Adaptive governance of Cape mountain zebra, can it work?

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Adaptive governance and network governance theory provide a useful conceptual framework to guide the conservation of threatened species in complex multi-actor, multi-jurisdictional social ecological systems. We use principles from this theory to assess strengths and weaknesses in (1) national legislation, and (2) the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Regulations applicable to the conservation of the Cape mountain zebra (*Equus zebra zebra*) (CMZ) in South Africa. A legislated conservation tool, Biodiversity Management Plans for Species (BMP-S), establishes a collaborative network of role players and facilitates the important principles of collaborative learning and adaptation. Effective governance of this network is critical to success, but challenging because of a mandate gap and limited capacity in government to provide essential network-level competencies. National regulations governing human use of CMZ (Threatened or Protected Species (TOPS) Regulations) accords with the principles of (1) being developed in consultation with stakeholders and (2) open to revision and adaptation. CITES Regulations also provide adequately for adaptation. Poor alignment of regulations between different regulatory authorities in South Africa and limited capacity for implementation of regulations seriously constrain learning and adaptation.

Key words: science–policy interface, threatened species, sustainable use, wildlife economy.

INTRODUCTION

Efforts to conserve threatened species often play out in a milieu of complex, multi-stakeholder social ecological systems (SES), where the outcomes of policies and management interventions are challenging to predict in advance or even to evaluate in hindsight (Runge, 2011). Adaptive governance represents a participatory, collaborative approach to the conservation and sustainable use of natural resources in complex SES (Chaffin, Gosnell & Cosens, 2014; Dietz, Ostrom & Stern, 2003, Folke, Hahn, Olsson & Norberg, 2005). This approach provides a conceptual framework to guide the management of large landscape conservation areas (Bixler *et al*., 2016), and has been found useful for the conservation of species in complex SES (Duval, Metcalf & Coates, 2017). Such systems are frequently governed through multi-actor networks, rather than a single authority, hence the relevance of network governance theory in evaluating their performance and effectiveness (Bixler *et al*., 2016; Provan & Kenis, 2008).

In South Africa, the governance system for the conservation of threatened large mammals is complex, requiring effective networking between various organs of state responsible for conservation and for control of livestock diseases, non-governmental organizations and diverse stakeholders. In this paper we relate the principles of adaptive governance and network governance to the governance regime applicable to the conservation and management of the Cape mountain zebra (*Equus zebra zebra*). Following Chaffin *et al.*

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(2014), we view governance as encompassing the system of institutions, including rules, laws, regulations, policies, social norms, and organizations involved in the conservation and management of threatened species. We start by outlining the current conservation status of the Cape mountain zebra (CMZ), then identify relevant principles and conditions that support adaptive management and adaptive governance, and finally evaluate the current governance framework against these principles and conditions. A questionnaire to private owners of CMZ, conducted in April 2016, provides an indication of the potential of the private sector to comply with the required governance measures and with the principles of adaptive management. Although the focus is on CMZ, our conclusions are relevant to any threatened species that occurs over different political or administrative boundaries in South Africa.

1. CURRENT STATE OF CONSERVATION OF CAPE MOUNTAIN ZEBRA: PROSPECTS FOR IMPROVEMENT

In some respects, the conservation of CMZ is a success story as the meta-population has increased steadily from fewer than 80 in the 1950s to a minimum of 4791 in 2015, these distributed among 75 sub-populations (Hrabar & Kerley, 2015; Novellie, Lloyd & Joubert, 1992; Novellie, Lindeque, Lindeque, Lloyd & Koen, 2002). Currently, most (69%) of the CMZ meta-population occurs in state-owned protected areas, with the remainder on private land (Hrabar & Kerley, 2015). The number of private landowners with CMZ has increased substantially since 2009 (Hrabar & Kerley, 2015). The increase in the CMZ meta-population was achieved partly through the growth of CMZ populations in state-owned protected areas (facilitated in some cases by expansions of the protected areas), and partly by the translocation of founder groups to new protected areas or to private landowners.

Despite the documented history of population increase, Hrabar & Kerley (2013) indicate reasons for concern regarding the conservation status of CMZ and recommend further expansion and management of the meta-population. Many of the CMZ sub-populations are small and this renders them at risk of genetic drift, inbreeding depression and susceptibility to disease (Frankham, 1996, 1997, 2015). Moreover, most of the sub-populations established since the 1980s derive exclusively from one of the three original relict CMZ sub-populations (the Cradock sub-population, rather than the relict sub-populations in Kammanassie and Gamkaberg). Although there is moderate genetic variability within the entire meta-population, genetic variability is low within the individual sub-populations (Moodley & Harley, 2005). Owing to inbreeding, genetic drift and reduction of genetic variation, all three relict CMZ stocks are significantly differentiated from each other; consequently mixing of the relict populations is desirable to reduce loss of genetic diversity (Moodley & Harley, 2005; Hrabar & Kerley, 2013, 2015). Thus, the increase in the CMZ meta-population transpired in a way that was less than ideal for the maintenance of genetic diversity.

