expertise at DWAF and CapeNature.

The Council for Scientific and Industrial Research (CSIR) and participating local authorities have also contributed substantially to the success of the Western Cape's RHP. Since 2003, a remarkable five State of the Rivers Reports have been produced for parts of or whole Water Management Areas and four supporting technical reports are currently at various stages of completion.

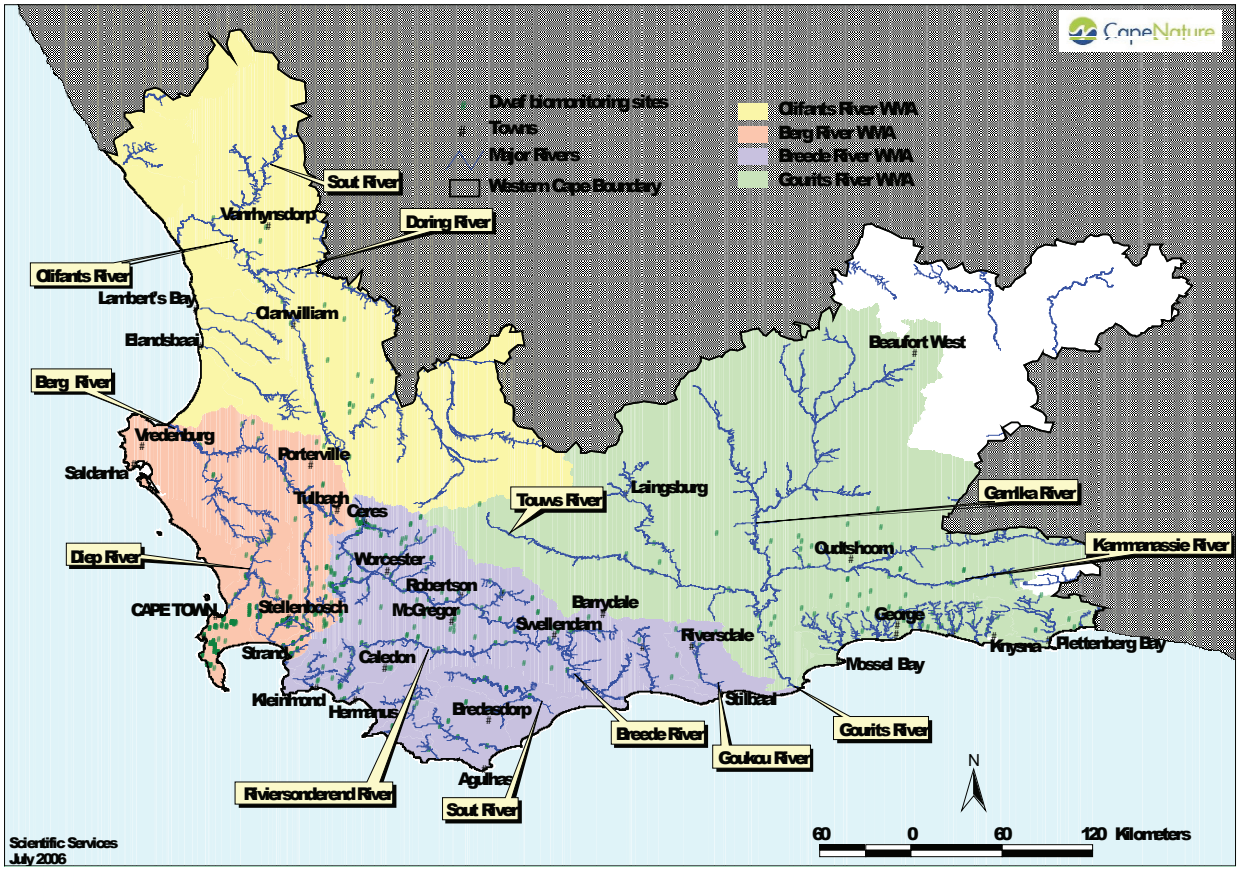

Figure 1. Monitoring sites for the River Conservation Unit's River Health Programme.

METHODS

One hundred and fifty-two RHP monitoring sites were selected in the Western Cape for this analysis. Of these, 11 are in the Gouritz Water Management Area (Goukou-Duiwenhoks Technical report, Reed *et al.* in prep), 28 in the Breede WMA (Overberg Technical report, Herdien *et al.* in prep), 40 in the Olifants/Doorn WMA (Olifants-Doring SOR 2006) and 73 in the Berg WMA (Greater Cape Town SOR 2004, Berg SOR 2005). These reports contain ecological health scores for each survey site, both in terms of overall ecological health, and for each biomonitoring health index, ranging from Natural to Poor. The indices used were: Index of Habitat Integrity, Geomorphological Index, Riparian Vegetation Index, Fish Index, SASS and a Water Quality Index (refer to Technical reports for calculations of each index).

