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Research and conservation of the larger parrots of Africa and Madagascar: a review of knowledge gaps and opportunities

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Parrot populations in Africa and Madagascar are declining and the need for conservation actions to address threats is increasingly recognised. Effective conservation requires a robust knowledge base on which decisions over appropriate actions can be made, yet at present there is no current and readily accessible synthesis of the status of populations, the threats they face and knowledge gaps. Here we begin to address this shortfall for the larger species in the region belonging to the genera *Coracopsis*, *Poicephalus*, *Psittacus* and *Psittacula*. We review developments since the production of the IUCN Parrot Action Plan published in 2000, identify areas where critical knowledge is lacking and highlight opportunities to address them. While advances have been made over the last decade, progress has not been evenly spread, with a strong bias towards populations in southern Africa. To date much research has focused on describing aspects of ecology and behaviour and there remains a need for studies determining the current status of populations and the factors limiting distributions and abundance. This review aims to provide a basis upon which progress towards an improved understanding of the conservation needs of the larger parrots of Africa and Madagascar can be made.

Keywords: conservation priorities, conservation status, *Coracopsis*, *Poicephalus*, *Psittacula*, *Psittacus*

Introduction

Parrots (Psittacidae) are one of the most threatened families of birds (Bennett and Owens 2002). Population declines are being driven by a range of processes including habitat alteration (e.g. Wirminghaus et al. 1999; Masello et al. 2011; Marín-Togo et al. 2012), capture for the pet trade (e.g. Wright et al. 2001), hunting for food (e.g. Krabbe

and Sornoza Molina 1996; Guerrero Ayuso and Arambiza Segundo 2004; Thiollay 2005), persecution as crop pests (e.g. Bucher 1992; Bomford and Sinclair 2002) and disease (e.g. Gartrell et al. 2005; Ha et al. 2009; Ortiz-Catedral et al. 2009). Despite their prevalence in captivity and relatively high public profile, little is known about the conservation status and basic biology of many wild populations (reviewed in Snyder et al. 2000; Masello and Quillfeldt 2002; Masello et al. 2010). This is particularly the case for parrots of the African continent and Madagascar (Perrin 2012). Some of these species have been among the most heavily traded in the world (Pain et al. 2006) and inhabit areas where rates of deforestation rank among the world's highest (FAO 2012).

Conservation practitioners, researchers and policy-makers often make decisions with implications for conservation based on insufficient evidence (Sutherland and Woodruff 2009). Often this is because there has been inadequate research or the necessary information is not available in a readily accessible form. In recognition of this need, in 2000 a status survey and conservation action plan was produced for parrots worldwide (Snyder et al. 2000). This Parrot Action Plan (hereafter referred to as the PAP2000) was the result of extensive consultation with field experts and conservation bodies from around the world. At its core were species accounts describing the status of populations, threats, and recommended conservation actions for 95 species, which met the criteria for inclusion on the IUCN Red List of Threatened Species at that time. This included three of the 22 species then recognised from mainland Africa and Madagascar.

In recent years, a number of research projects, investigating aspects of the ecology of African parrot species, have generated new information on the status of populations and taxonomic revisions in 2012 have added new species to the IUCN Red List (BirdLife International 2013a). At present there is no current and readily accessible synthesis of information regarding the conservation and research of the parrots of Africa and Madagascar. We aim here to address this shortfall, not only updating information on threatened species summarised in the PAP2000, but also expanding the scope to include species currently categorised as Least Concern on the IUCN Red List. We focus here on the 15 species of larger parrots of Africa that belong to the four genera *Coracopsis*, *Poicephalus*, *Psittacula* and *Psittacus*. The smaller lovebirds (genus *Agapornis*) will be treated in a forthcoming sister publication, following the approach of Wilkinson (1998a, 1998b). Separate treatment has merit as many aspects of the ecology, behaviour and life history of the larger parrots differ from those of the lovebirds, meaning that populations are likely to be affected by, and respond differently to, environmental changes and management interventions. *Agapornis* spp. have a 'faster' life history, laying larger clutches and having shorter generation lengths (Ndithia et al. 2007; Perrin 2012). They also differ in their nesting requirements, excavating their own cavities, modifying existing cavities by building nests (Eberhard 1998) and taking over the nests of weavers (Ploceidae spp.) (Warburton and Perrin 2005; T Mzumara in litt. 2012). Through this review we aim to identify existing knowledge gaps and highlight areas where further actions are needed to generate a 'road map' for future research and conservation initiatives on the continent.

Methods

Information regarding the current distribution, population trends, threats, and research and conservation initiatives was compiled from a number of sources. To identify relevant primary and secondary literature and other reports we used online databases, including the literature database of the Parrot Researcher's Group (PRG)/ Research Coordination Committee on Parrots (RCCP) of the International Ornithologists' Union (IOU), as well as correspondence with individuals with experience in the region. To connect with relevant individuals and organisations we used the PRG/RCCP forum and contacted conservation-related non-governmental organisations and relevant government bodies as well as posting on regional birding forums. The PRG/RCCP links a global network of individuals and organisations involved in parrot research and conservation. We solicited information from as wide a network of individuals and organisations as possible in order to maximise inclusivity and scope. We sent a questionnaire (Supplementary File S1) to relevant individuals asking for (1) details of qualitative and, if possible, quantitative assessments of range and population changes, (2) opinions of the scope, severity and impact of different threats (adapted from the IUCN-CMP Unified Classification of Direct Threats; IUCN 2011) and (3) opinions of research and conservation priorities for each species. Information obtained in correspondence is referenced throughout as 'in litt.'. Responses were received from 74 individuals, 34 of which contributed questionnaires covering all species apart from one (*Poicephalus crassus*) and 20 individuals contributed other information including unpublished reports or anecdotal observations.

Information obtained through the above process was summarised in a series of species accounts. Where possible we identified the subspecies, population and region to which the information pertained. For the majority of populations, systematic monitoring of abundance and distribution has not taken place. In its absence and, if suitable information was available, we inferred population trends by synthesising information on relative abundance (including encounter rates, density estimates, flock sizes and numbers of individuals using communal roosts) and distribution (presence/absence in specific locations). Sources of information included the peer-reviewed literature, reports to policy-makers, field guides, bird atlases, unpublished data and researcher field notes. Respondents were asked to estimate rates of population change in areas with which they are familiar, using categories described in the IUCN Red List Criteria (IUCN 2001). Expert opinions were consolidated and, where consensus was lacking, conflicting assessments presented (Sutherland et al. 2011). Lists of research and conservation priorities for each species were compiled from correspondence with individuals in each region. Due to the low numbers of experts for each species/region we were unable to follow a formal democratic process for selecting priorities of the kind advocated by Sutherland et al. (2011). We acknowledge

that, despite our best efforts, some important information will have been overlooked and some will be inaccurate or out of date at the time of publication.

At the species level we largely followed the taxonomy of BirdLife International (2013b), which currently recognises 12 parrot species on mainland Africa and two in Madagascar (excluding members of the genus *Agapornis*). At the subspecies level we followed Forshaw (2010) who in turn based the taxonomy largely on Dickenson (2003) but incorporated some changes proposed in subsequent studies. We made one exception by producing two separate accounts for the taxa *Poicephalus robustus* and *P. fuscicollis* (recognised by the IUCN as a single species, *P. robustus*). As the conservation and research situations of the two populations differ considerably and many regional authorities (Hockey et al. 2005; Sinclair and Ryan 2010) recognise the two taxa as distinct species (following the recommendations of Clancey 1997; Wirminghaus et al. 2002a; Perrin 2005), we believe separate treatment is the most useful approach for researchers and conservation practitioners in the region.

We limited the geographical scope of this review to mainland Africa and the island of Madagascar, excluding species only occurring in the Mascarene Islands. Being confined to Mauritius, the Endangered Echo Parakeet has not been included. This species has been the subject of considerable research and conservation efforts and the population status is well established. Populations of *Coracopsis nigra* and *C. vasa* on the Seychelles and Comoro Islands are included as the majority of their distributional ranges are found within Madagascar.

For the sake of brevity we used several abbreviations to denote countries and regions therein: CAR (Central African Republic), DRC (Democratic Republic of Congo), NP (National Park), N (northern), S (southern), E (eastern) and W (western).

Results and discussion

Species accounts

Coracopsis vasa Vasa Parrot

Distribution and habitat

Coracopsis vasa is widely distributed throughout lowland Madagascar and the Comoro Islands. In Madagascar, they occur in a variety of lowland habitats from open arid woodland and savanna in the N and W, to moist dense forest in the E and the semi-arid districts of the S (Milon et al. 1973), mainly up to 1 000 m but much more common below 600 m (Dowsett 2000). In W and S Madagascar they are less dependent on forests and are more conspicuous in open woodland habitats (Perrin 2012). On the Comoro Islands, they are largely dependent on evergreen forest above 300 m (Benson 1960), frequently visiting open country to feed. In Madagascar the subspecies *C. v. vasa* occurs in E areas intergrading with *C. v. drouhardi* in W areas (Forshaw 1989). The subspecies *C. v. comorensis* occurs on the Comorian Islands of Grand Comoro, Moheli and Anjouan.

Population and range trends

Little data exist with which to assess range and population changes. In Madagascar they were reported as very common and abundant in the twentieth century (Dee 1986; Langrand 1990) and they remain common in many localities (J Ramanampamonjy in litt. 2012). Flocks of more than 40 individuals are regularly seen in W and SW regions where populations are likely stable, but they are reported as rarer in E Madagascar (J Ramanampamonjy in litt. 2012). A study of the status of the population in 2000 concluded that the collection of adequate data was difficult, but that quantitative assessments were not a priority as they were generally common (Dowsett 2000). Populations are, however, becoming increasingly fragmented (J Ramanampamonjy in litt. 2012) and high levels of persecution have led to concerns that the population may be in decline (Collar 1997).

In the Comoro Islands they have been described as relatively common (Collar 1997) but little current information is available.

Threats

Habitat fragmentation and modification has reduced the original forest extent in Madagascar by over 75% (UNEP 2008) and has likely negatively impacted some populations. Forest clearance might be expected to reduce the availability of nesting cavities, which are found in large, mature trees (Perrin 2012). However, in the spiny forest habitat of S Madagascar, forest clearance did not reduce their abundance relative to other bird species in the area (Scott et al. 2006). They frequent human-modified habitats in some areas, readily feeding on a variety of crops, such as maize and rice (Dowsett 2000). In some areas, populations are heavily persecuted as they are perceived as crop pests, hunted for food and also captured for the caged bird trade (McBride 1996). These activities are only permitted between May and October, to limit impacts on breeding birds, but these restrictions are not widely known or obeyed and persecution in some areas occurs whenever they are considered to be most damaging to crops (Ekstrom 2004). A moratorium on all international trade was declared in 1995 and seems to have significantly reduced the numbers of exports from Madagascar (Dowsett 2000); no exports of wild caught birds have been reported since 1995 (UNEP-WCMC 2013). There is some local trade in caged birds, which have been occasionally seen for sale in Antanarivo (Ekstrom 2004). In Fôret de Kirindy, the number of birds eaten for food reportedly exceeds those captured for trade (Ekstrom 2004).

Research and conservation: overview

Dowsett (2000) attempted to estimate the population size in Madagascar but found aspects of the species behaviour precluded accurate estimates of density. Point records showing their distribution prior to 2000 were compiled and presented by Dowsett (2000). At that time they were reportedly present in a large proportion of protected areas (37 out of 42) in Madagascar. Although no systematic studies of feeding ecology have taken place, a large range of food sources have been reported (Goodman et al. 1997; Dowsett 2000; Ekstrom 2004).

In the Comoro Islands, little systematic research on ecology or conservation status has been conducted. Some observations on flock sizes, habitat preferences, and diet are reported by Benson (1960). A recent study of the

molecular phylogeny of the Indian Ocean parrots included samples from both Malagasy subspecies (*C. v. drouhardii* and *C. v. vasa*) but not the Comorian subspecies *C. v. comorensis* (Kundu et al. 2011).

Observations of unusual reproductive behaviour in captivity (Wilkinson and Birkhead 1995) prompted a systematic study of their polygynandrous mating system in the wild (Ekstrom 2002, 2004; Esktrom et al. 2007). Ekstrom (2004) and Ekstrom et al. (2007) observed multiple breeding attempts between 1999 and 2001, and collected data on copulation behaviour, male and female parental roles, genetically determined paternity and breeding success.

Research and conservation: recommendations
- Surveys to determine current distribution and abundance, particularly focusing on areas for which historical data on their distribution in Madagascar exists (Dowsett 2000 and references therein) could be used to assess trends
- Research into ways to resolve conflicts with farmers in areas where *C. vasa* is persecuted as a perceived crop pest
- Studies of systematics, focusing on the relationships among populations in the Comoro Islands and Madagascar.

Coracopsis nigra Black Parrot
Distribution and habitat
Coracopsis nigra is widely, but patchily, distributed throughout Madagascar (with the exception of the high plateau; Dowsett 2000), the Comoro Islands and Praslin Island in the Seychelles. In Madagascar, they occur in a variety of wooded habitats, including humid forest, dry forest, mangroves, secondary woodland and man-made ecosystems, including wooded surroundings to towns and villages up to 2 000 m (Rand 1936; Ekstrom 2004). They are generally considered to be more restricted to forest habitats and more frugivirous than the congeneric *C. vasa* (Forshaw 2010). In Madagascar the subspecies *C. n. nigra* occurs in E regions and *C. n. libs* in W and S regions. Populations on the Comoro Islands and Praslin Island have been treated by some authors as a single subspecies *C. n. sibilans* (e.g. Collar 1997), but a recent study based on DNA sequencing suggests the Praslin Island population has a long history of isolation and this population could be potentially considered as a distinct taxon (Reuleaux et al. 2013).

Population and range trends
A study conducted in 1999 estimated that the population on Madagascar totalled tens of thousands, although it was acknowledged that this figure was based on inadequate data due to the difficulties of conducting fieldwork (Dowsett 2000). Generally, they were considered to be widespread and common (Dowsett 2000), particularly in certain western dry forests (i.e. Kirindy and Zombitse) and rainforests of the east (J Ramanampamonjy in litt. 2012). They are present in the pine forests of Ifaty, although rarer in the south (J Ramanampamonjy in litt. 2012). Population declines may have occurred in some areas as forested habitats, for which they show a preference, have been greatly reduced, modified and fragmented (Irwin et al. 2010).