There are additional potential threats (Birss *et al.*, 2016). Hartmann's zebra (*Equus zebra hartmannae*) have been translocated to a few localities within the range of CMZ, creating risks of hybridization between the two subspecies. It has recently been discovered that CMZ can hybridize with plains zebra (*Equus quagga*) when confined within a fenced protected area, despite the fact that the two species were historically sympatric (Dalton *et al.*, 2017). Numerous CMZ sub-populations are being maintained together with plains zebra (Hrabar & Kerley, 2015). Hybridization between species occurred as a natural phenomenon during the evolutionary history of equines (Jónsson *et al.*, 2014). However, where the causes are largely anthropogenic – as is the case for CMZ – hybridization could threaten the persistence of the species (Hill, 2009). A number of CMZ sub-populations have been translocated outside the historical distribution range (Birss *et al.*, 2016), which adds to the complexity of regulating the movements of individuals to augment gene flow and to control hybridization risks. Finally, Lea, Kerley, Hrabar, Barry & Shultz (2016) recently demonstrated that some of the sub-populations were performing poorly in terms of growth and reproduction, particularly in grass-poor habitats. Thus, a proportion of the sub-populations may not contribute effectively to the conservation of the species.

Historically, the expansion of the CMZ meta-population has been enabled mainly through the offtake and relocation of CMZ from the Mountain Zebra National Park (Novellie *et al.,* 1996; Hrabar & Kerley, 2015). The largest sub-populations of CMZ currently occur in the Mountain Zebra and Karoo National Parks and these parks could potentially constitute important sources of individuals for

further re-introductions. However, the recent re-introduction of large predators to these sites creates uncertainty around the potential for future offtake (Hrabar & Kerley, 2013, 2015). This reflects the fact that CMZ are within the preferred prey size range for lions *Panthera leo* (Clements *et al.*, 2014), and the implications of this predation on CMZ demographics are unknown. Since these parks aim to closely manage predation to avoid deleterious conservation outcomes (Ferreira & Hofmeyr, 2014), the prospects of maintaining sustainable offtake of CMZ for meta-population management appear reasonable. Besides the Mountain Zebra and Karoo National Parks, the CMZ populations in several other state-owned protected areas have reached their preferred management densities (Winker, Novellie, Selier, Birss & Hrabar, 2016) and can potentially supply animals for re-introduction into other protected areas or private land.

Participants in the consultation process towards a CITES non-detriment finding expressed the view that the potential of the private sector to play a role in the future may be constrained by the low economic value of the species (CMZ Non-Detriment Finding, Government Gazette vol. 603, 10 September 2015 no. 39285). It was suggested that the low value may be due to difficulties in exporting CMZ hunting trophies. CMZ no longer meets the requirements for inclusion in CITES Appendix I, and was downlisted to Appendix II at CITES COP17, with a recommendation for the institution of a hunting quota (CoP17 Prop. 6) that will be set through a combination of active adaptive harvest management and management strategy evaluation (Winker *et al.*, 2016). It remains to be seen whether downlisting will ease requirements for import permits, and hence increase the attractiveness of CMZ to the private sector.

A draft Biodiversity Management Plan (BMP) (Birss *et al.*, 2016) for CMZ has been drawn up in accordance with the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM: BA), and has recently been published for public participation. The BMP identifies the need for the implementation of a meta-population management strategy to address the reasons for concern regarding the conservation status of CMZ as outlined above. Because the sub-populations are widely separated and isolated by fences, natural dispersal is not possible. A key component of the meta-population management strategy is therefore the translocation of individuals between existing sub-populations to provide gene flow expected within a naturally functioning meta-population. Although there are clear benefits to augmenting gene flow between fragmented populations, there are few published studies in this field and a general lack of guidelines (Frankham, 2014). Ongoing scientific inputs will therefore be critical to the development and implementation of the CMZ meta-population management strategy.

As noted above, the institution of a hunting quota has been recommended (CoP17 Prop. 6) in the hope of increasing the demand for CMZ in the private sector. The demand should be met in a way that (1) supports the meta-population management strategy, or at least does not exacerbate the current situation by increasing the number of small, vulnerable populations, and (2) avoids the risk of hybridization. An increase in the number and size of sub-populations capable of supporting sustainable off takes will benefit the conservation status of CMZ by providing genetically diverse animals for translocation.

2. PRINCIPLES OF ADAPTIVE GOVERNANCE

Dietz *et al.* (2003) recognize human institutions, ways of organizing and rules governing the way they work, as being critical to the sustainable use of natural resources in complex, multi-actor environments. They identified certain adaptive governance principles that are conducive to sustainable resource use. These principles were further developed by numerous others, Folke *et al.*, (2005), Olsson, Folke, Galaz, Hahn & Schultz (2007), Biggs *et al.* (2012), and Chaffin *et al.* (2014). Based on this scholarship, we identify the following eight adaptive governance principles that are relevant to CMZ conservation:

Principle 1: Capacity for governing rules to evolve.