The results from the SOR and Technical reports for each site and for each index at these sites were captured and imported into Microsoft Excel spreadsheet for descriptive statistical analysis. The following were then assessed:

- Overall condition of each of the indices in each of the assessed catchment areas. This was done for each index by determining the number of sites in each health class per catchment area and then reflecting this as a percentage per health class per index (Figure's 2-7).
- Overall condition of each of the indices in the combined assessment area. This was done for each index by determining the number of sites in each class for all catchments and then reflecting this as a percentage per health class per index (Figure 8).
- Overall ecological integrity condition of sites in each assessed catchment area. This was done by determining the number of sites in each health class in each catchment area and reflecting this as a percentage per health class per catchment (Figure 9).

Where percentages do not sum to 100% this is a result of rounding error.

There are two major limitations in the methods used as a means of accurately reflecting the ecological health of rivers in the catchment areas assessed in this report:

- Selection of RHP sites is aimed at monitoring the impact of human activities on river health; hence sites that show various types of impact are preferentially chosen. Each river generally has only one "natural" site that is monitored as a reference site. The results shown below are thus skewed towards health scores reflecting reduced river health.
- The assessments are based on survey sites and not necessarily river reaches. Although survey sites are chosen for representivity; this is often compromised by the need to choose sites that are accessible and safe to survey.

STATE OF RIVER HEALTH PER INDICES AND RIVER SYSTEM

1. MACRO-INVERTEBRATES (SASS5)

Macro-invertebrate communities respond relatively quickly to localised conditions in a river, especially water quality, though their existence also depends on habitat diversity. They are common, have a wide range of sensitivities and have a suitable life-cycle duration that indicates short- to medium term impacts on water quality and habitat. They are therefore a good indicator of many impacts of anthropogenic activities on the rivers of the province, particularly within urban and intensively farmed areas.

SASS results from five catchment areas were assessed and the results are shown in Figure 2. Of the 25 sites surveyed in the Berg catchment, 20% were natural, 12% were good, 52% were fair, and 16% were in a poor condition. Of the 43 sites surveyed on rivers in the Greater Cape Town area, 12% were natural, 28% were good, 39% were fair and 21% were in a poor condition. Of the 36 sites surveyed on rivers in the Olifants/Doorn catchment, 14% were natural, 31% were good, 44% were fair and 11% were in a poor condition. Of the 28 sites surveyed on rivers in the Overberg, 7% were natural, 11% were good, 78% were fair and 4% were in a poor condition. Of the 11 sites surveyed on rivers in the Goukou/Duiwenhoks catchments, 19% were natural, 36% were good, 36% were fair and 9% were in a poor condition. Results in Figure 2 do not contain data for five sites of the Greater Cape Town area and four sites of the Olifants/Doorn catchment.

The majority (about 80%) of SASS5 scores were fair or better, indicative of acceptable to good water quality; a comforting result for domestic and agricultural users of water. However, less than 40% of sites had SASS5 scores in the good to natural category – a worrying finding for biodiversity as pollution sensitive macro-invertebrates may be absent from 60% of river sites that were monitored. These species are an integral part of the river's food web, and their probable absence indicates that many of our river areas have impaired ecosystem functioning.