In the Seychelles, the population had declined to an estimated 50 individuals restricted to a single locality on Praslin Island by the late 1960s (Gaymer et al. 1969). Multiple population estimates made on Praslin over the last 40 years indicate a growing population (Reuleaux et al. 2013), but despite the positive trend this population remains vulnerable (N Bunbury and A Reuleaux pers. obs.). Recent population estimates in the Seychelles suggest there are currently 520–900 individuals (95% confidence intervals) (Reuleaux et al. 2013).

No current information could be found on the status of populations on the Comoro Islands, although it has previously been described as relatively common on Ngazidja and rare on Ndzuani (Benson 1960).

Threats
In Madagascar, habitat fragmentation and modification have likely impacted and continue to threaten populations. Although this species has been observed nesting outside forest, this habit is probably far less common than for the congeneric *Coracopsis vasa* (Ekstrom 2004). Population densities in forests in SE Madagascar have a negative relationship with canopy cover; densities are lower on the edges of forest fragments (Watson et al. 2004). They frequent agricultural areas, feeding on rice, maize and seeds in cassava fields (Dowsett 2000), suggesting that populations may be robust to some aspects of human-induced habitat change. This behaviour has brought it into conflict with farmers. In the 1970s they were officially listed as a pest (Ekstrom 2004) and were persecuted because of perceived crop damage (Wilkinson 1998a, J Ramanampamonjy in litt. 2012). There is some popularity among the Malagasy in keeping them as a cage bird (Ekstrom 2004) but an assessment of the size of this threat is lacking. In the Fôret de Kirindy the numbers hunted for food far exceed those taken for trade (Fauré 1996 cited in Dowsett 2000). Between 1995 and 2005, 2 112 were reported as exports but none since 2005 (UNEP-WCMC 2013).

In the Seychelles, the core of the palm forest habitat, which supports the highest densities (Rocamora and Laboudallon 2009), is well protected within a NP but hotel development threatens habitat elsewhere. They are illegally persecuted in small numbers as a perceived crop pest and breeding success is suspected to be suppressed by predation from introduced rats and nest competition from introduced Common Mynas *Acridotheres tristis* (N Bunbury and A Reuleaux pers. obs.).

Research and conservation: overview
Dowsett (2000) attempted to estimate the population size in Madagascar but found aspects of the species behaviour precluded accurate estimates of density. In the past a number of studies have reported data on aspects of their ecology, such as activity patterns, flock sizes, vocalisations, diet and foraging behaviour (Goodman et al. 1997; Hampe 1998; Böhning-Gaese et al. 1999; Dowsett 2000; Bollen and van Elsacker 2004; Bollen et al. 2004). There have been no systematic studies of social aspects of their breeding system in the wild, but data on nest trees, timing of breeding and breeding behaviour are reported by Ekstrom (2002, 2004). They are present in a large proportion of protected

areas (38 out of 42) in Madagascar (J Ramanampamonjy in litt. 2012). Forest areas are less well represented in protected areas in the W, therefore subspecies *C. n. libs* might be considered to be less well protected than *C. n. nigra* (Dowsett 2000). To our knowledge there have been no systematic studies of the conservation status or ecology of populations in the Comoro Islands.

On Praslin Island in the Seychelles, simultaneous counts have been carried out in most years since 1985, and in 2010/11 population estimates were also made using density estimates based on point counts (Reuleaux et al. 2013). Other recent research activity includes monitoring of breeding attempts, observations of feeding behaviour in relation to phenology, ringing, genetic sampling to assess inbreeding, recording of vocalisations and surveys of farmers attitudes (N Bunbury and A Reuleaux pers. obs.). Several breeding attempts were monitored in the 1980s (Merritt et al. 1986). Nest boxes were provided in the 1990s but are no longer considered necessary, as there are sufficient nesting trees in the main breeding area of Vallée de Mai (N Bunbury and A Reuleaux pers. obs.). Recent research based on DNA sequencing suggests that the Praslin population has been isolated for several million years and that *C. n. barklyi* is basal to the other *C. nigra* subspecies (Kundu et al. 2011). Morphological and plumage differences between the subspecies are reported by Asmus (2005).

Research and conservation: recommendations

- In Madagascar, surveys to determine current distribution and abundance, particularly focusing on areas for which historical data on distributions exist (Dowsett 2000 and references therein) could be used to assess trends
- In the Seychelles, continued population monitoring and research into the limits on breeding success (specifically the impact of invasive species), preservation and expansion of the endemic palm forest habitat, assessments of requirements and suitability of translocations to nearby islands
- Investigations of the conservation status, population trends and taxonomic status of the population in the Comoro Islands.

Psittacus erithacus Grey Parrot

Distribution and habitat

Psittacus erithacus occurs predominantly in lowland moist forest of W and central Africa, from SE Cote d'Ivoire and Ghana eastwards through Nigeria, Cameroon, Gabon, the Republic of Congo, N Angola and DRC (Juniper and Parr 1998). They are absent from Benin (Dändliker 1992a; Dowsett and Dowsett-Lemaire 2011) and Togo (F Dowsett-Lemaire in litt. 2013), with the exception of a feral population in Cotonou (B Portier in litt. 2012). The E margin of their range extends just east of the Albertine rift into Uganda, W Kenya and NW Tanzania. A separate subspecies, *P. e. princeps*, occurs on the islands of Príncipe (Sao Tomé and Príncipe) and Bioko (Equatorial Guinea) (Melo and O'Ryan 2007). Feral populations of several hundred each are noted in Kampala, Uganda (D Pomeroy in litt. 2012) and Kinshasa, DRC (T Hart in litt. 2012). A small population of most probably feral origin is also known from Sao Tomé Island, although its size and status are yet to be quantified (Christy and Clarke 1998; R Lima in litt. 2013).

Population and range trends

Although once widespread and common in many areas, population declines, which have been very dramatic in some instances, have occurred throughout much of its range. In Ghana by the late 1980s, populations were already considered to be greatly reduced due to trapping for export (Grimes 1987). Ongoing concerns over declining populations, in response to high export levels from Ghana, prompted CITES to initiate a population survey in the early 1990s (Dändliker 1992b). Several roosts of 700–1 200 parrots were located, but none of the size (2 000–3 000) previously reported by the Ghana Wildlife Department (Dändliker 1992b). Flocks of this order are no longer found in Ghana (F Dowsett-Lemaire in litt. 2012). In August 2007 a flock of 38 was reported in an area where Dändliker (1992b) had previously observed a roost of 800–1 200 in November 1991 (B Phalan in litt. to Dowsett-Lemaire and Dowsett 2014). The flock of 38 seen in 2007 is considered to be exceptional in size and no flocks of this size have been described since (Dowsett-Lemaire and Dowsett 2014; N Annorbah pers. obs.). Populations in protected areas have also been impacted. They area apparently extirpated from Bia NP and the associated Resource Reserve (LH Holbech pers. obs.) and may have disappeared or exist at very low numbers in most other forest reserves (Dowsett-Lemaire and Dowsett in prep.). In Kakum NP, where Dändliker (1992a) described them as extremely common 20 years ago, 10 days of surveys in 2011 failed to find a single individual (LH Holbech pers. obs.), although some birders visiting Kakum see several individuals in the 2–3 days they spend in the south of the park, possibly reflecting seasonal movements in and out of the park (F Dowsett-Lemaire in litt. 2013).

Little information on population trends in Côte d'Ivoire exists but it is likely that population reductions, similar to those observed in Ghana, have occurred given the geographic proximity of the two areas. *Psittacus erithacus* from Côte d'Ivoire have been regularly imported to Guinea for re-export (Clemmons 2003).

In Nigeria, their distribution in the early 2000s was reported as highly fragmented, having disappeared from many areas where they formerly occurred widely (McGowan 2001). Dramatic population declines have been observed within protected areas; only three individuals were observed in a three-week survey of Omo forest in 2009 (Olmos and Turshak 2009) where flocks of hundreds were reported in the 1990s (Green et al. 2007). It is now only known to occur in a few other localities (P Hall pers. obs.). Although systematic surveys are lacking, it has been estimated the national population could be as low as 1 000 individuals (P Hall pers. obs.). Concerns over population declines have led to its inclusion as a species that needs urgent attention by the Nigerian Conservation Foundation species programme (R Kagu in litt. 2012).

Declines have also been reported in Cameroon, where they were once described as a very common parrot, found everywhere in the forest (Good 1952). A recent report to CITES based on field surveys made between 2008 and 2011 concluded they are now rare or completely absent

in some parts of the range where they used to occur in abundance some 30–50 years ago (Tamungang and Cheke 2012). The national population estimated in this recent report (Tamungang and Cheke 2012) was 30–60% smaller than a previous estimate based on surveys made between 1996 and 1997 (Fotso 1998a). Comparison of these two estimates should be made with caution, as they were made using different survey methods. However, declines of this magnitude are consistent with the experiences of field workers and local residents. In S Cameroon, Tamungang and Cheke (2012) reported that *P. erithacus* populations have dwindled rapidly in the past 30 years. In Korup NP and surroundings these declines have been estimated to be extreme (>80% since c. 2001) (KS Bobo pers. obs.). In 2000, flocks of 15–20 individuals were reportedly seen regularly in Korup NP but are now rare (KS Bobo pers. obs.). Other field biologists working in the area have noted similar trends (M Waltert pers. obs.; S Tamungang pers. obs.). In the relatively pristine SE region (Lobéké, Boumba-bek and Nki NPs and surroundings), roost sizes were reduced by half between 2008 and 2012 and some roosts are now empty (KS Bobo pers. obs.). These trends are consistent with the declines of up to 49% since c. 2001 estimated in Lobéké NP (R Fotso pers. obs.). Trapping of the order of several thousand each year was reported to occur in the saline swamps of Lobéké NP in the late 1990s (Dowsett-Lemaire and Dowsett 2000). The minerals in the saline swamps attracted birds from surrounding areas, meaning that this level of trapping likely impacted an area several times that of the Reserve (Dowsett-Lemaire and Dowsett 2000). Similar trends have been observed in many parts of the country where the species occurred in great numbers up to the 1980s and to the late 1990s, notably around Kumba, Ebolowa, Kribi, Bertoua and Yokadouma towns, and neighbourhoods of Douala and Yaounde cities (Tamungang and Cheke 2012).

Population estimates in the W DRC were made in the Equateur region by Fotso (1998b) based on roost counts (for criticisms of this approach for estimating populations see McGowan 2001). At this time it was considered common and widespread in these areas but there were concerns about the high levels of capture for export (Fotso 1998b). No subsequent surveys have been made in the region, although population declines in W areas (e.g. Salonga NP) have been inferred from movements of trappers from Equateur province eastwards (Hart 2013). Surveys in Maniema and Orientale provinces indicate that they are uncommon even in areas of apparently suitable forest and that local villagers reported larger and more frequent flocks in the past (Hart 2013).

In the Republic of Congo populations in some areas might be stable (J Mokoko pers. obs.; K Cameron in litt. 2012). However, large declines since the early 2000s in the numbers of birds roosting in Bomassa, close to Lobéké, Ndoki and Nouabalé-Ndoki NPs may be linked to high levels of trapping along the Sangha river (F Maisels pers. obs.; T Breuer in litt. 2014).

On the island of Príncipe in the Gulf of Guinea, long-term population declines were reported by local residents (Juste 1996, Fahlman 2002). A recent recovery in the population following the national ban on parrot trade has been inferred from repeat counts made in 2003 and 2012 (S Valle unpublished data).

In E Africa, populations are declining or have disappeared altogether. In Uganda, surveys conducted in 2002–2003 report populations as small, fragmented and likely to fragment even further as the forest is threatened with further degradation (Amuno et al. 2007). Jackson and Sclater (1938) described them as plentiful in Entebbe and very common in Busoga but they are now scarce in both localities (D Pomeroy in litt. 2012). Their current range is much less extensive than implied by early descriptions (Carswell et al. 2005). In Kenya they are restricted to a single forest fragment of only 230 km^2 (Kakamega), but were previously more widespread (Lewis and Pomeroy 1989). The remaining population in Kakamega has reportedly declined by as much as 30–49% since c. 2001 (I Madindou and R Mulwa pers. obs.). In Rwanda, they are restricted to a few forest fragments, the largest of which is Nyungwe where populations were described as having undergone a sharp decrease in the 50 years prior to 1990 (Dowsett 1990). In Tanzania they are restricted to an extremely small population in the far NW of the country and a reintroduced population on islands in Lake Victoria (N Baker in litt. 2011).

Although data are lacking for large areas of the Congo Basin, if the declines in Cameroon, Ghana, Nigeria and E Africa are consistent throughout their range, then a decline of 30–49% in three generations (47 years) appears a highly conservative estimate (as speculated by BirdLife International 2013a).

Threats

Historically, this species has been among the most traded of bird species listed on CITES Appendix II. Reported exports of wild-caught *P. erithacus* and *P. timneh* (the vast majority *P. erithacus*) between 1975 and 2010 totaled 1 227 963 individuals (UNEP-WCMC 2013). Mortality from capture to export has been estimated at 40–50% in DRC (Fotso 1998b), 60–66% in Nigeria (McGowan 2001) and 30–50% in Cameroon (Fotso 1998a). Taking account of a 40–60% mortality rate between capture and export, the total number of birds taken from the wild could approximate 1.7–2 million. Some estimates suggest that c. 21% of the wild population has been harvested annually during some periods (BirdLife International 2013a), although this seems unlikely to hold throughout their range. Trapping for the wild bird trade has been implicated in declines throughout their range (CITES 2006b), including Burundi (D Bizimana pers. obs.), Cameroon (Fotso 1998a; Tamungang and Cheke 2012; KS Bobo pers. obs.), Côte d'Ivoire (M Waltert pers. obs.), DRC (Fotso 1998b; T Hart in litt. 2011), Ghana (LH Holbech pers. obs.), Kenya (I Madindou and R Mulwa pers. obs.), Nigeria (McGowan 2001; P Hall pers. obs.), and São Tomé and Príncipe (Inskipp et al. 1988; Juste 1996; Fahlman 2002). Bans on the importation of wild-caught birds in the USA and European Union, which were historically the largest importers, have coincided with a reduction of the number of export permits being issued. Internal trade in live parrots for pets, exhibitions, the bushmeat trade and for medicinal/ceremonial purposes is also a threat (Fotso 1998a; McGowan 2001; Clemmons 2003; Eniang et al. 2008; Tamungang and Cheke 2012). Fa et

al. (2006) estimated 112 carcasses of *P. erithacus* were consumed per year in rural areas of the Cross-Sanaga-Bioko rivers region. In Cameroon, one of the primary threats is poor management and security within protected areas (Tamungang and Cheke 2012). In Accra, Ghana, the number of *P. erithacus* for sale in markets has reduced in recent years, and has been replaced by more common species such as *Poicephalus senegalus* (LH Holbech unpublished data), possibly reflecting declines in wild populations. However, roadside sales of *P. erithacus* still occur in Accra (LH Holbech pers. obs.).