An essential principle regarding laws and rules for managing complex systems is that they must evolve to deal with pervasive change (Dietz *et al.*, 2003; Ruhl, 1997; Craig, 2010).

Principle 2: Capacity to generate information and novel understanding through monitoring of outcomes.

The necessary adaptation of governing rules is easier to achieve if the state of the resource can be monitored effectively (Dietz *et al.*, 2003).

Principle 3: Collaboration and information sharing between resource users, scientists and policy makers, facilitating the joint setting of the desired state and collective goals.

Frequent contact and information sharing between resource users promotes support for monitoring and learning, and furthermore helps to induce rule compliance. Sharing of trustworthy information is vital, and best achieved through dialogue between all stakeholders, including resource users, scientists and policy/decision makers (Biggs *et al.*, 2012; Cilliers *et al.*, 2013). A frequent outcome of information sharing and collaborative learning among resource users is the formulation of a jointly-derived desired state, referenced as a set of ecological outcomes agreed upon by the users (Chaffin *et al.*, 2014). The development of a joint vision of the desired state through meaningful engagement between role players can engender a sense of accountability for collective goals, even in the absence of contractual or legal commitments to accountability (Ostrom, 2010a; Jedd & Bixler, 2015).

Principle 4: Accountability for compliance with essential standards, means of conflict resolution, exclusion of resource users who do not comply with rules.

Outsiders or unauthorized users who do not follow collaboratively developed rules need to be effectively excluded from using the resource (Dietz *et al.*, 2003). The governance framework needs to provide for conflict resolution. Sharing of diverse perspectives between different resource users facilitates learning and change, provided that conflict can be resolved before it escalates to the point of dysfunction.

Principle 5: Polycentricity – governance through multiple, layered authorities each with its own sphere of responsibility.

Dietz *et al.* (2003) conclude that a variety of complex institutions that are nested in many layers, each with a degree of autonomy (termed polycentric governance, Ostrom, 2010a,b; Chaffin *et al.*, 2014), have proved to be superior to one centralized, sole authority. Polycentric structures have the advantage of being able to address environmental problems at multiple scales, their diversity enabling innovative, dynamic responses in the face of rapid change and uncertainty. Single-level, centralized governance units do not have the variety of response capabilities necessary to deal with complexity. An additional advantage of polycentric governance is that effective responses to threats at one scale of authority may offset failures at another scale (Olsson *et al.*, 2007; Ostrom, 2010). However, leadership, coordination and alignment of purpose across governance levels is necessary if the benefits of polycentricity are to be fully realized (Folke *et al.*, 2005; Lockwood, Davidson, Hockings, Haward & Kriwoken, 2012).

Principle 6: Avoidance of governance measures that assume stability and predictability of SES, treating management actions as experiments and monitoring their outcomes.

There is increasing appreciation that SESs are complex and inherently poorly predictable. In the interest of achieving adaptive governance it is necessary to foster an understanding of complexity theory (Biggs *et al.*, 2012, Cilliers *et al.*, 2013; McCool, Freimund & Breen, 2015). It is widely appreciated that reform of nature conservation governance is needed to align with the unpredictability of SESs, particularly in the face of global environmental change (Cliquet, Backes, Harris & Howsam, 2009; Craig, 2010; Lockwood *et al.*, 2012; McCormack & McDonald, 2014; McDonald, McCormack, Fleming, Harris & Lockwood, 2016). Environmental law is frequently based on unwarranted and untested assumptions of predictability and stability (Doremus, 2001; Green & Garmestani, 2012; Ruhl, 1997, 2011). Green & Garmestani (2012) note this shortcoming in the United States Endangered Species Act. Authorities are required to predict the likelihood of a certain action jeopardizing the continued existence of a protected species on the basis of available evidence. Once a decision is made, the process is effectively closed. Authorities have no obligation to gather additional data or to learn from outcomes.

Although reform of environmental law is necessary for flexibility to deal with complex systems, this needs to be balanced with accountability, including an enforceable mandate and accountability for rule compliance (Dietz *et al.*, 2003; Lockwood *et al.*, 2012). Agencies should not be allowed discretion to do nothing or to deviate from regulatory goals (Craig, 2010). Preston (2013) points out that in Australia statutes governing the protection of threatened species are generally conditional and provisional rather than absolute in that they allow regulatory authorities to grant approval for activities that may impact on the species. He argues that statutes may need to limit the discretion of authorities to approve impacts that would compromise essential environmental outcomes or standards.

Principle 7: Leadership in developing collaborative governance networks.

Folke *et al.* (2005) identify the important role of leadership in providing key functions for adaptive governance, such as building trust, guiding the interpretation of information, managing conflict, linking actors, initiating partnership among actor groups, compiling and generating knowledge, and mobilizing broad support for change. Lack of leadership can lead to inertia in SESs. Brink *et al.* (2011) note the need for leadership in reforming the governance of South Africa's wildlife industry.

Principle 8: Flexible provisions for resourcing.

