CHAPTER 4

AMPHIBIANS

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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

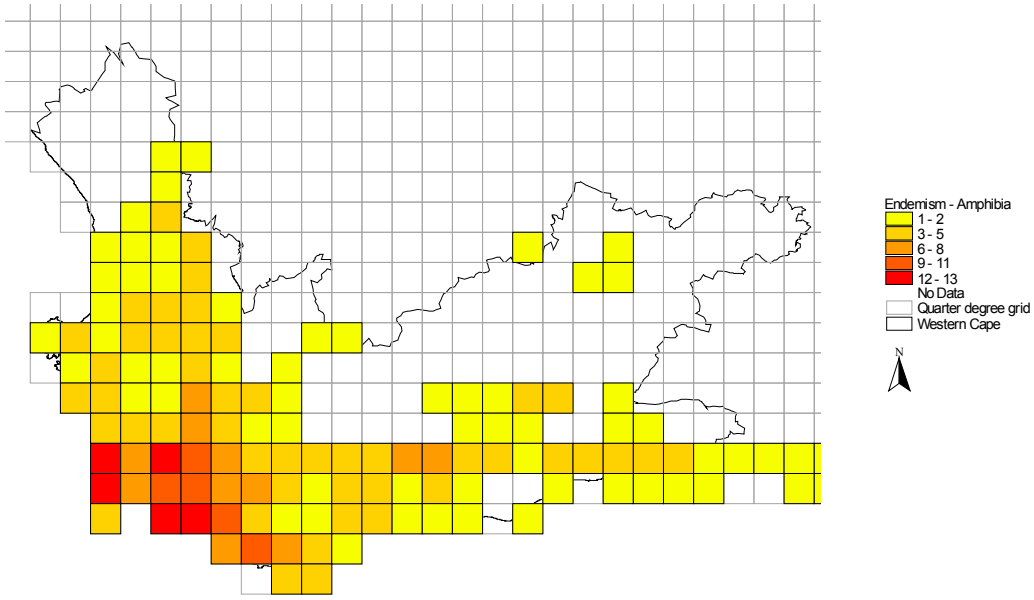

Figure 1. Numbers of endemic frog species per quarter degree square in the Western Cape Province.

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.

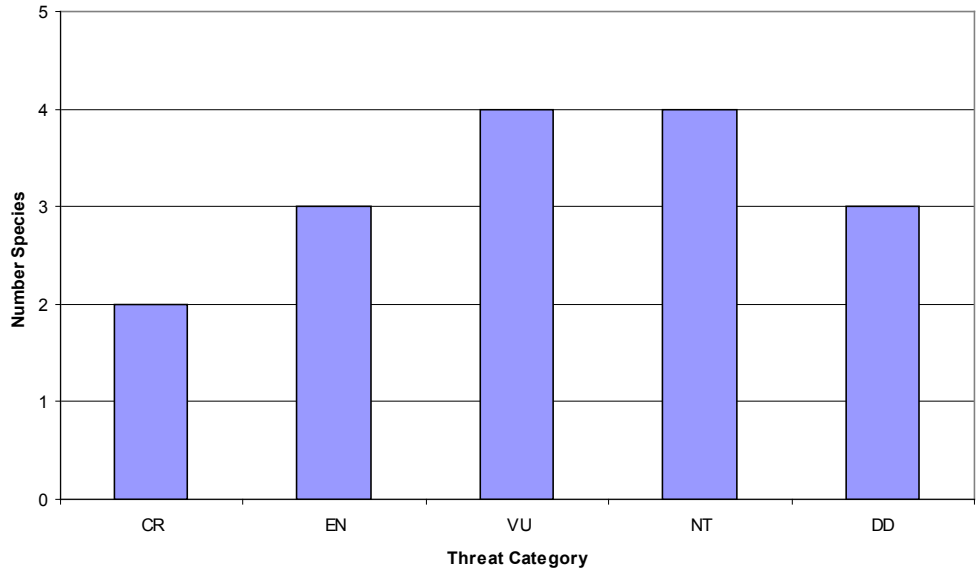

Figure 2. Conservation status of Western Cape Province frogs. CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened and DD = Data Deficient.

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*