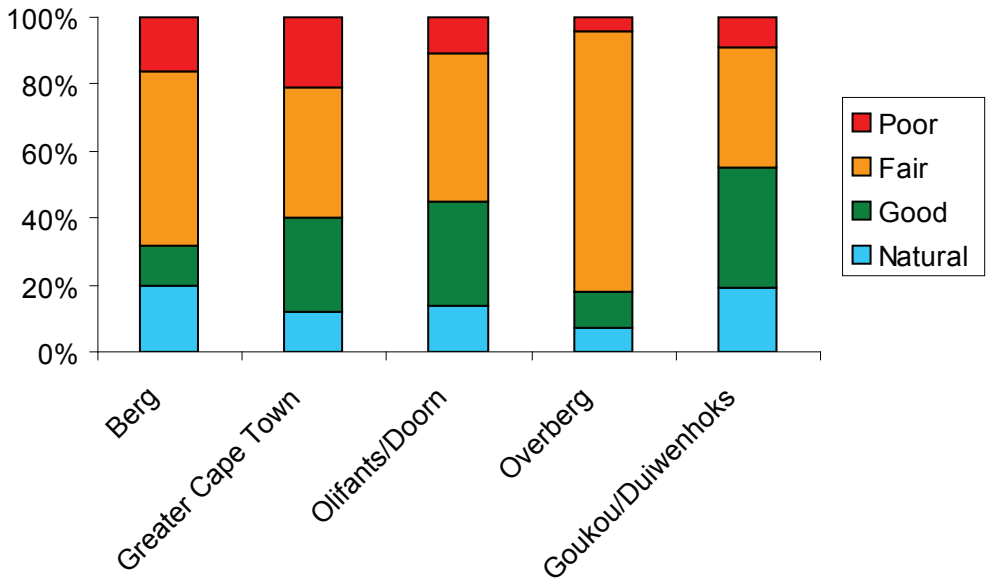

Figure 2. Combined SASS scores for rivers in five catchment areas of the Western Cape Province.

2. FISH

Fish comprise one of the main biological components of aquatic ecosystems. Because they are relatively long-lived and mobile they can indicate long-term influences (i.e. years) and general habitat conditions in a river reach. They also represent a variety of trophic levels and hence integrate the effects of environmental changes. In Western Cape rivers, with their naturally low numbers of fish species, the impact of invasive alien fish is a major influence on ecosystem integrity.

Fish Index results from five catchment areas were assessed and the results are shown in Figure 3. Of the 25 sites surveyed on rivers in the Berg catchment, 4% were natural, 28% were good, 28% were fair, and 40% were in a poor condition. Of the 46 sites on rivers in the Greater Cape Town area, 15% were natural, 28% were good, 24% were fair and 33% were in a poor condition. Of the 33 sites surveyed on rivers in the Olifants/Doorn catchment, 13% were natural, 22% were good, 40% were fair and 25% were in a poor condition. Of the 26 sites surveyed on rivers in the Overberg, 19% were natural, 7% were good, 38% were fair and 36% were in a poor condition. Of the 11 sites on rivers in the Goukou/Duiwenhoks catchments, 28% were natural, 18% were good, 45% were fair and 9% were in a poor condition. Results in Figure 3 do not contain data for two sites of the Greater Cape Town Rivers, seven sites of the Olifants/Doorn catchment and two sites of the Overberg catchment.

The Fish Index used in this province focuses primarily on the diversity and abundance of indigenous fishes present at sampling time. The severe impact of invasive alien fishes in Western Cape rivers is reflected by the high percentage of sites in most catchment regions (except the Goukou/Duiwenhoks) that were in poor condition, primarily because of localised extirpations of indigenous fishes in sites dominated by predatory invasive alien fishes such as smallmouth bass and rainbow trout.

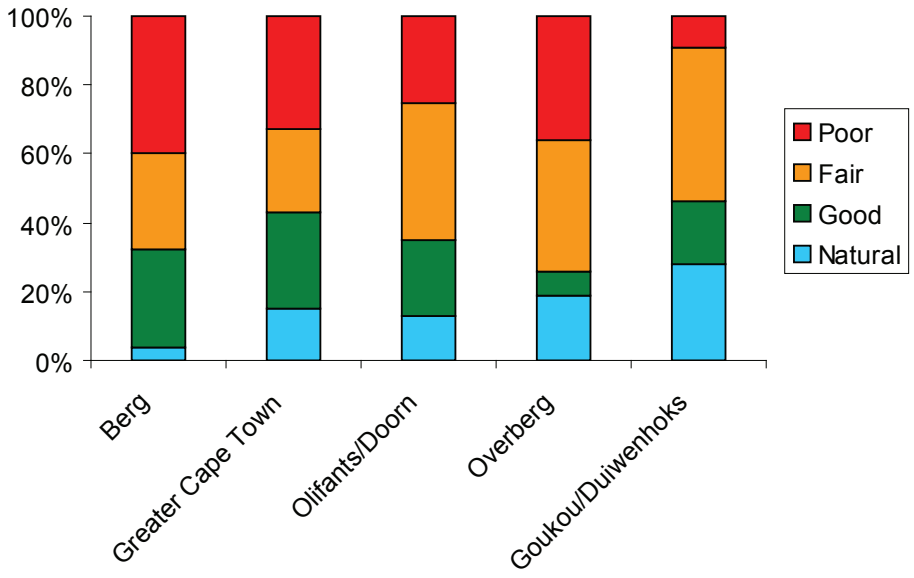

Figure 3. Combined fish health scores for five catchment areas of the Western Cape Province.

3. RIPARIAN VEGETATION

Healthy riparian zones provide a large number of important goods and services in rivers, such as the provision of food and habitat. Changes in riparian vegetation structure or function are commonly associated with changes in river flow, invasion of the riparian zone by alien invasive plants (for example by black wattle), or changing use of the riparian zone (for example for grazing or ploughing). Healthy riparian zones also provide an important buffer between the impacts of land-use activities and rivers. The status of the riparian vegetation is therefore a good indicator of the ecological state of the rivers and the levels of modification by urban and agricultural activities in particular.