Resource availability, in the broad sense of including knowledge, capital, equipment, or personnel (Rist, Felton, Samuelsson, Sandström & Rosvall, 2013), is an important component of governance. Adaptive governance requires innovative, flexible approaches to mobilizing and prioritizing resources to meet emerging needs of complex, unpredictable systems (Novellie, Biggs & Roux, 2016). The annual budget cycles of state conservation authorities assume predictability and stability, and do not provide this flexibility.

3. NETWORK GOVERNANCE THEORY

The models of Provan & Kenis (2008) are helpful in guiding the choice of effective network governance options. They consider three basic forms of network governance and examine conditions for the effectiveness of each form: (1) shared governance, which is highly decentralized and involves most or all network members interacting on a relatively equal basis in the process of governance, (2) governance by a lead organization that is also a network member, and (3) governance outsourced to an administrative entity that is not a network member. Provan & Kenis (2008) postulate that the effectiveness of three forms of governance depends on various factors, of which we consider two: the number of participants and the need for network-level competencies. The latter concept relates to the nature of the task performed by network members. The need for network-level competencies is high if the task requires close coordination between network members, as well as task-specific skills that individual members do not possess. Table 1 relates the effectiveness of the three forms of network governance to the number of participants and the network-level competencies.

4. OUTLINE OF THE CURRENT GOVERNANCE REGIME FOR CMZ

In terms of the South African Constitution, nature conservation is the concurrent responsibility of the national Department of Environmental Affairs (DEA) and the conservation authorities of nine provincial governments. At national level, relevant governing legislation includes the NEM: BA. Concurrent to the national level legislation, each of the nine provinces have their own legislation (*i.e.* Acts, Ordinances and Regulations, respectively) governing nature conservation in that Province. South Africa is a signatory of international biodiversity treaties, including the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), thus also imposing an international level of governance on its threatened species.

In addition to DEA and the nine provincial conservation authorities, national level public entities with a biodiversity mandate include the South African National Biodiversity Institute (SANBI), which generates, coordinates and interprets the knowledge and evidence required to support biodiversity policies and decisions, and the South African National Parks (SANParks), which is responsible for developing and managing the country's

Table 1. The three basic forms of network governance and conditions for the effectiveness of each form (adapted from Provan & Kenis, 2008).

Network governance option	Conditions for effectiveness
Shared governance	• Few participants • Low need for network-level competencies
Governance by a lead organization (also a network member)	• Moderate number of participants • Moderate need for network-level competencies
Governance outsourced to an administrative entity	• Moderate to high number of participants • High need for network-level competencies

national park system. SANBI is responsible for monitoring and reporting on the conservation status of threatened or protected species. In addition to the government role players, private landowners (principally involved as game ranchers) and various non-governmental organizations are playing an increasingly important role in the management of South Africa's wildlife, including threatened species (Brink *et al*., 2011; Taylor, Lindsey & Davies-Mostert, 2015; Hrabar & Kerley, 2013).

The natural distribution range of CMZ falls within three provinces of South Africa: the Western Cape, Eastern Cape and Northern Cape (Boshoff *et al*., 2016). An extralimital population occurs in a protected area in the Free State (Hrabar & Kerley, 2013). Altogether, five conservation authorities manage the various state-owned protected areas that maintain CMZ populations: one national (SANParks), and four provincial: CapeNature (Western Cape), Eastern Cape Parks and Tourism Agency (ECPTA), Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (FS DESTEA) and Northern Cape Department of Environment and Nature Conservation (NC DENC) (Birss *et al.,* 2016).

CMZs in private ownership are regulated by the provincial conservation authorities. In the Western Cape and Northern Cape provinces the conservation authorities (CapeNature and NC DENC) are responsible for both provincial protected areas and for regulating CMZ on private land. In the Eastern Cape, CMZ on private land are regulated by the Eastern Cape Province: Department of Economic Development, Environmental Affairs and Tourism, rather than ECPTA, which is a separate government entity responsible for managing state-owned protected areas.

Two legislated tools falling under the ambit of NEM: BA are of relevance to the management of CMZ: Biodiversity Management Plans for Species (BMP-S) and the Threatened or Protected Species (TOPS) Regulations. Although responsibility for enforcement of NEM: BA is shared across various tiers of government, the approach to both compliance and enforcement may differ between provinces. CapeNature has elected to apply provincial legislation only, rather than the national level TOPS Regulations, which are in contrast implemented in both the Eastern Cape and Northern Cape, in addition to the relevant provincial legislation. A recent amendment to the TOPS Regulations to deregulate all forms of use of CMZ (*e.g.* possessing, hunting, trading etc.) except for activities that may lead to the spread of hybridization is in the process of being gazetted. Provincial legislation in all of the nine provinces regulates hunting, possession, keeping in captivity, transport, import, export, selling, buying, donating, and receiving as a donation, processing, curing and tanning in accordance with provincial policy provisions (Birss *et al*., 2016).