Deforestation has also impacted, and continues to threaten, many populations. There is a positive relationship between the status of the species and the status of primary forest (Dändliker 1992b) – where the forests are declining, so also are *P. erithacus* populations (Clemmons 2003). Population densities are reportedly higher in more pristine habitats in Príncipe (Juste 1996) and Cameroon (Tamungang and Cheke 2012). Between 2000 and 2010 rates of deforestation in the range states of *P. erithacus* and *P. timneh* averaged 8.3% (FAO 2012), with Nigeria and Cameroon having among the highest reduction in forested area over that period, losing 48% and 18% respectively (FAO 2012). Tamungang and Cheke (2012) suggest that the major threat to populations in Cameroon is not the lack of suitable forest habitat, but rather habitat fragmentation and degradation of keystone habitat resources (e.g. nest cavities and roost sites). All roost sites monitored in Cameroon had significant anthropogenic pressure and were under threat of removal, most of which were planted palm trees (Tamungang and Cheke 2012). In Ghana the timber industry targets the same tree species as those used for nesting parrots (N Annorbah pers. obs.).

Research and conservation: overview

Following concerns over the impact of trade on populations CITES export quotas have been reduced to zero in many countries. In 2007 the CITES Animals committee recommended a temporary moratorium on exports from Cameroon and lowered quotas for DRC (5 000 per annum) and the Republic of Congo. National export quotas have frequently been exceeded (from 1994 to 2010, a total of 109 896 specimens of *P. erithacus* were traded in excess of national quotas) and Cameroon and DRC have continued to exceed quotas since 2007. Despite the ongoing population declines in Cameroon (Tamungang and Cheke 2012) the CITES Standing Committee approved an annual quota of 3 000 in 2012 as part of a species management plan involving regular population monitoring, improvements to enforcement, establishment of new protected areas, community empowerment projects, and increased collaboration with other range states. If implemented effectively and in its entirety this management plan may limit or even reverse current population declines, but considerable resources and regional collaborative effort is required and are currently lacking. The resumption of exports before all components of this management plan have been implemented will most likely lead to the ongoing erosion of populations.

Several populations have received research attention and although *P. erithacus* is relatively well known, compared to other parrots in the region, information on many aspects of its ecology are lacking. Little data currently exists on key life-history parameters in wild populations, with the exception of some records of breeding success from Ghana (Dändliker 1992b), Gabon (Brosset and Erard 1986), Príncipe (Naurois 1983) and Nigeria (McGowan 2001). Ongoing research in Príncipe (S Valle, S Marsden and N Collar) and Cameroon (S Tamungang and G Kougoum) aims to address this knowledge shortfall. Other aspects of ecology such as diet, habitat preferences and nest cavity characteristics are reported in Chapman et al. (1993), Tamungang and Ajayi (2003), Dallimer and King (2007) and Amuno et al. (2007, 2010). Aspects of the ecology and behaviour of urban populations are reported by Twanza and Pomeroy (2011). A detailed study of the status of West African populations and the ongoing impacts of trade and habitat change is currently underway and will inform future conservation initiatives (S Valle, N Annorbah, S Marsden and N Collar in litt. 2012).

Research and conservation: recommendations

- Establish population trends by repeating surveys in areas for which baseline data exists, such as the roost counts conducted in Ghana (Dändliker 1992b), DRC and Cameroon (Fotso 1998a, 1998b) and density estimates made using DISTANCE in Cameroon (M Waltert unpublished data)
- Establish status and distribution in countries in which recent data are currently lacking, particularly the Republic of Congo and the DRC, which still export large numbers each year and are experiencing high rates of forest loss and degradation
- Identify, monitor and protect vulnerable capture sites utilised by large numbers of *P. erithacus*, including communal roosts, 'salt mud' clearings and drinking sites
- Studies of habitat requirements, breeding ecology and life-history parameters
- Research into the scale and socio-economic context of trapping and trade (e.g. Eniang et al. 2008) to determine appropriate strategies for addressing illegal trade, such as the development of alternative livelihoods for trappers
- Ensure that trade restrictions are implemented at local and international level through promoting close collaboration between range states and the development of a regional management plan (e.g. Tamungang and Cheke 2012)
- Take actions to reduce international demand for the pet trade.

Psittacus timneh Timneh Parrot

Distribution and habitat

Psittacus timneh is restricted to the moist, western lowland tropical forests of Upper Guinea and adjacent open savanna woodlands from the Bijagós Islands of Guinea-Bissau (although absent from the mainland) east through S Guinea, Sierra Leone, Côte d'Ivoire and Liberia (Clemmons 2003). In Côte d'Ivoire it occurs eastwards at least as far as 70 km east of the Bandama river (Demey and Fishpool 1994).

Population and range trends

In Guinea, trappers interviewed in the early 2000s reported declines of at least an order of magnitude (Clemmons

2003). The maximum count for the only intact roost located at the time was 200 individuals, whereas 10 years previously the same roost was reported to contain 550–650 individuals (Dändliker 1992a), although observations were made at a different time of year (Clemmons 2003). Dändliker (1992a) estimated densities in Guinea of up to 0.3–0.5 individuals km^{-2} in the south of the region of Guinée Maritime and Guinée forestrière based on counts at roosts and conversations with local trappers. Clemmons (2003) found that at many locations where trappers previously claimed there were roosts, there were few or no parrots present. In 2006, surveys made from vehicles (covering 509 km in Guinée Maritime and 818 km in Guinée forestrière and driven at 50 km h^{-1}) and on foot (covering 21 km in protected areas including Pic de Fon, Bossou/Nimba and Ziama) did not record a single individual (Rondeau et al. 2007). Demey and Rainey (2004) similarly reported that they were not seen in the forests of Pic de Fon. Rapid surveys conducted in forest reserves in SE Guinea in November 2003 reported that they were encountered daily during three days spent in Déré forest reserve, which borders Côte d'Ivoire, present but not seen on most days during seven days spent in Diécké, which is close to the border of Nimba county in Liberia, and were not seen during six days spent in Mont Bero (Demey and Rainey 2006).

They are not found on mainland Guinea-Bissau, in spite of the high proportion of apparently suitable forest habitat. A survey of the islands in Bijagós Islands reported their presence on nine out of the 15 islands surveyed (Clemmons 2003). The island of João Vieira in João Vieira NP supports the largest breeding population in Guinea-Bissau (P Catry in litt. 2013).

In Liberia, they were once described as occurring commonly throughout most parts of the country (Bannerman 1951), but were more recently described as locally common, rare in the N and NW areas and lacking in some coastal areas (Gatter 1998). They appear to have become extinct from the forests on and near Mt Nimba in Nimba County, Liberia; surveys between 2008 and 2011 in the East Nimba Nature Reserve and nearby forest failed to find the species, and there was no indication from locals that they have been present in recent times (Dowsett-Lemaire and Phalan 2013). The species was surprisingly scarce in the Nimba area as early as the 1970s (Colston and Curry-Lindahl 1986). Rapid surveys (5–8 days spent in each location) conducted in 2005 reported that they were encountered most days in North Lorma National Forest, encountered daily in Grebo National Forest and were present but not encountered most days in Gola National Forest (Demey 2007). In Zwedru forest, they were seen or heard almost daily in low numbers (maximum group size of four) in 2013 (Phalan et al. 2013).

In Sierra Leone, surveys conducted in 2005 and 2007 in the Gola forest area and Tiwai island reported them as frequent in primary and secondary forest, forest edge and farmbush particularly in NE parts of Gola forest (Klop et al. 2010). Additional surveys conducted in the Gola Forest reserve in 2006 observed them on 27 out of 32 days, 14 out of 15 days spent in Gola East, twice during 4–5 days spent near Belebu and daily NE of Lalehun (Dowsett-Lemaire and Dowsett 2007). They were mostly observed in pairs with an exceptional group of 11 at Sileti.

In Côte d'Ivoire surveys conducted between 1999 and 2002 in Taï NP indicate declines and complete disappearance from considerable portions of the forest, particularly close to human habitation (M Waltert pers. obs.). Until 1991 they were found in all areas of the NP (Gartshore et al. 1995), suggesting a rapid reduction of the population in areas where hunting pressure is high (M Waltert pers. obs.).

Threats

In combination with *P. erithacus* this species was one of the most heavily traded on CITES Appendix II. Between 1982 and 2011, 191 837 wild-caught birds were recorded in international trade (UNEP-WCMC 2013). At the peak of the trade, annual exports from Guinea of up to 11 000 exceeded the estimated wild population at that time (Dändliker 1992a). Large numbers have continued to be exported in excess of CITES agreed quotas and, following a 2007 moratorium on exports in wild-caught *P. timneh* (in all range states), there was a switch to exporting with invalid or fraudulent permits for 'captive-bred' parrots (CITES 2012a). The sustained large volume of exports in Guinea despite small local populations, and that many of the exported birds were of *P. erithacus* of which Guinea is not a range state, highlights that significant numbers of parrots are moved between countries in the region and the need for regional cooperation in trade regulation. Ongoing levels of capture to supply local and international markets are largely unknown but illegal capture is still suspected to be the primary threat to species survival in Liberia (F Molubah in litt. 2012; J Garteh pers. obs.). Some local trade exists and roadside sales occur openly in Monrovia (Phalan et al. 2013).

Populations are declining in areas where old-growth forests are declining (Clemmons 2003). In Guinea and Guinea-Bissau, the preferred species of nesting and feeding trees are also preferred timber species and forests are being cleared for rice cultivation, hydroelectric projects and charcoal production (Clemmons 2003). By the early 1990s, it was estimated that 77% of the Upper Guinean forest had been destroyed (Allport 1991). Forest loss continues to occur throughout much of their range (UNEP 2008).

Research and conservation: overview

Clemmons (2003) outlined a regional management plan, including international workshops involving stakeholders, monitoring of population trends, and the development of educational and wildlife tourism initiatives. It was proposed that after five years, strategies for conservation and the potential for sustainable harvesting could be assessed. This plan is, however, yet to be implemented and, although a moratorium on all international trade has existed since 2007, exports have continued.

In comparison to *P. erithacus*, there is a paucity of information on the status of populations and aspects of their ecology and behaviour. Some information on roost and flock sizes exist for Guinea and Guinea-Bissau (Dändliker 1992a; Clemmons 2003) and density estimates and encounter rates exist for Côte d'Ivoire (M Waltert pers. obs.) and may provide baselines with which to assess trends.

Nest site characteristics and diet are reported by Dändliker (1992a) and Clemmons (2003).

Research and conservation: recommendations
- Establish population trends by repeating surveys in areas for which baseline data exists, such as the roost counts conducted in Guinea (Dändliker 1992a; Clemmons 2003) and density estimates made using DISTANCE in Côte d'Ivoire (M Waltert)
- Establish current status and distribution in all range states
- Establish range boundaries of *P. timneh* and *P. erithacus* in E Côte d'Ivoire to confirm allopatric separation
- Investigate habitat requirements, diet, breeding ecology and life-history parameters
- Research the scale and socio-economic context of trapping and trade
- Develop and implement a regional management plan (e.g. Clemmons 2003) including all stakeholders and the development of alternative livelihoods for trappers (F Molubah and J Garteh pers. obs.)
- Ensure that trade restrictions are implemented at local and international level through promoting close collaboration between range states.

Poicephalus robustus Cape Parrot
Distribution and habitat
Poicephalus robustus is endemic to an archipelago of Afromontane mixed *Podocarpus/Afrocarpus* forest patches in the S and E parts of South Africa. Their distribution consists of four disjunct populations centred on the Amathole Mountains (Eastern Cape), the Transkei highlands and coastal forest (Eastern Cape), S KwaZulu-Natal in the foothills of the Drakensberg Mountains, and the Magoebaskloof area of Limpopo province (Wirminghaus et al. 2002b). They roost almost exclusively in forest patches between 1 000 and 1 400 m (Wirminghaus et al. 2000a, 2001a) but will exploit commercial orchards and semi-urban areas for food (Skead 1964, 1971; Symes and Downs 2002).

Population and range trends
In 2012 the global population was estimated to be at least 1 189 based on simultaneous counts made from 72 locations throughout their range (Downs 2012). Annual counts have been made since 1999 at which time the population was estimated to be around 500 (Wirminghaus et al. 2000a). Five years later the population was later estimated to be less than 1 000 (Downs 2005a). The higher estimates made more recently may reflect differences in survey effort rather than subsequent population increases with less than 1 600 in the wild (C Downs in litt. 2013). The range of *P. robustus* was likely much wider in the past (Wirminghaus et al. 1999), with some speculation that they once extended as far west as the Knysna–Tsitsikamma forests (Gill 1968; but see Skead 1964). Populations have declined since the early 1800s due to the clearance of Afromontane forest and the selective logging of mature *Afrocarpus* (*Podocarpus*) *falcatus* and *Podocarpus latifolius* and *P. henkelii* trees for timber (Wirminghaus et al. 1999; Adie et al. 2013). Since 2010, local declines have reportedly occurred in Eastern Cape province, possibly as a result of an outbreak of *Psittacine beak and feather disease virus* (PBFDV) (RS Boyes unpublished data).