Riparian vegetation index results from five catchment areas were assessed and the results are shown in Figure 4. Of the 25 sites surveyed on rivers in the Berg catchment, 8% were natural, 8% were good, 32% were fair, and 52% were in a poor condition. Of the 47 sites on rivers in Greater Cape Town, 11% were natural, 13% were good, 40% were fair and 36% were in a poor condition. Results in Figure 4 do not contain data for one site from rivers of Greater Cape Town. Of the 40 sites on rivers in the Olifants/Doorn catchment, 8% were natural, 41% were good, 43% were fair and 8% were in a poor condition. Of the 28 sites on rivers in the Overberg, 7% were natural, 11% were good, 25% were fair and 57% were in a poor condition. Of the 11 sites on rivers in the Goukou/Duiwenhoks catchments, none of the sites were natural, 9% were good, 36% were fair and 55% were in a poor condition.

Very few river sites in the assessed areas had riparian zones in a good condition or better, due to the degraded nature of riparian zones on most rivers. The main impacts on riparian zones are alien plant invasions (often in otherwise undisturbed catchments), destruction of riverbanks through bulldozing and canalisation, and the planting of crops and orchards within the riparian and flood zones.

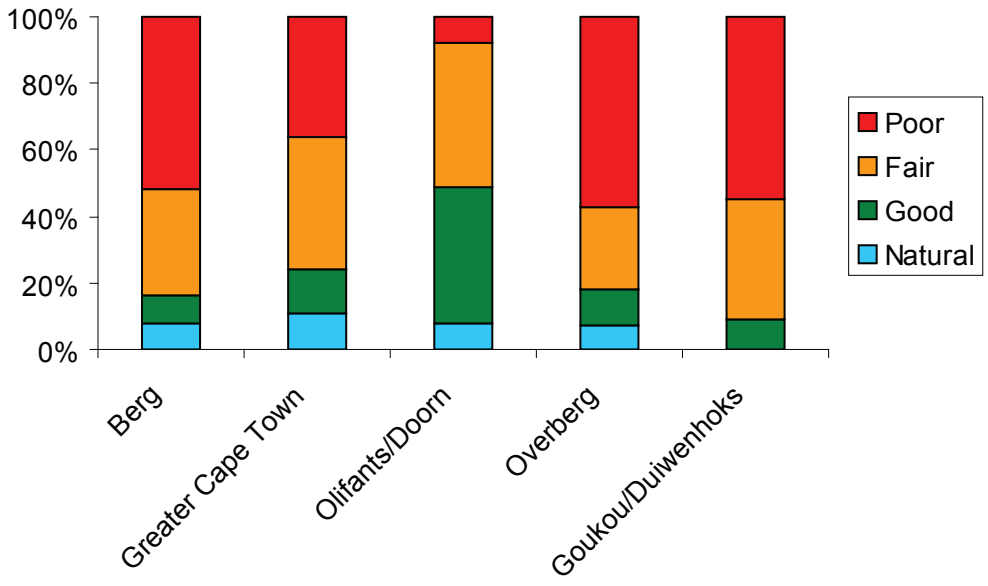

Figure 4. Overall health of riparian vegetation from five catchment areas in the Western Cape Province.

4. GEOMORPHOLOGY

Geomorphological processes determine river channel morphology which provides the physical environment within which stream biota live. Changes to channel form occurs both naturally and as a result of man-made changes to rivers or their catchments (e.g. impoundments and agricultural activities). Generally, once rivers leave mountain catchments and enter intensively farmed areas their geomorphological condition progressively deteriorates.

Geomorphological index results from four catchment areas were assessed and the results are shown in Figure 5. Of the 25 sites on rivers in the Berg catchment, 12% were natural, 20% were good, 52% were fair, and 16% were in a poor condition. Of the 40 sites on rivers in the Olifants/Doorn catchment, none were natural, 27% were good, 65% were fair and 8% were in a poor condition. Of the 28 sites on rivers in the Overberg, 4% were natural, 21% were good, 71% were fair and 4% were in a poor condition. Of the 11 sites on rivers in the Goukou/Duiwenhoks catchments, none of the sites were natural, 18% were good, 54% were fair and 28% were in a poor condition. Results in Figure 5 do not contain data for rivers of the Greater Cape Town catchments.