State conservation authorities are allowed in terms of their governing legislation to sell, place under custodianship and donate animals to private land owners. SANParks is empowered by the National Environmental Management Protected Areas Act (Act No. 57 of 2003) (NEM: PAA), to generate revenue through the sale or exchange of wildlife. This revenue provides a flexible source of funding that can be used to address needs arising in managing complex systems (Novellie *et al.* 2016). NEM: PAA sets the condition (Section 50) that revenue generating activities may not negatively affect the survival of any species in a national park, nature reserve or World Heritage Site. In the case of provincial government, revenue generated from state assets is normally absorbed into provincial treasury, unless specific provisions exist. However, CapeNature and ECPTA are able to retain income from wildlife sales or other sources and use it for conservation purposes. For ECPTA, financial flexibility is limited by the condition that income must be spent within the financial year it was generated, otherwise it reverts to the provincial treasury.

Another important role player in regulating the movement of wildlife is the National Department of Agriculture, Forestry and Fisheries (DAFF) which is responsible for the control of diseases in terms of the Animal Diseases Act, 1984 (Act No. 35 of 1984). Movements of CMZ must comply with regulations governing African horse sickness (AHS), a highly infectious viral disease affecting all equines including zebra, which are thought to be reservoir hosts of the virus. It is not directly contagious but is transmitted by biting midges, *Culicoides* spp. The AHS Control Policy (www.africanhorsesickness.co.za/Documents/Doc_55.pdf) defines a Controlled Area in the Western Cape Province and sets obligatory conditions for the movement of equines into and within this area. The western natural distribution range of CMZ falls within the Controlled Area.

5. EVALUATION OF THE CURRENT GOVERNANCE REGIME FOR CMZ AGAINST THE PRINCIPLES OF ADAPTIVE GOVERNANCE AND NETWORK GOVERNANCE THEORY

5.1. Institutional arrangements

The diversity and multiple layering of national and provincial authorities responsible for the conservation of CMZ conforms with the principle of polycentricity (Principle 5, Section 2), but the important prerequisite of leadership and alignment of purpose across polycentric structures is largely absent. There is no overarching authority with a mandate to impose regulations or policies across the entire CMZ meta-population. This arises from the fragmented mandates of the state conservation authorities; each provincial authority is limited to its particular Province, SANParks is responsible only for populations in national parks and, unlike provincial authorities, bears no regulatory responsibility for wildlife on private land. This 'mandate gap' is likely to have contributed to the shortcomings in the conservation status of CMZ outlined above. Coordination and alignment of purpose across the authorities could have better managed the supply of CMZ to the private sector, avoiding the proliferation of small and genetically depauperate sub-populations. Furthermore, this model would presumably have facilitated the genetic integration of the three founder populations decades ago, rather than allowing two of these to persist as small isolated populations.

Well-managed offtake and sale of CMZ from state-owned protected areas has the potential to strengthen the status of the meta-population by increasing both the number and the size of sub-populations in the private sector. The supply is, however, subject to economic constraints; income from sales is necessary to cover the costs of capture and translocation operations. The conservation authorities that are most involved in offtake and sales of CMZ, SANParks and ECPTA, are dependent on self-generated income and under pressure to develop revenue streams. Under these circumstances, conservation authorities are likely to favour the highest bidders rather than those most in need of new stock. In addition, the Public Finance Management Act (PFMA) and institutional Supply Chain Management (SCM) policies aim to maximize income from the disposal of state assets, thereby making it difficult to select buyers on the basis of conservation objectives rather than price. In recent years an increasing number of private land owners with CMZ have sold their excess stock to other private owners (Hrabar & Kerley, 2015), with economic considerations likely to have taken precedence over conservation considerations.

5.2. The Legislative Framework

5.2.1. *Biodiversity Management Plans for Species*

The Norms and Standards for Biodiversity Management Plans for Species (N&S) (Notice R. 214, Government Gazette number 31968 of 3 March 2009) allows for the compilers of the plan to consult with stakeholders and interested and affected parties, although this is not mandatory. Before publishing a BMP-S for implementation, the Minister of Environmental Affairs (hereafter 'the Minister') should conduct a general public participation process. A published BMP-S thus constitutes a legislated tool aimed at ensuring the long term survival in nature of a species with the involvement of all relevant role players. The draft CMZ BMP succeeded well in promoting collaboration and information sharing between resource users, scientists and policy makers, and achieved a jointly agreed desired state and objectives. The BMP therefore effectively promotes Principle 3 (Section 2).

The N&S provide for leadership (Principle 7) by stipulating that the BMP-S must include 'the responsible person, organization or organ of state to monitor and report on progress with implementation of the plan'. The Minister is required to appoint a lead agency, and to identify a suitable person, organization or organ of state willing to take responsibility for the implementation of the plan.

The N&S make provision for the identification of various role players and for the inclusion of agreements in implementing the plan or monitoring its outcomes. This provides a framework for coordination and resolution of any conflicts that may arise (Principle 4). At a workshop of the CMZ BMP held in May 2016 participants identified the interests and influences of the different role players and identified potential sources of conflict.