Threats
Afrocarpus and *Podocarpus* trees provide the majority of nest cavities (Wirminghaus et al. 2001b, Downs and Symes 2004) and their fruit forms the major part of the diet of *P. robustus* in KwaZulu-Natal and likely elsewhere (Wirminghaus et al. 2002b). The large-scale harvesting of mature trees and selective logging of dead and dying trees is likely to have played a role in driving historic population declines (King 1941; Cooper 1985; Downs and Symes 2004). Within protected areas there is concern over the lack of regeneration of *Podocarpus*, *Afrocarpus* and other indigenous trees (including *Celtis africana*, *Harpephylum caffrum* and *Olea europaea* subsp. *africana*) thought to be important for this species (Boyes 2012; Adie et al. 2013). Persecution throughout their range, due the perception that they damage commercial harvests of pecan nuts, resulted in hundreds of mortalities in the 1970s (Boyes 2011; C Symes in litt. 2012). In several areas there has been a reported increase in the number of parrots feeding in towns and orchards and there has been some speculation this reflects a decline in wild food sources (Symes and Downs 2002; Downs 2005a). Small numbers are suspected to be trapped or poached from nest cavities each year for the wild-caught bird trade (D de Villiers in litt. 2012; RS Boyes pers. obs.). Although little known in captivity, some aviculturists suspect their rarity may have led to an increase in demand (W Horsfield and S Wilkinson pers. comm. 2012) and current penalties may be ineffective (MR Perrin pers. obs.). PBFDV has been confirmed in three distinct populations (RS Boyes unpublished data) and, in concert with other environmental stressors, may be limiting population growth.

Research and conservation: overview
Estimates of the global population have been made annually since 1998 based on counts organised by the Cape Parrot Working Group. Variation in coverage due to different numbers of participating volunteers (200–300) and variable weather conditions means capacity to detect short-term population fluctuations is limited (Downs 2005a, 2012). The involvement of large numbers of the general public, particularly younger people, adds conservation value to the annual counts, raising the public profile of this species (Downs 2012). The second Southern African Bird Atlas Project (SABAP2) is providing an update of the distribution of this species and may identify changes since the first atlas was completed in the 1990s (Wirminghaus 1997a).

A number of aspects of its ecology have been investigated in the forests of S KwaZulu-Natal, including seasonal variation in diet in relation to the phenology of fruiting trees (Wirminghaus et al. 2001a, 2002a), courtship and parental behaviour and the growth and survival of nestlings (Wirminghaus et al. 2001b; Symes et al. 2004), characteristics of nest sites (Wirminghaus et al. 2001b; Symes et al. 2004), vocalisations (Wirminghaus et al. 2000b) and activity patterns (Wirminghaus et al. 2001c).

In the Amathole region, research concerning PBFDV has focused on identifying the origins of the viral strain circulating

in wild parrots (Regnard et al. 2014a) and investigating the links between viral loads and clinical signs (Regnard et al. 2014b). Wild birds, found suffering from the virus and too weak to fly, have been rehabilitated and released (RS Boyes unpublished data). A community-based conservation program has been established in the region, involving the planting of indigenous trees and the erection of over 600 artificial nest boxes. Investigation of patterns of nest box use may provide insight into the degree of nest site limitation. Previous attempts to induce *P. robustus* to use artificial nest boxes in KwaZulu-Natal and Limpopo were largely unsuccessful (Downs 2005b; L Strever in litt. 2012). The only known breeding attempt made in a nest box by this species was situated in a location where a natural nest cavity, previously used by a breeding pair, had been recently destroyed (Downs 2005b).

Several authors have recommended that *P. robustus* be recognised as a separate species (Clancey 1997; Wirminghaus et al. 2002a; Perrin 2005). This classification, however, is not accepted by some authorities on the basis that there is inadequate evidence that they are ecologically and morphologically distinct from nearby populations of *P. fusicollis suahelicus* (BirdLife International 2013a). Studies of populations of *P. f. suahelicus* in the eastern Soutpansberg foothills and the Luvhuvhu/Mutale river drainage lines in Limpopo province (South Africa) indicate that this taxon is restricted to woodland habitat and does not come into contact with populations of *P. robustus* in Afromontane forests c. 70 km further south (Symes et al. 2000; Symes and Perrin 2003a). However, observations in Malawi and NE Zambia indicate that montane forests are used by *P. f. suahelicus* in these areas (Dowsett-Lemaire 2004) and thus the inferred ecological separation of the two taxa in South Africa may be an artefact of current distributions. It has additionally been argued that genetic and morphological data indicate that *P. f. suahelicus* and *P. robustus* are sufficiently different to be considered a species (Perrin 2005). Preliminary genetic analyses were, however, inconclusive and additional analyses of samples from the area where the two taxa are in closest proximity in Limpopo province are currently underway (R Coetzer pers. comm. 2013). Additional research is investigating the use of genetic fingerprinting of captive birds to assist in the enforcement of laws controlling trade in wild-caught birds.

Research and conservation: recommendations

- Continue annual counts to monitor changes in populations and conduct additional research to determine relationship between count estimates and local population densities
- Survey distribution in areas that are currently inadequately covered by SABAP2, particularly in the E areas of Eastern Cape province (South Africa)
- Determine prevalence of BFDV, its impact on wild populations and the causes of a recent outbreak in Eastern Cape province
- Continue and expand community-based education and conservation projects
- Investigate the systematics of populations within South Africa and establish the relationship with *P. fuscicollis* to resolve current confusion over the taxonomy, which may impede conservation efforts
- Protect current roosting and nesting areas in all populations
- Review legislation to prevent illegal trading, possibly increasing the penalties in South Africa where current fines may be ineffective.

Poicephalus fuscicollis Brown-necked Parrot

Distribution and habitat

Poicephalus fuscicollis occurs in moist savanna woodlands, riverine forest and mangroves in a number of disjunct populations in West Africa and more widely across S central Africa (Juniper and Parr 1998). In West Africa, isolated populations of the subspecies *P. f. fuscicollis* are primarily found in the savanna of Ghana, Nigeria, Côte d'Ivoire and the mangrove forests of Gambia (Juniper and Parr 1998; Perrin 2005). In S central Africa the subspecies *P. f. suahelicus* is widely but sparsely distributed in mopane, mixed broadleaf, miombo or savanna woodlands, and riverine forests from NE South Africa, to Tanzania and Uganda in the N, and from E Angola through S DRC to the east coast of Mozambique (Juniper and Parr 1998; Symes and Perrin 2008). It has also been reported in evergreen montane forests in the DRC, Angola and Malawi (Dean 2000; Juniper and Parr 1998; Dowsett-Lemaire 2004). It has been speculated that the isolated population in NW Angola is an intermediate between the two subspecies due to the inconsistent colouration and proximity to each subspecies (Dean 2000).

Population and range trends

Poicephalus f. fuscicollis are uncommon throughout their range in West Africa and populations are highly fragmented. They have been described as rare in Liberia (Gatter 1998) while in Ghana they occur in a number of localities within the forest/savanna transition zone and the richer woodlands of the north, with a few records in the rain forest (Dowsett-Lemaire and Dowsett 2014). Although more widely distributed, the status of populations of *P. f. suahelicus* varies considerably. They are reported to be stable and widespread in Zambia (Dowsett et al. 2008; L Roxburgh in litt. 2012; R Tether in litt. 2012), but restricted to small patches of fragmented woodland habitat further north in Burundi (D Bizimana pers. obs.), sparse in N Botswana and uncommon in Angola (Perrin 2012). In Malawi, where they were once widespread, they have disappeared from the SE and numbers are decreasing elsewhere (Dowsett-Lemaire and Dowsett 2006). They are widely distributed in SW and SE areas of Tanzania (Baker and Baker 2014) but populations have declined significantly (Perrin 2012). At the southern limit of their range in South Africa, populations are confined to the N Kruger National Park, with seasonal incursions further SW within Limpopo province (Symes and Perrin 2003a).

Threats

Populations of *P. f. fuscicollis* are likely impacted by capture for the pet trade both past and current. Between 1975 and 2011, 9 127 wild-caught individuals were exported, of which Guinea exported more than 50% (UNEP-WCMC 2013). They were often exported along with shipments

of *P. erithacus* and *P. timneh*, although not in the same volumes. Exports to emerging markets in Russia and the Far East have increased in recent years (UNEP-WCMC 2013). In Nigeria, they are also considered threatened by commercial logging, wood harvesting and land conversion for agriculture (M Shiiwua in litt. 2012) and similar processes are likely to threaten populations elsewhere.

Between 1975 and 2011, 7 116 wild-caught *P. f. suahelicus* were exported with the majority (>75%) coming from Tanzania before 2000 when trade was banned (UNEP-WCMC 2013). The threat of legal trade may have declined as reported exports are now low (UNEP-WCMC 2013), but local trade may threaten some populations and roadside sales remain common in Zambia (L Roxburgh in litt. 2012; R Tether in litt. 2012; RS Boyes pers. obs.). Habitat destruction, particularly loss of mature trees with nest cavities, is an additional threat for *P. f. suahelicus* in parts of S and E Africa (L Roxburgh in litt. 2012; R Tether in litt. 2012; D Bizimana pers. obs.). Poaching activity was considered the primary threat to populations outside of protected areas in South Africa particularly as nest cavities are destroyed in the process of removing chicks from nests (Symes and Perrin 2004a).

Current status of conservation and research

The ecology and population status of *P. f. fuscicollis* remains very poorly known and to our knowledge there are no research or conservation efforts targeted at populations in West Africa. Multiple aspects of the ecology of *P. f. suahelicus* have been researched at the S limit of their range in NE South Africa. These include aspects of breeding biology (Symes and Perrin 2004a), seasonal movement patterns (Symes and Perrin 2003a), daily activity patterns (Symes and Perrin 2003b), diet (Symes and Perrin 2003c), behaviour and vocalisations (Symes and Perrin 2004b) and habitat preferences (Symes and Perrin 2008). Observations of seasonal movements and diet made over multiple breeding seasons in Zimbabwe are reported by Fynn (1991). Bird atlases of Botswana, Malawi, Mozambique, South Africa, Zambia and Zimbabwe provide systematically collected distributional data, which could be used with historical records to determine population trends. In Tanzania an ongoing project bird atlas project is yielding similar data (Baker and Baker 2014). Structured bird monitoring taking place in Kasanka NP (Zambia) aims to detect changes in populations (F Willems in litt. 2012).

Recommendations

- Determine distribution, status and degree of isolation of populations throughout their range, prioritising isolated populations of *P. f. fuscicollis* in West Africa, which are poorly known and could be threatened
- Repeat historical distributional surveys where atlas data exist for *P. f. suahelicus* to determine population trends
- Investigate systematics of subpopulations and resolve ambiguities in the taxonomic affinity to *P. robustus* in South Africa
- Investigate the impact of trade on populations and the extent to which permitted trade in *P. fuscicollis* affects the much rarer but morphologically similar *P. robustus*.

Poicephalus gulielmi Red-fronted Parrot

Distribution and habitat

Poicephalus gulielmi occurs predominantly in primary and secondary moist forest in several disjunct populations in West, central and East Africa. They are more common in disturbed forest feeding on the seeds of pioneering species. The subspecies *P. g. fantiensis* largely inhabits lowland forest areas in E Liberia (Gatter 1998), S Côte d'Ivoire and SW Ghana (with the known exception of the closed-canopy forests of Ankasa and Cape Three Points; Dowsett-Lemaire and Dowsett 2014). *Poicephalus g. gulielmi* inhabits the forests of the Congo River basin, including SW Uganda to N Angola and extreme SE Nigeria and S CAR. In Angola they have been noted to occur in secondary and coffee forest (Dean 2000). *Poicephalus g. massaicus* inhabits *Podocarpus* and *Juniperus* forest fragments in the highlands of central and W Kenya and N Tanzania (Jackson and Sclater 1938) from 1 800 to 3 250 m (Lewis and Pomeroy 1989).

Population and range trends

In West Africa, field surveys in the Western Region of Ghana indicate populations have declined since the 1990s (LH Holbech pers. obs.) and major declines are suspected to have occurred since the 1970s (LH Holbech pers. obs.), although quantitative assessments are lacking. Even within protected areas such as Bia NP and Bia Resource Reserve, populations have declined (Dowsett-Lemaire and Dowsett 2014). Little is known of the status of populations in Côte d'Ivoire, where they were described as 'rare' in the 1980s (Thiollay 1985), and few reported sightings exist prior to 1990 (Demey and Fishpool 1991). In Liberia, in the late 1990s, they were described as 'uncommon' with much of their original habitat having disappeared (Gatter 1998).

Throughout much of the Congo basin this species is poorly known, particularly in the Republic of Congo and DRC, which likely constitute a large proportion of their range. In Cameroon, declines in numbers have been reported, especially in and around Korup NP in the SW region but also in around Lobéké, Boumba-bek and Nki NPs in the south-east (KS Bobo pers. obs.). In Gabon they have been described as 'fairly rare' (Collar 1997) and in Angola as 'uncommon' (Dean 2000). At one time they were known to occur as far south as Cuanza Norte and Malanje in Angola (da Rosa Pinto 1983) but its continued presence in those areas needs verifying.

In the highlands of East Africa the subspecies *P. g. massaicus* has been described as locally common and widespread Collar (1997) but Kenyan populations that were once plentiful were reportedly in decline by the late 1980s (Lewis and Pomeroy 1989). Populations in Tanzania are restricted to the montane forests on Kilimanjaro, Meru, Kitumbeine and the Crater Highlands (Baker and Baker 2014) and populations have likely declined in line with deforestation in those areas.

Threats

Levels of international trade are a continuing concern. Between 1975 and 2010 permits for the export of 61 648 individuals from Africa were issued (UNEP-WCMC 2013). Recent declines in reported exports of wild-caught birds

in some countries have been offset by sharp increases in exports of birds, reported as 'captive bred', in others (e.g. Guinea, Senegal and South Africa). Since 2007, no permits for export have been issued from Liberia, Côte d'Ivoire or Ghana, but substantial numbers have been exported from neighbouring countries where this species does not occur in the wild, notably Guinea (2 932 between 2008 and 2010) and Mali (640 between 2008 and 2010) (UNEP-WCMC 2013). CITES does not know of any commercial captive breeding of CITES-listed species and thus exports from Guinea are considered to be based on invalid and fraudulent permits (CITES 2012a). Local trade within Ghana is thought to have diminished (LH Holbech pers. obs.) and they are now only occasionally seen for sale in Accra (Dowsett-Lemaire and Dowsett 2014). This apparent decline may reflect a reduction in wild populations. The DRC has historically been the largest exporting nation, with 20 415 individuals since 1989. Export levels from DRC remain high and an export quota of 3 000 was proposed for 2012 (CITES 2012b). Concerns of the impact of trade on populations in Tanzania in the 1990s prompted CITES to conduct a Review of Significant Trade and implement zero export quotas (CITES 2001).