The assessment showed that most of the assessed sites were disturbed, generally by alien plant invasion or activities (usually agricultural) within the flood zone of rivers. The impact of severe alien plant infestations within the flood zones of rivers is most acutely felt after heavy flooding. This is when alien plants are washed away from riverbanks by floodwaters, resulting in severe bank erosion and head-cutting. Other major impacts on the geomorphological condition of our rivers are instream structures (roads and weirs) and farming/urban activities within the flood zones of rivers.

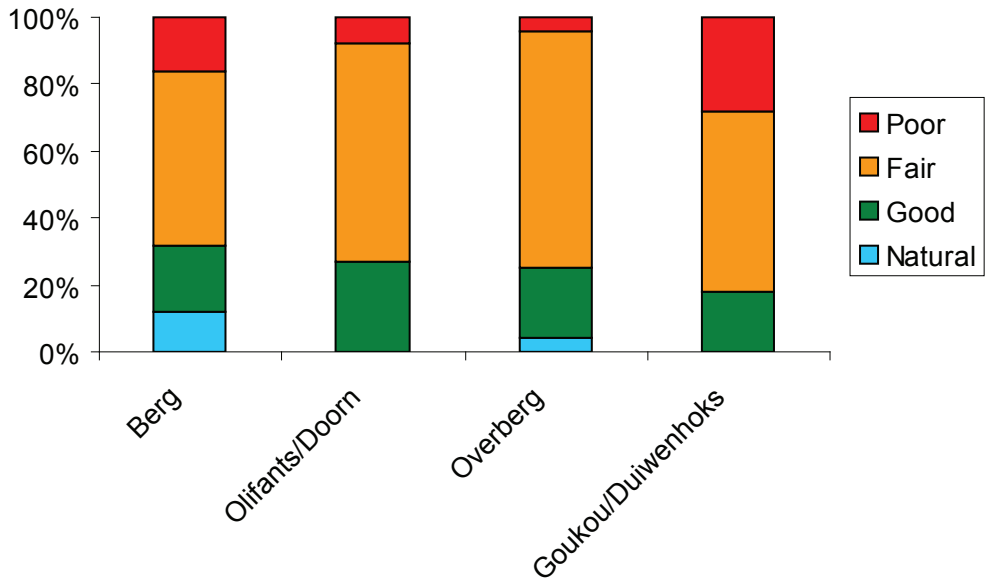

Figure 5. Overall geomorphological condition of rivers in five catchment areas of the Western Cape Province.

5. HABITAT INTEGRITY

Ecological integrity can be regarded as a combination of habitat and biotic integrity. The habitat integrity of a river provides the template for a certain level of biotic integrity to be realised. The Index of Habitat Integrity (IHI) assesses the impact of disturbances on a river on the capacity of that river to provide suitable habitats for organisms and therefore provides a good overall indication of the ecological state of the rivers.

Index of Habitat Integrity health scores from five catchment areas were assessed and the results are shown in Figure 6. Results in Figure 6 do not contain data for two of the sites of the Greater Cape Town rivers and for one site of the Overberg catchments. Of the 25 sites on rivers in the Berg catchment, 12% were natural, 16% were good, 40% were fair, and 32% were in a poor condition. Of the 46 sites on rivers in the Greater Cape Town area, 11% were natural, 24% were good, 45% were fair and 20% were in a poor condition. Of the 40 sites on rivers in the Olifants/Doorn catchment, 8% were natural, 42% were good, 35% were fair and 15% were in a poor condition. Of the 27 sites on rivers in the Overberg, 7% were natural, 14% were good, 75% were fair and 4% were in a poor condition. Of the 11 sites on rivers in the Goukou/Duiwenhoks catchments, none were natural, 28% were good, 36% were fair and 36% were in a poor condition.