In accordance with Principle 2, the N&S make clear provision for monitoring and review. It is obligatory to include monitoring of current utilization of the species, and to submit an annual report to the Minister on the implementation of the BMP,

including achievement of the objectives, as well as identification of impediments and bottlenecks. The Minister is obliged to review a BMP at least every five years with regard to compliance with the plan and the extent to which its objectives are being met. These provisions for monitoring and review make it possible for the objectives and governance rules of the BMP to evolve with learning (Principle 1).

A drawback is that approval and publishing of a BMP-S by the Minister does not necessarily ensure sufficient resources to implement the plan. The Minister may require independently-obtained proof of the lead agency's human and financial resources, but approval is not explicitly conditional on the presentation of a budget or other proof of capacity to implement the plan. The N&S state the BMP-S may 'identify resources needed and outline a resource mobilization strategy to ensure acquisition and sustainability of resource requirements'. Essentially this places the onus on the compilers of the plan, particularly the lead agency, to find ways to resource it. In view of the mandate gap, this has potentially serious implications for species that are dispersed across a number of provinces.

5.2.2. *TOPS Regulations and permit systems of provincial authorities*

TOPS accords well with the adaptive governance principle that regulations must change in response to learning (Principle 1). Since its inception TOPS has undergone a number of revisions and improvements. The recently proposed revision of conditions applying to CMZ is exemplary in taking into account new knowledge. It would deregulate activities that incentivize wildlife ranching – including possession, sale and hunting – while prohibiting/regulating activities that would expose CMZ to the serious threat of hybridization (Dalton *et al.*, 2017) that was not foreseeable when TOPS was originally promulgated. The proposed revision enhances flexibility and should help to change attitudes to TOPS. Furthermore, it accords with the recommendation of Preston (2013) that species need absolute rather than conditional protection against the most serious threats.

In their application, TOPS and other permitting systems in South Africa may potentially suffer from the front end, predictivist approach described by Green & Garmestani (2012) for the United States Endangered Species Act. Authorities may decide whether a hunting or other permit may be issued and leave it at that. Adaptive management and governance require record keeping of what transpires after the issue of a permit, for example whether an animal was actually hunted or not. Permit regulations applying to CMZ do allow for data collection. For those provinces that apply TOPS, the issuing authority has the discretion of issuing a once-off or a standing permit. TOPS requires a permit recipient to report annually against permit requirements. These provisions have the potential to generate data for monitoring of outcomes, providing a basis for decisions as to whether future permits should be granted or withheld. Permitting regulations in the Western Cape also have this potential. Possession permits are reviewed after three years. If the possessor wishes to capture and sell animals an additional permit is necessary, which requires a motivation based on the provision of relevant data, for example on the size and performance of the sub-population. The issuing authority may set basic monitoring and reporting requirements as permit conditions and it is envisaged that this will be implemented within the framework of the CMZ BMP. In practice, however, record keeping does not always take place (Williams *et al.,* 2015). Poor return rates and lengthy turn-around times render data from licences and permits unreliable (C. Birss personal observation). The CMZ Non-Detriment Finding (Government Gazette vol. 603, 10 September 2015 no. 39285) records that monitoring and learning from outcomes is limited by resource constraints faced by permit issuing authorities.

Another consequence of resource constraints is a pervasive inefficiency in administration of the permit system. Brink *et al.* (2011) report concern in the private sector with the way the use of wildlife is governed, including lack of consultation, inconsistent regulation, indecisiveness, lack of capacity and leadership. Taylor *et al.* (2015) report complaints that TOPS is burdensome, unnecessarily hampers translocation of species, creates financial impediments rather than benefits, permits are expensive and are processed too slowly. Taylor *et al.* (2015) note that these difficulties are perceived to stem from shared responsibilities between national and provincial governments, and the fact that the legislation and regulations are different in each Province. In the view of the wildlife industry, an aligned and improved national permitting system would go a long way to alleviating the problems. Currently it is an almost impossible task

in some provinces to extract information from permit records.

Wildlife ranchers are of the opinion that interest in CMZ is limited because of its low economic value (Hrabar & Kerley, 2013). However, it is important to consider the possibility that antipathy towards the permit systems could be an additional disincentive to manage CMZ.

5.3. Network Governance Theory

The N&S enable the development of a network of role players for the implementation of a BMP-S, which is appropriate for the multi-level context in which threatened species conservation takes place in South Africa. In requiring the Minister to appoint a lead agency for the implementation of the BMP the N&S opt for specific forms of network governance. Two of Provan & Kenis' (2008) governance models are compatible with the N&S: governance by a lead organization that is also a network member, and governance outsourced to an administrative entity. These two forms of governance are appropriate when the number of participants is moderate to high and when there is a moderate to high need for network-level competencies (Table 1). Fully shared governance would not be consistent with the N&S.

Provan & Kenis (2008) note that shared network governance may become difficult when the number of participants exceeds six to eight. However, this depends on circumstances, governance being more difficult when participants are spread out geographically, making frequent meetings of all participants difficult or impossible. The CMZ BMP-S lists 19, highly geographically scattered organizations interested in developing and implementing various aspects of the plan (Birss *et al.*, 2016). This does not include all the individual private sector landowners with CMZ, which further adds complexity. Fully shared governance is therefore clearly inappropriate.