Due to their reliance on forest habitat, deforestation and forest degradation are likely the principle threats in the long term. Within range states in West Africa, little primary forest cover remains and deforestation rates between 2005 and 2010 were among the highest in the tropics (FAO 2010a). Between 1990 and 2010 the forested areas in Ghana were reduced by 33% (FAO 2010b). Even within protected areas, subsistence farming and illegal logging has degraded forest habitat, and several forest reserves have been converted to teak *Tectona grandis* plantations (F Dowsett in litt. 2012). Although they reportedly occur in logged and coffee forests where large dead trees remain (Gatter 1998), it is unclear whether these habitats can sustain populations in the long term.

In East Africa, the highly fragmented nature of the highland forest habitat increases the risk of local extinctions, which may have occurred in some areas. High levels of trapping in Tanzania, in which this species has a very restricted range, led to speculation that they may disappear from some areas, in particular the slopes of Mt Kilimanjaro where trapping reportedly occurred year round (Collar 1997), but recent surveys confirm their continued presence in this area (Baker and Baker 2014).

Research and conservation: overview

A number of studies of the range and population in West Africa have taken place or are ongoing. Ornithological surveys of protected areas conducted in 2005 by the wildlife division of the Ghanaian Forestry Commission provide basic information on the status in protected areas and an atlas describing their distribution in Ghana has recently been completed (Dowsett-Lemaire and Dowsett 2014). Field surveys in Ghana's Western Region have been ongoing since 1990 and may present an opportunity to quantify population trends over the past 20 years (LH Holbech pers. obs.). In Côte d'Ivoire a survey of birds in Taï NP, a UNESCO Biosphere reserve and one of the largest and least disturbed remnants of Upper Guinean rainforest, was conducted between 2000 and 2001 providing a baseline against which population changes could be assessed (M Waltert unpublished data.). In 1988 a flock of 35 was reported on the edge of the Parc National de la Maraoué close to the coast (Holyoak and Seddon 1990).

In Cameroon, presence–absence data were collected at Important Bird Areas (IBAs) and during the initial stages of a bird atlasing project between 1999 and 2000 (KS Bobo pers. obs.). To our knowledge no other data on central African populations exists.

In East Africa past distributions are described in atlases of Kenya (Lewis and Pomeroy 1998), Uganda (Carswell et al. 2005) and Tanzania (Baker and Baker 2014). Populations and distributions elsewhere in the region have been poorly described.

There have been almost no systematic studies of the basic ecology and habitat requirements of this species, in particular the degree to which they depend on primary forests. For the W and central subspecies (*P. g. fantiensis* and *P. g. gulielmi*), a number of records of feeding behaviour are summarised by Collar (1997), Forshaw (1989) and Juniper and Parr (1998), but details on breeding ecology are scant. For E Africa a study of *P. g. massaicus* conducted in 1971/72 in N Tanzania described nest characteristics and breeding behaviour at 18 nests and clutch sizes from two (Morgan-Davies and Peterson 1976, Walters 1976).

Research and conservation: recommendations

- Survey current distribution and collation of data on historical distribution to assess recent range changes. Efforts should focus on areas where recent data on distribution is unavailable (for *P. g. fantiensis* this includes Côte d'Ivoire and to a lesser extent E Liberia, and for *P. g. massaicus* Kenya and Uganda). As there is little recent distributional data for *P. g. gulielmi* surveys of all areas of the Congo basin where it is suspected to occur would be of value to resolve ambiguity over the distribution in this region
- Analyse existing data from field surveys, which could provide insight into population and range trends with little additional field effort (e.g. the Western Region of Ghana and Taï NP in Côte d'Ivoire)
- Research the habitat requirements of each subspecies, particularly the extent to which they are dependent on primary rainforest and whether modified forest habitats outside of protected areas, such as coffee forest and selectively logged areas, can sustain populations. In this respect data on nesting and dietary requirements/preferences would be valuable to determine priority areas for conservation
- Identify and establish monitoring programmes for key populations, particularly within protected areas (e.g. Taï NP in Côte d'Ivoire and Bia NP/RR in Ghana)
- Investigate the origin of birds exported from countries in which this species does not occur in the wild and from which exports have recently increased, notably Guinea, South Africa and Mali
- Investigate the size, impact and socio-economic context of domestic trade, particularly in W and central Africa
- Research the systematics and phylogeography of the three currently recognised subspecies, especially with regard to ecological and genetic differentiation.

Poicephalus flavifrons Yellow-fronted Parrot

Distribution and habitat

Poicephalus flavifrons is endemic to Ethiopia, occurring predominantly between 1 150 and 3 200 m (Ash and Atkins 2009) in forested areas in the central and W regions, with some isolated populations in the north. Greatest densities are found in *Juniperus–Podocarpus* and *Hagenia* forests in highland areas (Ash and Atkins 2009). They also occur where there are *Ficus* trees in light woodlands, and acacia savannas along riverine forests (Ash and Atkins 2009; Redman et al. 2009; Y Abebe pers obs.).

Population and range trends

Population declines and local extinctions have occurred in a number of areas (Boussekey et al. 2002, 2004; M Boussekey in litt. 2012; Y Abebe pers. obs.), but data on the overall magnitude of declines are lacking. Prior to the 1980s, they were described as occurring frequently in the Entoto range north of Addis Ababa but major decreases, in line with observed reductions in suitable habitat in this area, have reportedly occurred (Y Abebe pers. obs.). Declines since the late 1980s have similarly been reported in the Bale Mountain NP (Y Abebe pers. obs.), although flocks of over 50 parrots can still be observed nearby where suitable habitat remains (M Wondafrash pers. obs.). In some areas (e.g. Wondo Genet) declines have occurred over the past five years (Y Abebe pers. obs.).

Threats

Due to their dependence on forested areas and the high rate of deforestation in many areas of Ethiopia, habitat loss is likely to be the principal threat. There are several areas where their presence has been recorded in the past, but now all trees have been removed and no parrots remain (M Boussekey in litt. 2012). Between 1990 and 2010 the extent of forest in Ethiopia declined by 18.6% (FAO 2010c). Habitat modification threatening *P. flavifrons* is driven by a combination of continued pressure from rural populations, who clear trees for agriculture, to make charcoal and for construction (Boussekey et al. 2002), and commercial logging, particularly in moist forest areas. More recently, land clearance for large-scale commercial farming of tea, coffee and palm oil has occurred, especially in S Ethiopia (Y. Dellegen in litt. 2012). There is little direct exploitation of *P. flavifrons* for food or for the domestic or international caged-bird trade. They are reportedly perceived as crop pests in some areas, particularly in N Ethiopia, and may be persecuted as a consequence.

Research and conservation: overview

There has been no structured monitoring of any of the populations of this species and little data exist on their basic ecology. Field studies by Boussekey and colleagues in the early 2000s (Boussekey et al. 2002, 2004) established their presence in a number of sites in S and W Ethiopia and collected some of the first data on their basic ecology, including habitat preferences, diet and breeding behaviour (based on observations at a single nest). These data are unpublished and there have been no more recent studies. Little information exists on populations in N areas.

During assessments in 1995/96 they were recorded as present in eight IBAs (Fogera Plains, Entoto range, Menagesha State Forest, Metu Gore forest, Abijatta Shalla Park, Lake Awassa and Bale Mountains; EWNHS 1996, 2001), but there has been no subsequent monitoring in these areas.

The majority of Ethiopia's national parks have not been legally constituted and habitat degradation is ongoing in protected areas where this species occurs, such as Bale Mountain NP (Teshome et al. 2011). Two UNESCO Biosphere Reserves have recently been established in forested areas (EPA 2012), potentially conferring increased levels of protection.

Research and conservation: recommendations

- Survey current distribution. The approach used by Boussekey et al. (2002, 2004) in S and W Ethiopia should be extended to include more sites and other areas not included in these initial surveys, in particular isolated populations in N areas
- Assess recent changes in distribution and abundance; repetition of surveys carried out by Boussekey et al. (2002, 2004) would provide an indication of range and population changes in the core of their distribution over the past decade
- Identification of key areas for conservation through field surveys, research into species requirements (i.e. for feeding and breeding) and consideration of the socio-economic and legal situation
- Establish monitoring of key populations (e.g. Bale Mountain NP)
- Develop conservation initiatives in key areas to reduce rates of habitat degradation. As pressure from expanding rural communities is one of the primary threats to the parrots (Y. Dellegen in litt. 2012), initiatives involving the participation of local communities and developing alternative livelihoods (e.g. FZS 2007) are likely to yield the greatest benefits (Federal Democratic Republic of Ethiopia 2005).

Poicephalus cryptoxanthus Brown-headed Parrot

Distribution and habitat

Poicephalus cryptoxanthus inhabits forest-savanna and dry woodland in S and E Africa (Taylor and Perrin 2004, 2006a). The southern subspecies *P. c. cryptoxanthus* occurs from extreme NE South Africa to E Swaziland, SE Zimbabwe and in Mozambique south of the Save river (Juniper and Parr 1998; Parker 1999). The subspecies *P. c. tanganyikae* occurs in N Mozambique, S Malawi, E Tanzania and SE Kenya (including the islands of Zanzibar, Pemba and Wasiri). The two subspecies are thought to come into contact in central Mozambique but their respective ranges in this region are unknown (Parker 2005). They favour areas with baobab *Adansonia* spp. and miombo *Brachystegia* spp., and also riparian forests, plantations and mangroves (Collar 1997). In central Mozambique the highest densities were found in palm woodlands (Parker 2005).

Population and range trends

Although historically widespread, local declines have been reported and may be occurring in multiple areas throughout

their range. For *P. c. cryptoxanthus* range contractions and population declines have been reported at the S and W range margins. Comparisons of the distributions recorded by two consecutive bird atlas projects in S Africa, SABAP1 (which took place between 1987 and 1991; Wirminghaus 1997a) and SABAP2 (which commenced in 2007; SABAP2 2013) indicate range contractions over the last 20–25 years. Within South Africa they have disappeared from areas where they were formerly described as 'common' (Woodward and Woodward 1897; Wirminghaus 1997b) and they are now largely restricted to protected areas, principally Kruger NP (S Taylor pers. obs.).

Bird atlases of S and central Mozambique describe them as a very common resident of woodlands (Parker 1999, 2005). Data used to compile the bird atlas for S Mozambique was largely collected between 1994 and 1998 (Parker 1999) and for the atlas for central Mozambique between 1992 and 2003 (Parker 2005). Parker (1999) estimated densities in the four major woodland types using line transect methods and used these to produce population estimates of 20 000 individuals in S Mozambique and 10 000 individuals in central Mozambique. However, he acknowledged that these density estimates were too crude to establish accurate measures of absolute densities and intended these data were used for density comparisons between woodland types and not population estimates (Parker 1999). Furthermore, since these estimates were made, populations have likely been impacted by a number of threats and are now out of date. Reductions have taken place in parts of S Mozambique and they are now absent from some areas. In 2000, a local parrot trader reported that numbers had declined to the point that trapping for trade was no longer economically viable (S Taylor pers. obs.). A field trip in 2012 failed to find any individuals in areas where they previously occurred (RS Boyes pers. obs.).

In S Malawi the subspecies *P. c. tanganyikae* was previously described as common in acacia woodland (Williams 1963) but they have disappeared from some areas in which they were formerly present, including Blantyre and Zomba (Likangala river) (Dowsett-Lemaire and Dowsett 2006). In SE Tanzania, they reportedly remain widespread but range contractions may be occurring away from the core of its range (Baker and Baker 2014). They persist on the island of Pemba but no recent records exist from Zanzibar (Baker and Baker 2014). In SW Kenya, Lewis and Pomeroy (1989) found them to be 'uncommon' in areas where they had been described as 'common' in 1920, suggesting population declines over this period.

Threats

In the south of their range they are threatened by a combination of habitat destruction and trapping for the pet trade. In South Africa, populations within protected areas (principally Kruger NP) are likely stable but, outside of these confines, the development of agriculture has led to the degradation of suitable habitat (S Taylor pers. obs.). In some areas they may also be persecuted as crop pests as they are thought to raid orchards and nut plantations as well as grain crops such as maize and sorghum (Wirminghaus 1997b). In Mozambique, habitat degradation, driven by commercial logging for hardwoods and demand for charcoal in urban areas, is particularly pronounced in central regions (Parker 2005). Parker (1999) describes an expanding local trade in wild-caught birds and suggests *P. cryptoxanthus* is possibly the most popular among illegally traded birds. The majority of trapping for both local and international trade occurs in S Mozambique (Parker 2005) but substantial numbers are currently sold in markets in central Mozambique (RS Boyes pers. obs. 2012). It has been estimated that 2 600–5 200 are sold locally each year and that this level of trade is driving population declines (Taylor and Horsfield 2001). Between 1975 and 2010, 14 274 export permits were issued (UNEP-WCMC 2013). The majority of these exports were from Tanzania between 1985 and 1995 and from Mozambique between 1990 and 2005. Seizures made at the South African border indicate the existence of illegal exports in excess of figures reported to CITES (Parker 1999). Exports have declined from most countries and permits for only 86 were issued between 2005 and 2010. The market for wild-caught *P. cryptoxanthus* in South Africa has reportedly declined and local demand is currently met largely through captive breeding (M Perrin pers. obs. 2012).

Current threats in the north of the range (N Mozambique, Malawi, Tanzania and Kenya) are poorly known but the expansion of commercial-scale agriculture and pressure from rural communities, particularly for charcoal, is likely driving the loss of large trees important for nesting and feeding. There are anecdotal reports of breeding in introduced *Eucalyptus* spp. trees and large flocks (100+ individuals) using commercial coconut plantations in central Mozambique, raising the possibility that populations may be robust to some aspects of land-use change (Parker 1999; RS Boyes pers. obs. 2012).

Research and conservation: overview

In the south of their distribution, a repeat of the first Southern African Bird Atlas Project is beginning to provide data on range changes in South Africa, although Zimbabwe is not covered by this second initiative. Historical distributional data collected during the 1990s in S and central Mozambique (Parker 1999, 2005) and the 1980s in Kenya (Lewis and Pomeroy 1989) provides a similar opportunity and in Tanzania an atlas describing their current distribution is in preparation (Baker and Baker 2014).

Research conducted in Kruger NP between 1997 and 1999 and in S Mozambique in 1997 focused on vocalisations (Taylor and Perrin 2005), diet (Taylor and Perrin 2006a) and breeding behaviour (Taylor and Perrin 2006b). No similar data exists for the northern subspecies *P. c. tanganyikae*.