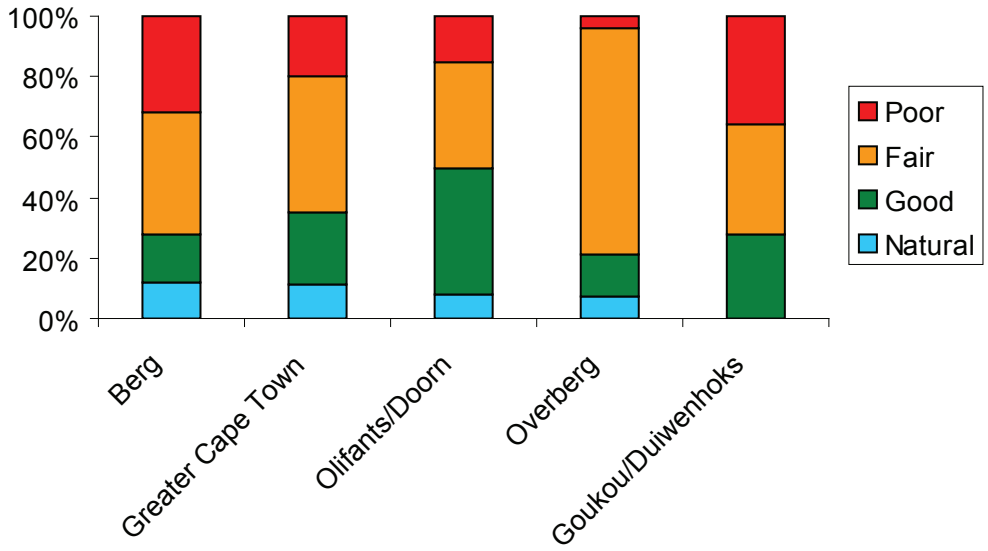

Figure 6. Overall habitat quality of rivers in five catchment areas of the Western Cape Province.

6. WATER QUALITY

Aquatic ecosystems and their biota are affected by turbidity, suspended solids, temperature, pH, salinity, concentrations of dissolved ions, nutrients, oxygen, biocides and trace metals. Changes in these due to pollution, geomorphological or hydrological factors can have detrimental or even lethal effects on aquatic organisms. An assessment of the suitability of the water quality for aquatic biota is therefore an important component of a river health status assessment.

Water quality results from three catchment areas were assessed and the results are shown in Figure 7. Of the 41 sites surveyed in rivers in the Greater Cape Town area, 17% of sites were natural, 24% were good, 37% were fair and 22% were in a poor condition. Of the 38 sites surveyed in the Olifants/Doorn catchment, 13% were natural, 52% were good, 33% were fair and 2% were in a poor condition. From the 11 sites on rivers in the Goukou/Duiwenhoks catchments, 18% were natural, 45% were good, 9% were fair and 28% were in a poor condition. The rivers of the Berg River catchment were also assessed and the results for the 24 sites showed that 29% were natural, 17% were good, 37% were fair and 17% were in a poor condition.

The high proportion of sites with poor water quality in the Greater Cape Town area was not surprising; given the highly developed nature of catchments, the number of canalised rivers, the release of treated sewage water into rivers and inadequate attention given to river management in this area. Rivers entering urban areas suffered most, with many in a state where human contact (e.g. swimming) should be prohibited.

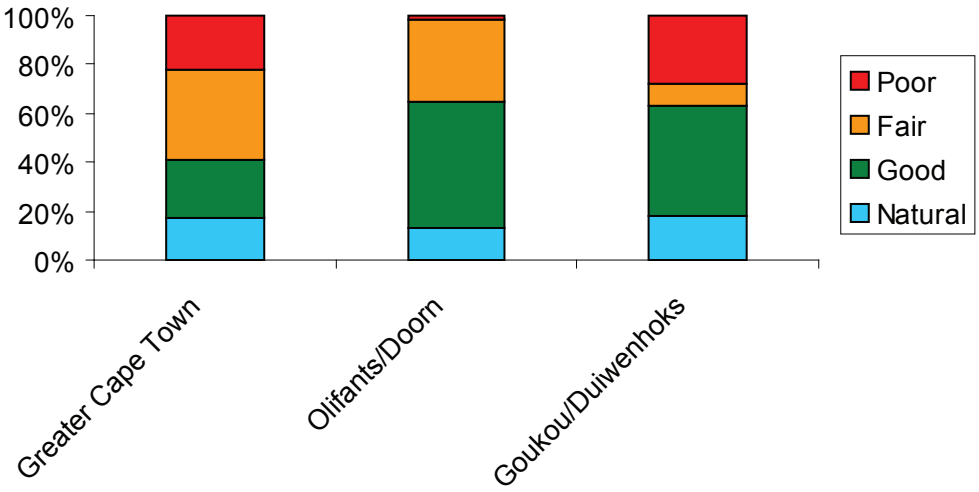

Figure 7. Water quality i0ee catchment areas of the Western Cape Province.

OVERALL INDEX HEALTH

The overall condition of the five River Health indices (water quality, SASS, fish, riparian vegetation, geomorphology and habitat integrity) in five catchment areas of the WCP is shown in Figure 8. Of the 90 sites surveyed for water quality, 15% were natural, 38% were good, 33% were fair, and 14% were in a poor condition. Of the 143 sites surveyed for SASS, 13% were natural, 25% were good, 50% were fair and 13% were in a poor condition. Of the 141 sites surveyed for fish health, 14% were natural, 22% were good, 33% were fair and 31% were in a poor condition. Of the 151 sites surveyed for riparian vegetation health, 8% were natural, 19% were good, 36% were fair and 37% were in a poor condition. Of the 104 sites surveyed for geomorphological condition, 4% were natural, 23% were good, 62% were fair and 11% were in a poor condition. Of the 149 sites surveyed for overall habitat integrity, 9% were natural, 26% were good, 46% were fair and 19% were in a poor condition.