The need for network-level competencies for the BMP-S is high. The meta-population management strategy needs to be guided by ongoing scientific inputs and requires costly management measures, including a programme of capture and translocation to augment gene flow and to control hybridization risks. Such network-level competencies are ideally provided by a dedicated network administrative entity (Provan & Kenis, 2008). Theoretically the N&S allow the Minister to assign responsibility to such an entity, but it would be problematic for any of the government conservation agencies to assume this role. In view of the mandate gap, it would entail operating to some extent beyond the agency's mandate. Agencies do not have resources for extra-mandate activities and, as noted, the N&S are weak on resourcing.

Resource constraints limit the capacity to learn from and respond appropriately to research and monitoring results (Government Gazette vol. 603, 10 September 2015 no. 39285). Monitoring is frequently poorly developed and implemented in adaptive management programs, and lack of sustained long-term funding is commonly cited as an impediment (Lindenmayer & Likens, 2010; McCool *et al.*, 2015, Ruhl & Fischman, 2010; Westgate, Likens & Lindenmayer, 2013). The BMP workshop held in May 2016 noted the lack of capacity in provinces as well as the lack of incentives in the private sector as challenges/conflicts. Obtaining standardized data throughout poses a major obstacle. The costs of obtaining reliable census data for CMZ is a major constraint.

5.4. CITES Regulations

CITES is an international agreement regulating the international trade in species included in one of three Appendices. Adaptive management of Appendix I species is not possible, since international trade in wild specimens for commercial purposes is prohibited. Fortunately, a proposal to transfer the CMZ from Appendix I to Appendix II was recently adopted at COP17. In relation to species included in Appendix II, we agree with Martin (2010) that CITES should be conducive to adaptive management, but frequently is not because of the tendency of developed countries to demand *a priori* 'scientific proof' that utilization will not be harmful. In fact, the United States of America requires *a priori* proof that utilization of species listed as Endangered in its Endangered Species Act (ESA), the CMZ for example, is beneficial to the conservation of the species concerned. Given the uncertainties of complex systems, sustainability cannot be guaranteed in advance, but needs testing through monitoring and adaptive management. Martin (2000) identified the CITES export quota system as having potential for effective use in adaptive management.

An export quota is described in CITES Resolution Conf. 14.7 (Rev. CoP15) (Management of nationally established export quotas) as a maximum limit to the number of specimens that may be exported in a year. The Resolution takes care to

avoid unnecessary administrative layers and emphasizes the need to keep procedures uncomplicated and practical. It requires that the CITES Secretariat be informed of the quota 30 days in advance of the start of the year over which the quota will be exported, thereafter the Secretariat is required to publish the quota on the CITES website. The Resolution allows flexibility and processes to adjust quotas in cases where there are concerns about the technical or administrative aspects of the quota, either expressed by the CITES Secretariat or by any other Party. The Party establishing the quota is responsible for monitoring exports, ensuring that the quota is not exceeded, and for reporting on the quota and its implementation in national annual reports.

It is important that the quota constitutes a limit rather than target that must be achieved. This allows flexibility to reduce actual offtake adaptively as required by circumstances. It is therefore desirable to manage expectations on the part of users to avoid pressure to fill a quota. Provided that export quotas are well founded and well administered, and that species included in Appendix I can be easily transferred to Appendix II when they no longer meet the criteria for an Appendix I listing, the CITES procedures provide sufficient flexibility for adaptive management.

6. THE POTENTIAL OF PRIVATE OWNERS TO MEET THE REQUIREMENTS OF ADAPTIVE GOVERNANCE

Monitoring of population performance in the private sector has been facilitated by willingness on the part of land owners to respond to questionnaires. The responsiveness of private land owners has been vital to successive updates of the CMZ meta-population (Novellie *et al.,* 1992; Novellie *et al.,* 2002; Hrabar & Kerley, 2013, 2015), showing a willingness and capacity to support Principles 2 and 3 (Section 2). It is particularly encouraging that the surveys of Hrabar & Kerley (2013, 2015) were funded by a private sector organization.

The majority of private sector respondents to the questionnaire of Hrabar & Kerley (2015) indicated willingness to collaborate effectively with the governance system. This willingness, together with minimal poaching of CMZ, suggests that it will not be a problem to control exploitation by 'outsiders' who are unwilling to follow governance rules (Principle 4, Section 2).

The questionnaire survey conducted in April 2016 was answered by 29 private land owners with CMZ on 31 different properties. Twenty six of 29 respondents confirmed willingness to monitor and report on the performance of their populations. The results suggest that the respondents all had adequate capacity to monitor population performance. Population totals were provided for all 31 properties, although in most cases, the respondents admitted to a possibility of error in the reported totals. Twenty eight of the 31 properties gave estimated age and sex compositions of the populations in addition to the total number, whereas three provided only the total numbers. The total numbers of CMZ summed over all 31 properties was 989, and the total numbers maintained by those 21 owners who expressed interest in a hunting quota was 696. The number is likely to grow as the majority of private properties with CMZ reported population increases. In conclusion, the respondents showed willingness to share information and to collaborate with the existing system of governance, which augurs well for the adaptive co-management of a hunting quota.