Research and conservation: recommendations

- Assess range changes in South Africa using data available in the first and second Southern African Bird Atlases
- Survey current distributions in areas where previous atlases provide baseline data against which range changes can be assessed (i.e. SE Kenya, S Malawi, S Mozambique and SE Zimbabwe) and N Mozambique where distributions have not been previously determined
- Investigate the extent to which rapidly expanding human-modified habitats, such as coconut plantations, can

sustain populations, with particular reference to the extent to which these habitats provide adequate nest sites and food
- Investigate the extent to which this species damages crops and/or is perceived as a crop pest and persecuted as a result. If necessary, identify solutions to this human–wildlife conflict
- Investigate domestic trade, particularly the size, impact, socioeconomic context and regional differences in trade levels, especially in countries where domestic markets pose the greatest threat (i.e. Mozambique and Tanzania)
- Establish population monitoring and investigate the extent and causes of declines in protected areas in South Africa, which have occurred despite little human-induced habitat change.

Poicephalus crassus Niam-Niam Parrot
Distribution and habitat
Poicephalus crassus occurs in the Sudan-Guinea savanna biome in central Africa, although details of the precise distribution are very poorly known. Most of the range falls within the CAR with populations thought to extend into S Chad, SW Sudan, E Cameroon and extreme north of DRC. They occur primarily in wooded savanna, forest–savanna mosaic, gallery forest, mixed lowland savanna and waterberry (*Syzygium*)–*Adina* riparian woodland, often near water, up to 1 000 m (Collar 1997). The distribution does not approach the northern edge of the equatorial rain forest (Chapin 1939).

Population and range trends
The current status is uncertain as even the most basic data on distributions are lacking. Carroll (1988) described them as 'uncommon' in the Manovo-Gounda-Saint Floris NP in N CAR and in Lobaye in SW CAR. Cave and Macdonald (1955) described them as 'rare 'in SW Sudan, being recorded only a few times near Yambio.

Threats
Possible threats can only be speculated upon, but the principal threat is probably changing patterns of land use leading to habitat modification and the loss of large trees. Increasing numbers of cattle and associated burning practices are likely to be leading to the degradation of suitable habitat in some areas (Dowsett 2001) and clearance for agriculture may pose threats elsewhere. These processes are occurring even within formally protected areas. It is largely unknown in captivity and currently the pet trade is unlikely to be a major threat.

Research and conservation: overview
This species was described as the least known African parrot by Collar (1997). There has been no monitoring of any of the populations of this species and to our knowledge almost no basic data exist on aspects of their ecology, such as diet or habitat associations. They are known to occur in five IBAs, four of which receive some national protection. In N CAR, the Manovo-Gounda-Saint Floris NP is a UNESCO World Heritage Site and is managed by a European Union-funded programme (Dowsett 2001), and the nearby Bamingui-Bangoran is a UNESCO Biosphere Reserve.

Research and conservation: recommendations
- Determine the current distribution and status of populations
- Investigate basic ecology, such as habitat associations, diet and aspects of its breeding behaviour (e.g. timing and preferred nest sites), which may assist in assessments of the conservation of the species.

Poicephalus rueppellii Rüppell's Parrot
Distribution and habitat
Poicephalus rueppellii are endemic to N Namibia and S Angola, occurring predominantly in subdesert, dry grass steppe and arid woodlands below 1 500 m (Dean 2000) and at highest densities along the courses of ephemeral rivers (Jarvis and Robertson 1999) where larger trees, in particular *Vachellia erioloba* (*Acacia erioloba*) and *Faidherbia albida*, are found (Simmons and Brown 2012). In more arid areas, such as the Namib Desert, their distribution is restricted to watercourses (Simmons 1997). Further details on distribution and habitat preferences can be found in Simmons (1997), da Rosa Pinto (1983), Dean (2000), Sinclair et al. (2004), Simmons and Brown (2012), Selman et al. (2000, 2002, 2004).

Population and range trends
The Namibian population was estimated by Robertson et al. (1995) to be 9 700 (±3 915 SE) by combining reporting rates in the SABAP1 (Simmons 1997), with bird-density estimates based on detections on line transects. This estimate was later revised by incorporating data on variation in density with rainfall and altitude to 29 466 (±15 392 SE) (Jarvis and Robertson 1999). No more recent population estimates exist and no attempts have been made to estimate the population in Angola. Based on data from SABAP1, the total range has been estimated as 170 000 km^2 (Robertson et al. 1995). Estimates for the proportion of the total population that occurs in Angola range from 10% (Robertson et al. 1995) to 20% (Dean 2000). In Angola, in 2004 they were reported as quite common in Kissama NP, approximately 70 km south of Luanda (Sinclair et al. 2004).

Populations may be declining (Simmons and Brown 2012). Reductions in flock sizes since the 1980s have been reported from areas in the south of the range (Selman 1998, Simmons and Brown 2012, C Cohen in litt. 2012). On account of their restricted range and suspected decline, they are recognised as Near Threatened in the 2012 Namibian red data book (Simmons and Brown 2012).

Threats
Despite their protected status, illegal capture of wild parrots for the pet trade may be one of the biggest threats. Selman (1998) estimated that 1 000, and possibly many more, were exported annually to South Africa or Europe. Exports under CITES from Namibia have historically been low; the most permits issued in a single year was 90 in 1998 (UNEP-WCMC 2013). There are reports that some breeders in South Africa have previously accumulated large flocks (Gleuck 1994) and South Africa has been the largest exporter of this species, issuing permits for 7 175 individuals between 1994 and 2010 (UNEP-WCMC 2013).

It is illegal to capture or trade in wild birds in Namibia, but the fine for doing so may be inadequate in light of the retail value of this species (Selman 1998). Market prices have fallen in recent years (Simmons 2012), suggesting that illegal trade may have declined following reduced demand from the EU as a result of the 2007 ban on imports in wild birds (Perrin 2012). Protected areas, particularly Etosha NP, and in the Waterberg Plateau Park comprise c. 8% of the species total area of occupancy (Jarvis et al. 2001). Outside of protected areas, they are reportedly captured by farm labourers, sold on and smuggled across the border to South Africa (Selman 1998). Little information exists on trade in Angola.

Changes in habitat likely impact populations at least in parts of their range. Rüppell's parrots drink surface water regularly (Selman et al. 2000) and changes to the water table due to groundwater extraction may reduce the availability of surface water, and reduce survival in some areas (Selman et al. 2000). Bush encroachment is occurring throughout much of their range due to the removal of browsers (Selman 1998, Simmons 1995) and the harvesting of fire wood for local and regional use likely reduces the number of suitable nesting trees and limits regeneration along water courses.

In light of the importance of surface water for this species, changes in climate could be significant. Since 1979 summer rainfall has declined and annual mean surface temperatures in the region have increased (Morishima and Akasaka 2010). Future climate changes may exacerbate this pattern acting in concert with land-use changes.

Research and conservation: overview

A study of dietary and nesting requirements in N Namibia was made in 1996 and 1997 (Selman 1998, Selman et al. 2000, 2002, 2004). An attempt in Namibia to induce Rüppell's parrots to breed in nest boxes was unsuccessful (R Simmons pers. comm. 2012).

Selman (1998) proposed a review of wildlife trade legislation in Namibia and South Africa to resolve the problem of illegal trade. In draft versions of Namibia's Parks and Wildlife Management Bill (Ministry of Environment and Tourism 2004), *P. rueppellii* was identified as a specially protected species, providing legal protection for nesting and roosting areas through severe legal penalties and fines. The bill would also require that the population be maintained at viable levels. Despite over 10 years in development this bill is not yet gazetted. The Namibian red data book classification of Near Threatened confers no legal obligations, but serves to highlight its conservation status in Namibia and the need for further attention from conservation bodies.

In Namibia, the initiation in 2012 of SABAP2 should provide valuable up-to-date information on distribution, as well as range and population changes through comparisons with the distribution recorded in the first *Atlas of Southern African Birds* (Simmons 1997).

Research and conservation: recommendations

- Assess population and range trends in Namibia through (1) special focus by SABAP2 volunteers on areas where *P. rueppellii* were recorded during SABAP1 to investigate changes in range, and (2) repetition of surveys to estimate densities conducted in 1993 (Robertson et al. 1995) and 1996 (Jarvis and Robertson 1999) to investigate population trends
- Prevent illegal trade in Namibia, particularly with respect to international exports, achieved through (1) passing of the Namibia Parks and Wildlife Management Act followed by lobbying for severe penalties for transgressions, and (2) improvement of border controls, through improved training of staff and resourcing. This will be complemented by investigations of current illegal trade. Simmons and Brown (2012) propose infiltration of the black market (if it still operates) to determine who is funding and buying illegally caught birds
- Assess the current range and population in Angola; due to past civil unrest very little information is available for this species and substantial recent population declines are possible
- Depending on the findings of surveys, identification and protection of key habitats (i.e. nests, roosts and food trees) in Namibia and Angola through actions to limit degradation of habitat. Actions should be developed in consultation with current users of resources to mitigate potential conflicts of interests.

Poicephalus rufiventris Red-bellied Parrot

Distribution and habitat

Poicephalus rufiventris is endemic to East Africa, occurring from NE Tanzania and the Kenyan coast, to N Somalia. Usually associated with semi-arid vegetation, including dry bush areas and *Commiphora*–acacia steppe woodlands (Ash and Atkins 2009). In the south of their range they occur in the greatest densities in Baobab savanna *Commiphora* thornbush (Forshaw 1989) and in riverine woodlands. Further north in Ethiopia, they occur in acacia–*Chrysopogon* savanna up to 2 000 m (Benson 1945). Further discussions on habitat preferences and diet can be found in Archer and Godman (1961), Ash and Atkins (2009), Collar (1997), Forshaw (1989), Lewis and Pomeroy (1989) and Massa (1995).

Population and range trends

Few details of the current population size and distribution are available, particularly in N and E Ethiopia and N Somalia. In S Ethiopia it has been described as a 'fairly common' breeding resident (Ash and Atkins 2009) and populations as 'stable' (M Ewnetu pers. obs.). Frequent sightings have recently been reported both in and outside protected areas in Ethiopia (M Ewnetu pers. obs.). A detailed description of distribution in Kenya in the 1980s is provided by Lewis and Pomeroy (1989), where they were described as fairly common in dry wooded country but little recent information on which to assess population and range changes is available. Similarly, in Tanzania there is little information on which to assess past trends but an ongoing atlasing initiative is generating current distributional data (Baker and Baker 2014).

Threats

The principal threat is likely posed by habitat degradation and the loss of large trees, particularly due to increasing rural populations and expanding commercial logging and

farming (M Ewnetu pers. obs.). Although no recent population declines are suspected in Ethiopia, ongoing habitat loss may have significant impacts in the near future (M Ewnetu pers. obs.).

In the past, moderately high volumes of birds were taken from the wild for international markets. Tanzania exported over 16 000 individuals between 1983 and 1990 (Edwards and Broad 1996). Having peaked in 1986 the volume of legal trade has since declined and there have been no export permits issued in Tanzania since 2002 (UNEP-WCMC 2013). Exports from South Africa, which is not a range state for this species, have increased in recent years with 2 029 exported between 2006 and 2010 (UNEP-WCMC 2013).

Research and conservation: overview

Very little has been reported on aspects of their diet, habitat preferences or breeding biology. Some anecdotal observations of courtship behaviour in N Tanzania are reported by Massa (1995). Bird atlases describing their distribution were compiled for Kenya in the 1980s (Lewis and Pomeroy 1989), more recently in Ethiopia (Ash and Atkins 2009) and are ongoing in Tanzania (Baker and Baker 2014). They are present in a number of protected areas throughout their range, the largest of which is Tsavo East NP in S Kenya.

Research and conservation: recommendations

- Determine the distribution in Somalia and E Ethiopia where systematic data have not been reported
- Determine habitat requirements and potential impacts of land-use changes on populations, particularly in areas where commercial interests and rural populations are expanding and of concern (i.e. Ethiopia and Kenya)
- Assess levels of domestic and international trade and their potential impacts on populations.

Poicephalus senegalus Senegal Parrot

Distribution and habitat

Poicephalus senegalus occurs throughout the savanna woodland belt of West Africa in a variety of woodland habitats ranging from closed-canopy forest to open farmland with scattered palms and trees, from Senegal and S Mauritania in the west through to SW Chad, NE Cameroon and N CAR in the east. Seasonal rain-dependent movements occur in some areas (Rowan 1983). The subspecies *P. s. senegalus* occurs from Senegal, Gambia, Guinea, S Mauritania and S Mali to Burkina Faso and N Nigeria, and a small population, which was likely introduced, is known in Liberia (Gatter 1998). *Poicephalus s. versteri* occurs from W Côte d'Ivoire to SW Nigeria. A third subspecies, *P. s. mesotypus*, is recognised by some authors (e.g. Forshaw 2010) in NE Nigeria, adjacent parts of SE Niger, N Cameroon, extreme SW Chad and possibly extreme NW CAR, but others consider it as indistinguishable from the nominate form (Collar 1997; Sinclair and Ryan 2010).

Population and range trends

A number of historical accounts indicate that this species was once locally very common in areas of suitable habitat, e.g. N Nigeria, N Ghana and Senegal (Forshaw 1989). In the late 1980s, Benson et al. (1988) described populations as robust and that none of the subspecies appeared to be isolated or of obvious conservation concern. However, more recently there have been indications that populations have been declining in parts of their range. In Senegal, trappers reportedly had to travel further into E Senegal than previously to obtain stock (CITES 2006a). Concerns about population declines and the impacts of continued high volumes of exports prompted CITES to classify populations in Senegal, Guinea and Mali (the three largest exporting countries) as of possible concern (CITES 2006a). There have also been several reports by field ornithologists of local declines in the east of their range including S Niger (J Brouwer per. obs.), Nigeria (M Shiiwua in litt. 2012) and N Ghana where recent surveys report numbers in many areas now very small (Dowsett-Lemaire and Dowsett 2014). In Mali they have been recently described as common in Sudanian woodland and gallery forest in the south-west, from the Guinea border to Baoulé-nord and Pont-Bani (M Crickmore in litt. 2012). They are widespread in the northern savannas of Nigeria, particularly within protected areas (P Hall pers. obs.)