What is interesting about this analysis is that all river health indices showed common trends, especially in terms of the percentage of sites in natural and good condition. Four of the five indices (excluding water quality) yielded very similar scores for sites in a natural (index scores ranged from 8-15%) or good (index scores ranged from 19-26%) condition. Only 4% of river sites had a natural geomorphological condition, showing that once rivers leave undisturbed mountain catchment areas, and enter agricultural areas in our province, their banks and flood zones become disturbed. The major causes of disturbance are invasive alien vegetation within the riparian zone, canalisation of rivers, destruction of riparian vegetation and planting of crops and orchards within the flood zone of rivers.

Significantly, SASS and Index of Habitat Integrity percentage scores corresponded to Riparian Vegetation Index, Fish Index and Geomorphological Index scores. This shows, as expected, that the geomorphological condition of a river and its associated biodiversity has an important effect on the water quality of a river. That is why a highly impacted river with polluted water (e.g. the Palmiet River at Grabouw) can be rejuvenated downstream with good water quality when it enters a pristine catchment (e.g. the Palmiet River in the Kogelberg Nature Reserve). Each river has the capacity to cleanse its waters if it is in a good to natural ecological condition.

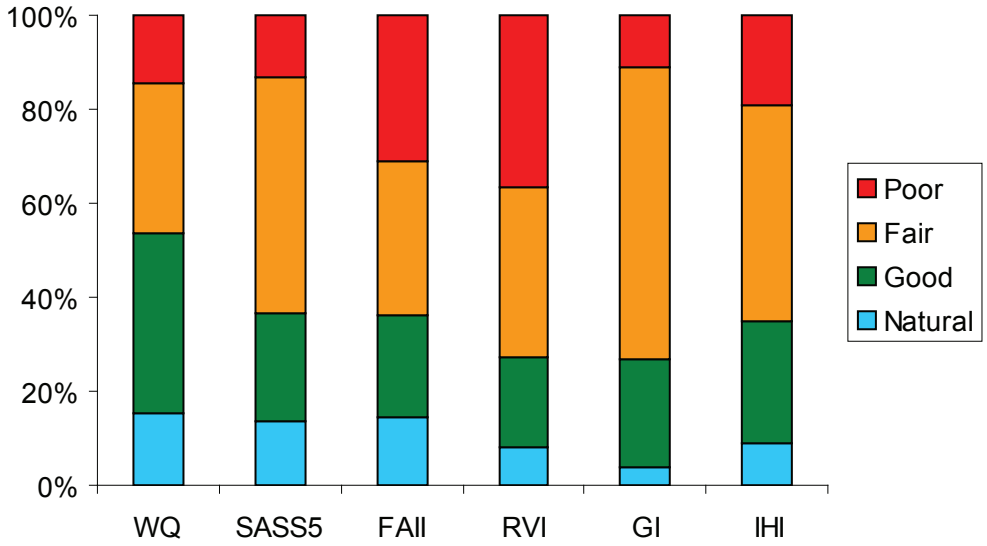

Figure 8. Condition of rivers in five catchments, as reflected by overall health of each index

ECOLOGICAL INTEGRITY OF RIVERS

The EcoStatus or overall ecological integrity of a river is the totality of the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. This score is derived by combining each of the index scores at a river site . The number of sites in each river health category in five catchments in the Western Cape is shown in Figure 9. Of the 25 sites on rivers in the Berg catchment, 12% were natural, 16% were good, 44% were fair, and 28% were in a poor condition. Of the 48 sites on rivers in the Greater Cape Town area, 8% were natural, 25% were good, 44% were fair and 23% were in a poor condition. Of the 40 sites on rivers in the Olifants/Doorn catchment, 5% were natural, 45% were good, 45% were fair and 5% were in a poor condition. Of the 28 sites on rivers in the Overberg, 7% were natural, 7% were good, 76% were fair and 10% were in a poor condition. Of the 11 sites on rivers in the Goukou/Duiwenhoks catchments, none were natural, 27% were good, 55% were fair and 18% were in a poor condition.

This gives us an overall picture for the rivers assessed in the Western Cape as follows: 7% are still in a natural condition, 26% in a good condition, 51% in a fair condition and 16% are in a poor condition. This indicates that most of the provinces rivers have been largely modified and few are unimpacted.