7. DISCUSSION AND CONCLUSIONS

The governance regime for CMZ accords at least to some extent with all of the identified adaptive governance principles. South African legislation on threatened species, through Biodiversity Management Plans for Species, enables adaptive governance by a network of role players. Procedures for establishing and reporting on CITES quotas appear to pose no serious barriers. The main shortcoming is that there is no overarching authority with a mandate to align regulations or policies across the entire CMZ meta-population, or to lead the implementation of the BMP-S. This is counter to the principle of maintaining accountability through an enforceable mandate (Craig, 2010; Dietz *et al*., 2003; Lockwood *et al*., 2012). The mandate gap and capacity constraints make it impossible for any of the government conservation authorities to implement a form of network governance (Provan & Kenis, 2008) that would quickly and effectively provide the competencies required to address the conservation needs of CMZ. An effective meta-population management strategy is essential to avert the risk of inbreeding depression and genetic drift faced by the numerous small sub-populations of CMZ. However, this is currently beyond the capacity of CMZ governance mechanisms.

The extent to which the mandate gap may limit the effectiveness of the CMZ BMP remains to

be evaluated in practice. Conventional theory of collective action holds that, in the absence of externally enforced regulations, participants will pursue short-term benefits and fail to achieve outcomes that yield higher returns for all involved. Ostrom (2010a) states that such failure is not inevitable, and polycentric governance can achieve benefits at multiple scales, especially when participants develop trust that others are complying with mutually-agreed policies. Thus, overarching regulation is not necessary to engender a sense of accountability (Jedd & Bixler, 2015). The process of drafting the CMZ BMP achieved a degree of alignment, mutual understanding and trust between the different provincial and the national authorities that did not exist previously. If this momentum is developed and maintained the participants in the BMP can potentially find innovative ways to compensate for resource constraints and fragmented mandates.

Although in theory permit regulations are sufficiently flexible to allow adaptation, it is in practice doubtful that permitting systems can be applied in a way that supports adaptive management and adaptive governance. The shortcomings arise from limited human and financial resources in some of the provincial authorities. Partly they reflect a mental model of governance that emphasizes regulation through control, rather than joint learning by doing, the central tenet of adaptive management (Brink *et al.,* 2011). In this respect the permit system does not support Principle 6 in that it is insufficiently flexible to deal with complexity. In the absence of capacity to collect and learn from permitting data it may be better for TOPS Regulations to focus on controlling, or if necessary prohibiting, only the most serious threats. The proposed revision of TOPS to focus on the threat of hybridization between CMZ and other equids therefore makes sense. Assuming the proposal is gazetted, it would be valuable to monitor and evaluate the impact of this revision on the private sector's role in conserving CMZ.

The capture and sale of CMZ by conservation authorities emerges as important but potentially double-edged. It is key to enhancing the adaptive financing potential of conservation authorities as well as increasing the size and number of CMZ sub-populations. The challenge is to reconcile income generation with conservation priorities. A balance will be needed if the impact of a hunting quota is to be aligned with the vision of the BMP. The PFMA and institutional SCM Regulations introduce considerable complexity to the sale of wildlife by organs of state, potentially adding difficulties in reconciling income generation with conservation priorities. The implementation of SCM by the public sector in South Africa faces numerous challenges (Ambe & Badenhorst-Weiss, 2012) and reform may be needed regarding the disposal of wildlife, which constitutes a state asset of an essentially different kind.

There is also a need for better integration of regulations between regulatory authorities, including animal disease regulations which are sometimes in conflict with the interests of biodiversity conservation. This calls for transdisciplinary engagement between DAFF, DEA and the provincial conservation authorities in the drafting of regulations affecting the movement of wildlife.

Despite the areas of uncertainty, the CMZ BMP-S has made a good start towards a transition from top down, fragmented regulation to co-regulation and setting a framework for adaptive governance. Especially in view of the limited scientific knowledge to guide meta-population management, ongoing research will be critical to collaborative learning. The conservation of CMZ has benefited greatly from the involvement of scientific role players and this needs to be sustained. We suggest that an action research project (collaborative investigation in practice of solutions to specific problems – Stringer, 1978) be initiated to explore innovative solutions to problems in the implementation of the CMZ BMP. As noted, the most challenging problem is to develop and implement an effective meta-population management strategy.

Finally, our assessment shows the usefulness of adaptive governance and network governance theory in indicating potential weaknesses in governance regimes for species conservation. Although there is considerable literature on the application of these theories in the context of conservation in SES (Chaffin *et al*., 2014), they have not been widely applied to species conservation (but see Duvall *et al*., 2017). Species conservation in complex SES has close parallels with network governance of large landscape conservation areas (Bixler *et al*., 2016; Scarlett & McKinney, 2016) and can draw on knowledge from this rapidly developing field.

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