In some urban centres (i.e. around Accra in Ghana and Monrovia in Liberia), feral populations, possibly derived from the pet trade, have become established (Gatter 1998; Dowsett-Lemaire and Dowsett 2014; LH Holbech pers. obs.). Relatively high abundance close to human populations may mask declines elsewhere in its range.

Threats

Very large numbers have been captured and exported for the international pet trade and for much of the last two decades *P. senegalus* were among the most heavily traded of all CITES-listed birds (UNEP-WCMC 2013). Export quotas were regularly exceeded (CITES 2006a) and between 2000 and 2003 over 100 000 were exported from countries across W Africa (SSN 2004). Following a CITES Review of Significant Trade in 2006, 'cautious' annual export quotas were introduced as an interim measure (CITES 2006a). These interim quotas were not based on data for the status of this species or the impacts of trade and will likely need to be revised following future studies. Following this measure and a ban on the importation of wild-caught birds into the EU, reported exports declined (CITES 2012c). However, substantial numbers were still exported – between 2006 and 2010, 21 847 were exported from Mali, Guinea and Senegal. Recent confiscations in Guinea (C Senni in litt. 2012) indicate illegal trade persists and may occur under the guise of captive-bred birds. They are often seen for sale in bird markets and roadsides supplying domestic markets (Dowsett-Lemaire and Dowsett 2014; LH Holbech pers. obs.; J Brouwer pers. obs.).

As they are generally associated with more open, wooded habitats it has been speculated that the widespread loss of closed canopy forests, which have been converted to agricultural or savanna landscapes, may actually benefit populations (CITES 2006a). They are apparently well adapted to human-modified landscapes and frequent plantations (Dowsett-Lemaire and Dowsett 2014; LH Holbech pers. obs.) where they are perceived as pests (M Diop pers. obs.), particularly of ripening millet, maize and harvested

peanuts (Forshaw 1989), although this has not been investigated in detail.

Research and conservation: overview
Given the large numbers of birds that have been extracted from the wild there has been surprisingly little research into the status of populations and the impact of trade. The CITES Review of Significant Trade (CITES 2006a), recommended that a study be conducted into the impacts of trade on populations in Mali, Senegal and Guinea, which have historically been the largest exporters. However, to date no such studies have been initiated and interim quotas (as recommended by CITES 2011) remain in place.

There has similarly been little research into aspects of their ecology and there have been no systematic studies of their breeding biology, habitat requirements or seasonal movements. Some, largely anecdotal, observations of diet and timing of breeding are summarised in Forshaw (1989), Collar (1997), Juniper and Parr (1998) and Perrin (2012).

Monthly monitoring of numbers seen in savanna and gallery forest in Yankari NP in NE Nigeria has been taking place since 2007 (JD Onoja in litt. 2012).

Research and conservation: recommendations
- Determine the current distribution and collate data on historical distribution to assess recent range changes, particularly in countries in the west of their range from which large numbers of this species have been harvested for the international trade (i.e. Mali, Côte d'Ivoire, Senegal and Guinea). Similar surveys would be valuable in other countries where this species was once common but population declines due to domestic trade, illegal international trade and land degradation have been reported (i.e. Ghana, Nigeria and Cameroon)
- Investigate the size, impact and socioeconomic context of domestic and illegal international trade both as a pet and for use in traditional medicine
- Investigate seasonal movements and seasonal variation in patterns of habitat use
- Research systematics and phylogeography to determine the degree to which subspecies and populations, some of which could be threatened due to high levels of trade, should be recognised as units for conservation
- Depending on findings of research mentioned above it may be appropriate to develop conservation initiatives for key populations aimed at mitigating the impacts of habitat degradation and trapping for the pet trade.

Poicephalus meyeri Meyer's Parrot
Distribution and habitat
Poicephalus meyeri has the widest distribution of any parrot in Africa, extending from NE South Africa to NE Cameroon and S Sudan, throughout wooded habitats. They are most strongly associated with riverine forest galleries (e.g. *Syzigium–Adina* woodlands or *Diospyros–Garcinia* woodlands), dry savanna woodland (e.g. acacia–*Combretum* woodlands), miombo woodlands (e.g. *Brachystegia* woodlands), secondary growth around cultivation, and dry acacia scrubland with *Tamarindus* and *Adansonia* along river valleys (Rowan 1983; Forshaw 1989; Juniper and Parr 1998; Boyes and Perrin 2009a). The subspecies *P. m. meyeri* ranges from NE Cameroon to W Ethiopia and SW Eritrea. *Poicephalus m. saturatus* occurs in Uganda, W Kenya, Rwanda, Burundi and W Tanzania. *Poicephalus. m. matschei* occurs in Tanzania, N Malawi, SE Kenya, SE DRC and Zambia. *Poicephalus m. reichnowi* from N and central Angola to adjacent DRC. *Poicephalus m. damarensis* occurs in S Angola, N and central Namibia, and NW Botswana. *Poicephalus m. transvaalensis* occurs in Zimbabwe, NE Mozambique, SE Botswana and N South Africa (Juniper and Parr 1998; Boyes 2009).

Population and range trends
Historically, they have been described as common and widespread throughout their range (Mackworth-Praed and Grant 1952, 1962; White 1965; Mackworth-Praed and Grant 1970; Urban and Brown 1971; Benson et al. 1988; Lewis and Pomeroy 1989; Wirminghaus 1997c). However, many of these descriptions pre-date the loss of forest cover in range states (Kelatwang and Garzuglia 2006; Bodart et al. 2013), which may have driven population declines in multiple areas. Populations in Zambia, Burundi and Kenya are reportedly declining and becoming increasingly fragmented (L Roxburgh in litt. 2012; F Willems pers. obs. 2012; D Bizimana pers. obs.; R Mulwa pers. obs.). In South Africa, populations of *P. m. transvaalensis* have become sparse in areas in which they were described as 'abundant' over 100 years ago (Tarboton 1968; Rowan 1983). However, preliminary data indicates a degree of range expansion over the last 15 years (SABAP2 2013). They are absent from most of Mozambique with the exception of the Tete corridor where they have been described as 'common' (Parker 2005). During 100 hours and over 7 000 km of vehicle-based surveys in Botswana, Zambia, Tanzania and Malawi in 2009, only one sighting of Meyer's Parrot was seen outside of protected areas (RS Boyes pers. obs). However, atlas data from Tanzania indicates a wider distribution in central, N, W and NW areas (Baker and Baker 2014). Recent assessments and descriptions of the status of populations in many range states, notably in the N and W parts of its range are lacking.

Threats
Loss of habitat, especially large fruit-bearing hardwood trees in riverine habitat, is a major threat as these are considered critical resources (Boyes 2009; Boyes and Perrin 2009a). Deforestation and habitat changes in most range states has slowed since the 1990s (Kelatwang and Garzuglia 2006). However, increasing commercial logging, illegal charcoal production, cutting for fuel wood, and land conversion for agriculture still threaten many areas of habitat (UNEP 2008). Their nest cavity preferences are apparently specialised (Boyes 2009) making them potentially vulnerable to the removal of suitable nest trees (Boyes and Perrin 2010a).

Over 80 000 Meyer's Parrots have been exported from the wild since 1975 (UNEP-WCMC 2013). Recently, the threat of international trade in wild-caught *P. meyeri*, which breed easily in captivity, has declined, although local populations may be at risk in places (Boyes 2009). Local trade has been recorded outside of protected areas

in S Zambia and N Tanzania (RS Boyes pers. obs.) and is suspected to be causing a gradual population decline in Zambia (L Roxburgh in litt. 2012).

Persecution as a perceived crop pest occurs in some areas (Boyes 2009). In villages in Botswana and Zambia pest parrots have been observed being trapped in fishing nets (Boyes and Perrin 2009a; RS Boyes pers. obs.). Declines in South Africa over the last 100 years are thought to have been driven by persecution as a pest on citrus orchards, in combination with habitat destruction (Tarboton 1968; Rowan 1983).

Research and conservation: overview
Several aspects of their ecology have been systematically studied between 2004 and 2007 in the Okavango Delta (N Botswana), including temporal variation in diet and activity patterns (Boyes and Perrin 2009a, 2009b, 2009c), habitat associations (Boyes and Perrin 2010b), nest cavity preferences (Boyes and Perrin 2010a), parental behaviour, pair bond duration and reproductive success (Boyes 2009). Ongoing research in N Botswana is exploring patterns of artificial cavity occupation in relation to habitat variables and the presence of nest-site competitors to determine nest site limitation.

In South Africa and Namibia, the SABAP2 is providing an update of their distribution and will identify changes since SABAP1 (Wirminghaus 1997c). Atlas projects are also underway in Angola and Tanzania and historical distributional data exist in bird atlases for Botswana, Mozambique, Ethiopia, Kenya, Malawi, Uganda, Zambia and Zimbabwe.

Research and conservation: recommendations
- Determine current distribution in countries in central and W Africa for which no bird atlas data exist, particularly for the N subspecies (*P. m. meyeri*, *P. m. saturatus*, *P. m. matschei* and *P. m. reichnenowi*), which are poorly known
- Collate and compare historical records and recent atlas data to determine range changes
- Investigate their economic impact on crops and the degree to which persecution contributes to population declines
- Investigate systematics and phylogeography of subspecies together with the morphologically and ecologically similar taxa currently recognised as species, including *P. rueppellii*, *P. cryptoxanthus*, *P. crassus*, *P. rufiventris* and *P. senegalus.* These have previously been described together with *P. meyeri* as a 'super-species' complex (White 1965; Rowan 1983; Massa et al. 2000; Boyes 2009).

Psittacula krameri Rose-ringed Parakeet
Distribution and habitat
Psittacula krameri are widely distributed in the Sahelian zone from Mauritania, Senegal and Guinea-Bissau east through Mali, S Niger, N Côte d'Ivoire, N Ghana, Burkina Faso, Togo and Benin to N Nigeria and Cameroon, S Chad, N CAR, S Sudan to N Uganda, Ethiopia and W Somalia, a little north of the forest belt and are widely distributed in S Asia (Benson et al. 1988). They occur in a variety of woodland types, typically thorn scrub, but also light secondary moist forest, riparian woodland and mangroves, savanna grassland, open farmland with scattered trees, and parks and gardens in urban areas, usually below 2 000 m (Benson et al. 1988). The subspecies *P. k. krameri* occurs eastwards from Sene-Gambia intergrading with *P. k. parvirostis* in E Sudan and Ethiopia (Perrin 2012). Introduced populations have become established in a number of African cities including Durban, Johannesburg and Pretoria (South Africa), most probably as a result of the pet trade (Symes 2014).

Population and range trends
They have been described as common to abundant throughout their range in Africa and the Indian subcontinent (Collar 1997). Given they are clearly adaptable, having successfully colonised multiple areas outside of their natural range, populations are likely to be robust. However, there is a lack of recent information on the status of populations in Africa (Perrin 2012). Forshaw (1989) suggested that populations in Nairobi NP may represent a recent eastern extension of their range.

Threats
Local trade may threaten populations in some areas, particularly in W Africa where they are openly sold in local markets (M Sazhin in litt. 2012; J Brouwer pers. obs.; LH Holbech pers. obs.). Habitat change, especially the loss of large mature trees that provide nest sites, is occurring in many parts of their range (including Niger; J Brouwer pers. obs.), and is likely impacting populations in rural areas.

Research and conservation: overview
Although considerable research has been done on feral populations established in Europe, particularly in relation to competition with native cavity-nesting species (e.g. Strubbe and Matthysen 2007; Czajka et al. 2011), little is known about populations within their native range, including Africa.

Research and conservation: recommendations
- Determine the scale and impact of local trade on populations
- Determine the scale and impact of habitat modification on populations.

Research trends for parrots in Africa and Madagascar
There exists considerable variation in our knowledge of parrot populations in Africa and Madagascar (Table 1). While some populations, such as *Poicephalus robustus* in South Africa, have been the focus of a number of research publications and population monitoring, others such as *Poicephalus crassus* are known only from a handful of natural history observations. There has been a heavy bias towards research on populations in southern Africa; the sharp increase in the number of peer-reviewed publications concerning parrots in Africa since the year 2000 largely results from studies conducted in southern Africa (Figure 1). This bias is likely driven by greater research capacity, infrastructure and political stability in southern Africa compared with other regions.