Figure 9 indicates that the number of sites degraded to a poor or unacceptable condition is related to human population densities and associated urban development, with Cape Town rivers and the Berg River system having the highest number of poor scores. This is not surprising as most rivers, especially smaller ones, flowing through urbanised areas in South Africa are in a poor condition, due to a variety of anthropogenic impacts. What is distressing is the low number of sites in good to natural condition. As most sites are situated in areas of impact (e.g. farmed or urbanised areas), one should have a very low proportion of natural sites but still a good number of sites in good condition. Worryingly, 51% of sites are in a fair condition and with further degradation will move into a poor condition. Common factors in the province that substantially lower site scores are invasive alien plants in the riparian zone, invasive alien fishes and destruction of riparian zones by farmers for supposed flood protection purposes. Rehabilitation of riparian zones is possible, but is a costly business. Eradication of alien fishes from parts of a river can be achieved through the application of piscicides. Increased summer base flows are another key objective but requires the support of key water abstractors. So there is hope for improving the river health status of many rivers, but only through substantial funding and greatly increased human capacity for river management.

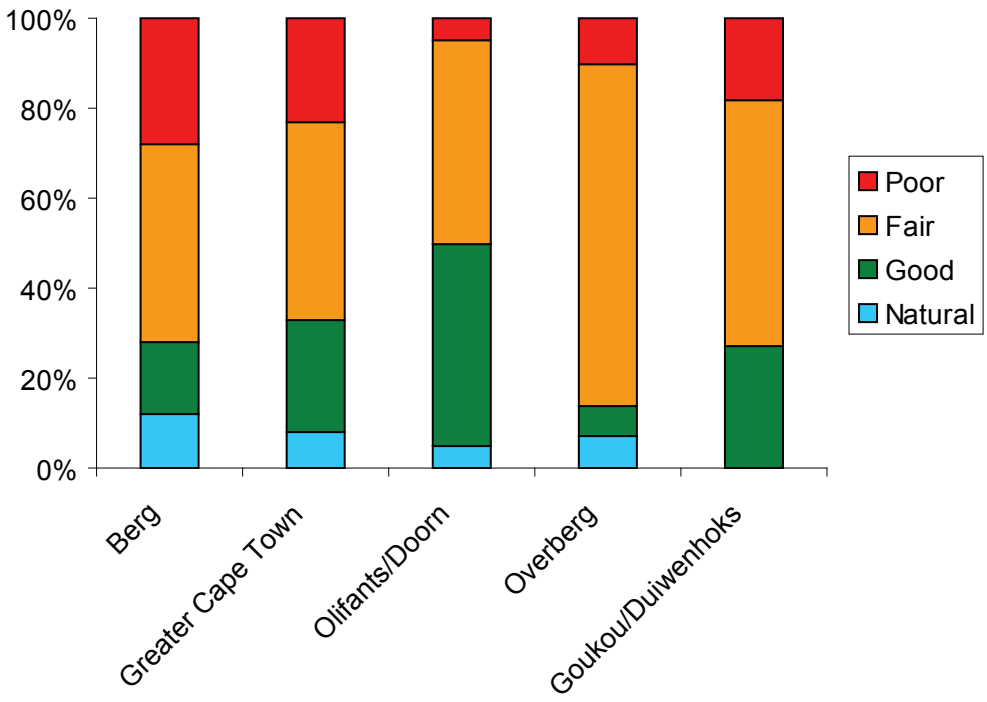

Figure 9. Ecological integrity of rivers in five catchment areas of the Western Cape Province.

CONCLUSIONS AND RECOMMENDATIONS

Rivers in the province are under severe pressure from a steadily increasing human population (especially within the City of Cape Town) and growing agricultural production. Global climate change is expected to place further pressure on rivers, as recent predictions show that the region will become hotter and drier. This assessment should hopefully serve as a useful baseline against which to measure future change.

The Western Cape Province's River Health Programme has been an excellent tool for measuring the ecological health of the province's rivers and for increasing awareness of river issues through its regular State of River reports. These reports also highlight management interventions (e.g. alien plant eradication) that are required to improve the ecological condition of the province's rivers.

However, without active and effective management and sufficient resources, the condition of our rivers will continue to deteriorate. The province needs effective and capacitated catchment management. It is hoped that DWAF's Catchment Management Agencies, once fully capacitated and functional, will allow for greatly improved river management. A key component of this will be accurate determination and active implementation of in-stream flow requirements for rivers that are under abstraction pressure.

ACKNOWLEDGEMENTS

The River Health Programme is a partnership of various stakeholders. We would particularly like to thank personnel at CapeNature, DWAF, CSIR and the City of Cape Town who have contributed to the success of the RHP in this province through financial support, field assistance and the preparation of State of River and Technical reports.

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