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Commentary

Grey parrot *Psittacus* harvesting for conservation must have a robust scientific basis: Commentary on Tamungang et al. (2013)

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INTRODUCTION

The need for population estimates

Estimates of population size inform many aspects of conservation policy and planning, including IUCN Red List decisions and CITES decisions on trade in endangered species. For population size estimates to be useful to decision-makers, it is critical that they are made using appropriate methods and that when reported, sources of uncertainty and systematic bias are discussed and accounted for in the conclusions. A failure to do so impedes effective decision-making with potentially negative consequences for conservation.

Populations of Grey Parrots *Psittacus erithacus* have declined throughout much of their range. In 2012, the species was categorised as *Vulnerable* on the IUCN Red List on the basis of population declines, however given the "massive level of capture for trade and the high levels of forest loss in parts of the range" it was speculated this categorisation may be conservative (BirdLife International, 2013a). *Psittacus erithacus* has been one of the most heavily traded of all birds and mammals on CITES Appendix II. Between 1975 and 2010 reported exports totalled 1 227 963 (UNEP-WCMC, 2013). Despite concerns about the impact of trade on wild populations and the lack of data on which to base harvest quotas, exports from several range states have persisted. Cameroon has historically been the main exporter of Grey Parrots, accounting for 48% of exports between 1990 and 1996 (Waugh, 2010). In response to recommendations from CITES (CITES Secretariat document SC55 Doc. 17, 2007), the government of Cameroon arranged for an inventory of Grey Parrots to be conducted. The results of these surveys were recently published by Tamungang et al. (2013) in the International Journal of Biodiversity and Conservation (DOI: 10.5897/IJBC2013.0569).

Tamungang et al. (2013) estimated populations for five different administrative regions in Cameroon. Population estimates were made using point transect sampling to determine parrot densities (parrots/km^2) in each administrative region. Density estimates were then multiplied by the surface area occupied by rainforest within the species' "endemic

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range”. Several aspects of the methods used likely led to systematic biases in the population estimate and an unvalidated level of precision. Furthermore, several aspects of the methods were not described and sources of key data were unreferenced. As a result, it is not possible to know the degree of confidence that can be placed in these estimates nor would it be possible to independently repeat the study.

Criticisms of Tamungang et al. (2013)

Our main criticisms of the methods used by Tamungang et al. (2013) are as follows:

i) Selection of sampling sites was systematically biased

The method used for the selection of sampling sites is likely to have induced bias leading to the overestimation of mean density across the focal area. Of the 32 sampling sites selected across the five regions, 17 were located in protected areas, eight were in BirdLife International Important Bird Areas (IBAs) and the remainder were in places “where parrots were known to have occurred”. All of these areas might be expected to have relatively high densities of Grey parrots. Protected areas are often designated in relatively undisturbed and pristine areas and are the focus of conservation efforts (Bruner et al., 2001; Hobbs et al., 2010). IBAs are designated on the basis of supporting important populations of species of conservation concern (BirdLife International, 2013b). It is reasonable to suppose that sites where grey parrots are known to occur may have relatively high densities, compared with those in which they are not known to occur. When determining a sampling strategy it is critical that sampling sites are representative of the whole focal area across which estimates of density will be extrapolated. To achieve this, sampling sites should either be selected at random or be regularly spaced within the area into which densities will be later extrapolated (Bibby et al., 1993; Sutherland et al., 2004).

Although estimates of area of rainforest cover were used to calculate final population estimates, sampling also took place in other habitat types such as active farmland and secondary vegetation (Tamungang et al., 2012). Density estimates of parrots can differ between forest habitat types (Marsden and Pilgrim, 2003; Evans et al., 2005; Lee and Marsden, 2012) and densities of Grey parrots have been found to be highly variable (Marsden et al., in prep). It is unclear whether the “area of rainforest” used in the calculation incorporated these other habitat types and if so what might be the implications of extrapolating from different habitat types.

ii) Analysis ignores spatial variation in density

Tamungang et al. (2013) surveyed multiple transects in multiple locations within each region but present no explanation for how these survey data were used to estimate densities either within each region or for each year. It appears that the confidence intervals presented for each region only account for between-year variation and not spatial variation. Parrot densities are highly variable even within areas of apparently suitable habitat. Such variation can have important implications for the precision of estimates, particularly in the context of the small number of sampling sites Tamungang et al. (2013) used in each region, which ranged from 2 to 9. When small numbers of sampling sites are used there is a high probability that those sites will not be representative and confidence intervals should therefore be correspondingly large (Zar, 1999). The failure to take this uncertainty into account means that the confidence intervals presented for each region are misleadingly small.

iii) Inaccurate distance estimates can over-inflate density estimates

When using point count methods to estimate densities, random errors in the estimation of distances to detected birds will lead to an overestimation of density (Buckland et al., 2001, 2008). Line transects are often favoured for estimating parrot densities (Casagrande and Beissinger, 1997; Lee and Marsden, 2012; Legault et al., 2012) and will not lead to systematic bias in density estimates providing the mean error is zero (Buckland et al., 2008). With both methods, it is imperative that distances to detected birds are measured accurately. Small errors can have potentially large effects on density estimates, particularly when the number of detections is small (Buckland et al., 2001). Tamungang et al. (2013) did not report data on the repeatability of distance estimations within and between fieldworkers, nor did they attempt to improve accuracy by using laser rangefinders (Buckland et al., 2008).

iv) Assumptions over detections are not described

Animals that spend much of their time perched silently in the tops of trees in structurally complex forests are challenging to observe directly. In such environments many detections are made aurally, group sizes can be difficult to determine, and a significant proportion of birds may only be detected while flying. Accounting for these factors requires a number of assumptions to be made with implications for the precision of density estimates (Buckland et al., 2001). The ways in which the authors account for these potential sources of error were not described and neither are the implications discussed.

v) Methods used to determine species' endemic range are not described

The species 'endemic range' in Cameroon is used to calculate the area of occupancy and in turn the population size in each region. The authors provided no explanation for how the endemic range was determined despite this being a critical parameter for the estimation of population size. Surveys of a species' current distribution, potentially in conjunction with habitat suitability models, are an essential foundation on which to base population estimates.

Conclusions

Improving the scientific basis for the conservation of Grey Parrots

Tamungang et al. (2013) study was stimulated by CITES recommendations that the scientific basis for harvesting must be improved to address the declining overall trend in range states and improve management decisions by the Cameroon government. Robust data on population sizes would be an important initial step towards realising that goal. However the failure to randomise sampling sites and the use of inappropriate field methods, analytical techniques and scientific reporting mean that these basic data remain lacking.

A recent project conducted by BirdLife International in conjunction with CITES and national partners in five Grey parrot range states, piloted candidate survey methods for Grey Parrots with the aim of devising appropriate and robust methods for density estimation (CITES, 2013). Methods included line transect distance sampling, encounter rates, road surveys and occupancy based on interviews (CITES, 2013). We contend that considerable improvements to the methods employed by Tamungang et al. (2013) can be made. However the species' current rarity, variable abundance, cryptic habits and mobility, together with logistical and resource challenges may present insurmountable obstacles for its effective study (Marsden et al. in prep). While a scientific basis for harvest quotas is an admirable goal, establishing robust population estimates remains a major obstacle to the effective implementation of non-detrimental harvesting regimes for this threatened species.

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