There is a marked lack of published studies on species that have been highlighted as of conservation concern, notably those species on the IUCN Red List of Threatened

Table 1: Summary of research on the larger parrots of Africa and Madagascar

Scientific name	Common name	IUCN Red List[a]	Data on distribution and abundance (no. of range states)					Data on life-history and ecology			
			Range states occupied	Distribution data[b]	Density estimates[c]	Aggregation counts	Population monitoring	Nest productivity	Post-fledging or adult survival	Nest site characteristics	Habitat associations
Coracopsis vasa	Vasa Parrot	LC	1	0	0	0	0	Yes	No	Yes	Yes
Coracopsis nigra	Black Parrot	LC	3	1	1	1	1	Yes	No	Yes	Yes
Psittacus erithacus	Grey Parrot	VU	15	3	2	6	2	Yes	No	No	No
Psittacus timneh	Timneh Parrot	VU	5	1	0	1	0	No	No	No	No
Poicephalus robustus	Cape Parrot	LC[d]	1	1	0	1	1	Yes	No	Yes	No
Poicephalus fuscicollis	Brown-necked Parrot	LC	19	9	1	0	0	No	No	Yes	Yes
Poicephalus gulielmi	Red-fronted Parrot	LC	13	5	0	0	0	No	No	No	No
Poicephalus flavifrons	Yellow-fronted Parrot	LC	1	1	0	1	0	No	No	No	No
Poicephalus cryptoxanthus	Brown-headed Parrot	LC	7	6	1	1	0	No	No	Yes	No
Poicephalus crassus	Niam-Niam Parrot	LC	5	0	0	0	0	No	No	No	No
Poicephalus rueppellii	Rüppell's Parrot	NT	2	1	1	0	0	No	No	Yes	No
Poicephalus rufiventris	Red-bellied Parrot	LC	6	5	0	0	0	No	No	Yes	No
Poicephalus senegalus	Senegal Parrot	LC	16	3	0	0	1	No	No	No	No
Poicephalus meyeri	Meyer's Parrot	LC	19	12	1	0	0	Yes	No	Yes	Yes
Psittacula krameri	Rose-ringed Parakeet	LC	17	5	0	0	0	No	No	No	No

[a] LC = Least Concern, NT = Near Threatened, VU = Vulnerable

[b] Data published in bird 'atlases' or similarly systematic efforts to describe distribution

[c] Estimates made using distance sampling

[d] As this population is not treated as a distinct species from *Poicephalus fuscicollis* by the IUCN its status is listed as Least Concern; however, it has been argued that if treated as a distinct species it would fulfill criteria for Critically Endangered (Perrin 2012)

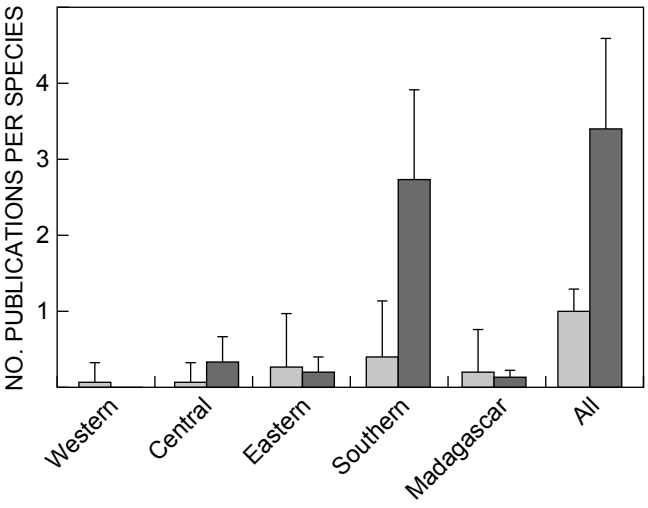

Figure 1: Regional trends in the number of peer-reviewed publications per species of larger parrots (genera *Coracopsis*, *Poicephalus*, *Psittacus* and *Psittacula*) in Africa and Madagascar. Bars represent mean number of peer-reviewed publications listed on Web of Science (Thomson Reuters) on 13 December 2012 with accompanying standard errors. Light grey bars indicate publications between 1989 and 2000, and dark grey bars those between 2001 and 2012

Species (*Psittacus timneh* and *Psittacus erithacus*; BirdLife International 2013a) and those populations that have been the subject of CITES Reviews of Significant Trade (CITES 2001). *Poicephalus senegalus* have historically been among the most heavily traded of all birds listed under CITES, yet almost no information exists on population trends, the impact of harvesting or other threats to populations. *Psittacus timneh* have been heavily impacted by trapping for the pet trade, forest loss and degradation yet systematically collected data on current distributions and abundance is lacking. Although both *Psittacus* species have been the subject of a number of studies (Dändliker 1992a, 1992b; Fotso 1998a, 1998b; McGowan 2001; Clemmons 2003; Yaokokoré-Béibro 2004; Amuno et al. 2007; Tamungang and Cheke 2012) reports of the majority of these are unpublished. A lack of systematically collected and published data still dominates discussions on appropriate conservation actions in these species (RO Martin pers. obs.).

Assessment of conservation status

A considerable proportion of published research has focused on aspects of behaviour, nest-site characteristics, diet and vocalisations (see Species accounts). Relatively few have investigated the distribution, abundance or demographic parameters required for determining conservation status. Opportunities for assessing trends vary considerably between species, subspecies and populations and the greatest advances will be gained through making use of a variety of information sources and the coordination of initiatives.

In some areas, bird atlases already provide valuable baseline information on presence and absence against which range changes can be assessed. Atlas data exists in some form for 21 of the 48 sub-Saharan states and atlases for several additional countries are under construction. Historical coverage has been heavily biased towards Southern and East Africa and remains lacking for most of Central and West Africa. Comparisons of atlases of the same areas can provide information on range changes. For example, the SABAP2 is beginning to provide valuable data on recent changes in *P. robustus* and *P. fuscicollis*. In a number of areas, atlas data is now at least 10–20 years old, presenting an opportunity for new surveys to determine recent trends. It is important to ensure that methods are replicated using similar methods so that direct comparisons can be made (Donald and Fuller 1998). The historical distributions of several species have been poorly described, but the potential exists to compile information from museum collections, early written accounts and other literature to provide a baseline against which current atlases or sources of presence/absence data can be compared. However, it is important to recognise that such an approach is generally more useful for detecting range contractions rather than expansions due to the tendency of such sources to only report information on presence and not absence.

Determining changes in abundance prior to local extinctions can be achieved through a variety of approaches. Although estimates of absolute population size are sometimes required by decision-makers, the potential to obtain estimates with a desirable degree of accuracy is limited for many populations. Counts at aggregations, such as roosts or mineral licks, require either all aggregation sites to be known or reliable estimates of the number of aggregations and variation in their size (Casagrande and Beissinger 1997; Cougill and Marsden 2004; Berg and Angel 2006; Masello et al. 2006). Obtaining such information can be challenging, particularly in areas where the infrastructure is poorly developed. Although this approach has been used to estimate populations for some parrots in Africa (e.g. Dändliker 1992; Fotso 1998) it has received considerable criticism (McGowan 2001). Distance sampling is commonly used for estimating the densities of wild animals, which can be used along with data on occupancy, to generate estimates of population size (Buckland et al. 2001). Such methods can work well in environments where animals are highly visible and evenly dispersed, but they are less well suited for counting parrots inhabiting forests where visibility is poor, distributions are clumped and detections are largely based on vocalisations (Casagrande and Beissinger 1997). It is often difficult to meet the assumptions underpinning this approach and, although steps can be taken to minimise these problems (Buckland et al. 2008), it may not be possible to quantify uncertainty in the resulting population estimates. It is critical that decisions based on such data take account of the limits of these approaches, which can include considerable uncertainty.

The above methods, and others such as counts at flyways and simple encounter rates, may provide useful indexes of population size that can be used for determining population trends providing there is some certainty the index is linked to actual population size (Bibby et al. 1993). Monitoring programmes currently exist for only a few populations (Table 1) and there is an urgent need for additional efforts, particularly where population declines are suspected. Despite this need, careful consideration

must be given to whether additional monitoring is the optimal way to allocate conservation resources in each situation (McDonald-Madden et al. 2010). Existing bird monitoring programmes such as those in IBAs (Bennun et al. 2005) or NPs (e.g. Taï NP in Côte d'Ivoire and Kakamega NP in Kenya) can potentially provide valuable information on relative abundance with little additional expense, but it is critical to ensure monitoring methods are appropriate for parrots. There is a need to develop simple and standardised monitoring protocols that can be easily implemented, yet are sensitive enough to detect changes in parrot populations.

In the absence of systematically collected data it may be necessary to infer population trends from other information sources, such as reports of roost sizes, flock sizes or encounter rates. Although such information exists for a number of populations, it is often anecdotal and not readily accessible, being presented in government reports, field guides and unpublished studies. Information of this kind must be interpreted with appropriate caution but can be critical for determining population trends and conservation priorities where additional data is lacking.

Determining threats and appropriate actions

Identifying the processes driving population declines and the management options required to address these threats underpins conservation actions. As human populations and economies expand, many of the habitats exploited by parrots are changing. Although habitat destruction and degradation likely play an important role in many declines, crude metrics of changes in land cover may only partly reflect impacts on populations.

Predicting the impact of habitat change on populations requires detailed knowledge of the ecological requirements of species and the degree to which different habitats may meet them. For instance, many larger parrots are secondary cavity nesters and rely on large mature trees for nesting sites. Often these larger trees are selectively logged for timber or suffer disproportionately from fragmentation (Laurance et al. 2000; Lindenmayer et al. 2012). Although absolute levels of forest cover may be little changed, the loss of key elements such as these could be catastrophic. Conversely, the impact of other types of land-use change may be more benign. It has been speculated that the degradation of primary forest habitats in West Africa may be beneficial for populations of *Poicephalus senegalus*, which are found in more open habitats (CITES 2006a). Artificial water holes installed for livestock in Namibia may sustain populations of *Poicpehalus rueppellii* in arid areas (Selman et al. 2000). Furthermore, agricultural areas are exploited for food by a number of species, e.g. *Coracopsis nigra* in Madagascar (Dowsett 2000; Ekstrom 2004), *Poicephalus cryptoxanthus* in Mozambique (Wirminghaus 1997b) and *Poicephalus meyeri* (Tarboton 1968; Boyes and Perrin 2009a), and may provide critical resources at certain times of year. Exploitation of crops by parrots can lead to their persecution (Bucher 1992; Bomford and Sinclair 2002). However, the level of damage caused and therefore the justification of this action is rarely directly assessed (Bucher 1992). It has been speculated that diets largely consisting of non-native food sources may be detrimental to populations in the long term (Boyes 2012), although this has not been investigated in detail. The extent to which degraded and modified landscapes can support populations is unclear and further research into the ecological requirements and the ability of different habitats to meet them is needed.

Parrot populations in Africa have a long history of exploitation for the pet trade (Pain et al. 2006). In recent years levels of international trade in wild-caught parrots have declined following reductions in CITES quotas and the EU ban on the importation of wild birds (Figure 2; CITES 2012c). However, large numbers of some species continue to be exported both legally and illegally with exports increasing to the emerging economies of the Middle East and Asia. All parrot species are listed under Appendix II of CITES, which means that exports from signatories to the convention are only permitted within limits determined by annual quotas. Although quotas are intended to ensure that levels of harvesting are sustainable and in the best interest of the species' conservation, in reality the data necessary to determine appropriate levels of harvesting is lacking for all species (Gilardi 2006). In addition to the challenges of estimating the densities of wild populations and the factors that regulate populations, it is further necessary to determine key life history parameters, such as breeding productivity and adult survival (Beissinger and Bucher 1992; Beissinger 2001). Productivity estimates are available for alarmingly few wild populations (Table 1) and estimates that exist are limited by small sample sizes and short duration (Wirminghaus et al. 2001b; Symes and Perrin 2004a; Boyes 2009). Data on juvenile and adult survival is lacking for all species (Table 1). In the absence of these data it is important that a precautionary approach is used to ensure international trade is not detrimental to populations.

In addition to exports sanctioned under CITES, large numbers of parrots are also harvested for illegal export and domestic trade. A lack of information currently impedes the design of appropriate actions to address this component of trade and there is a need to initiate studies of the scale and drivers of illegal trade, such as those conducted in the neotropics (Herrera and Hennessey 2007; Gastañaga

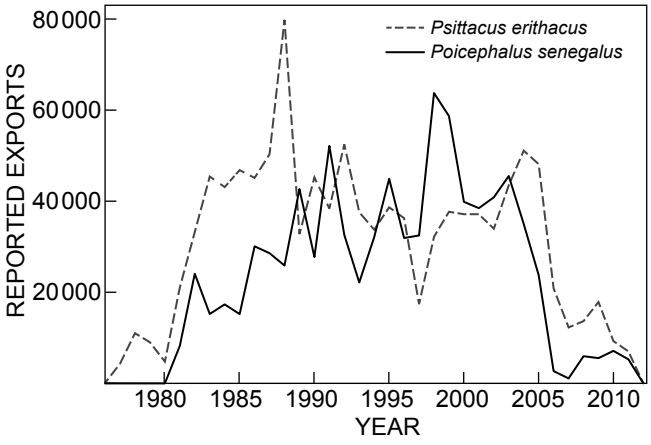

Figure 2: Exports of wild-caught *Psittacus erithacus* and *Poicephalus senegalus* reported to UNEP-WCMC between 1975 and 2012

et al. 2010; Pires and Clarke 2011, 2012). In particular, studies investigating the degree to which current quota systems facilitate illegal trade are required to inform appropriate trade policy.

Systematics

Many aspects of the taxonomy and phylogeography of parrots in Africa remain poorly understood, yet this information is critical for determining management units for conservation (Hey et al. 2003; Agapow et al. 2004; Mace 2004). Recent population genetic studies have highlighted the existence of significant genetic structure within morphological parrot species (e.g. Caparroz et al. 2009; Masello et al. 2011; Wenner et al. 2012).

To date there have been few genetic studies concerning the larger parrots of Africa and much of the current taxonomy of parrots is based on the geographical separation of populations and morphological differences measured from museum skins (Perrin 2012). The most comprehensive genetic study to date explored the relationship between six species in the genus *Poicephalus*, *Psittacus erithacus* and *Agapornis roseicollis*, based on samples from captive birds using RAPD fingerprinting (Massa et al. 2000). There is an urgent need for studies employing the latest genetic techniques to analyse georeferenced samples in order to investigate the degree to which morphological variation reflects underlying genetic diversity.

Within the genus *Poicephalus* there is considerable morphological variation that underpins the description of numerous subspecies (Perrin 2012). For instance, up to six subspecies of *Poicephalus meyeri* are recognised (Forshaw 1989; Collar 1997). However, with the exception of a study of *Pociephalus robustus*, *P. fuscicollis* and *P. fuscicollis suahelicus* (Perrin 2005), there have been no investigations of the genetic variation within currently recognised *Poicephalus* species. Some subspecies (e.g. *Poicephalus gulielmi massaicus* and *Poicephalus fuscicollis fuscicollis*) have highly restricted and disjunct distributions and genetic studies could help to determine the conservation importance of these populations.

The future of research and conservation

In the 14 years since the Global Parrot Action Plan (Snyder et al. 2000) was published there have been considerable advances in our knowledge of the larger parrots of Africa and Madagascar. In many instances these advances have served to highlight the conservation challenges faced by parrots across the region, which have shown little improvement since 2000 and loom larger than ever. Population declines have occurred for most, if not all, large parrot species in Africa. Although significant knowledge gaps remain, it is critical that decision-makers and conservation practitioners are pragmatic about the threats faced by parrots and the resources available for research and conservation. Some species (e.g. *Psittacus timneh*) are now restricted to a handful of populations and there is an urgent need to protect known populations while monitoring the outcomes of interventions and conducting surveys to identify additional populations. In other situations (e.g. *Poicephalus flavifrons* and *Poicephalus rueppellii*) it would be advantageous to make the most of opportunities to repeat previous survey efforts, which may provide insight into population trends and inform necessary conservation actions. Elsewhere (e.g. *Poicephalus crassus*) there is a need to conduct preliminary surveys to establish baseline data and develop hypotheses concerning the status of populations and potential threats. Balancing the needs of multiple competing priorities within the confines of limited resources is a central challenge of conservation. It is our hope that this review will provide a foundation on which such decisions can be based and, in doing so, facilitate advances towards the conservation of parrots in Africa and Madagascar.

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