Population survey and conservation assessment of the globally threatened cheer pheasant (*Catreus wallichi*) in Jhelum Valley, Azad Kashmir, Pakistan

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Abstract: The cheer pheasant *Catreus wallichi* is a globally threatened species that inhabits the western Himalayas. Though it is well established that the species is threatened and its numbers declining, updated definitive estimates are lacking, so in 2011, we conducted a survey to assess the density, population size, and threats to the species in Jhelum valley, Azad Kashmir, which holds the largest known population of cheer pheasants in Pakistan. We conducted dawn call count surveys at 17 points clustered in three survey zones of the valley, 11 of which had earlier been used for a 2002−2003 survey of the birds. Over the course of our survey, 113 birds were recorded. Mean density of cheer pheasant in the valley was estimated at 11.8±6.47 pairs per km^2, with significant differences in terms of both counts and estimated density of cheer were significantly different across the three survey zones, with the highest in the Chinari region and the lowest, that is the area with no recorded sightings of the pheasants, in Gari Doppata. The total breeding population of cheer pheasants is estimated to be some 2 490 pairs, though this does not consider the actual area of occupancy in the study area. On the whole, more cheer pheasants were recorded in this survey than from the same points in 2002−2003, indicating some success in population growth. Unfortunately, increasing human settlement, fires, livestock grazing, hunting, and the collection of non-timber forest products continue to threaten the population of cheer in the Jhelum valley. To mitigate these potential impacts, some degree of site protection should be required for the conservation of cheer pheasants in Pakistan, and more effective monitoring of the species is clearly needed.

Keywords: Abundance; Habitat analysis; Cheer Pheasant; Jhelum valley; Pakistan

The cheer pheasant *Catreus wallichi* (hereafter referred to as cheer) is distributed throughout the southern foothills of the western Himalayas, occurring in northern Pakistan, India and central Nepal (Birdlife International, 2012). Pakistan marks the western limit of the distribution of cheer which, historically, extended to the mountains of Kahaber Pakhtoon Khawa and Azad Kashmir (BirdLife International, 2003). In the early twentieth century, this species was recorded at Qazinag on the fringes of Azad, Jammu and Kashmir at Qazinag (Baker, 1930), in Kishtwar and the hills of the Jhelum valley (Osmaston, 1927; Ward, 1926), Jhelum valley (Awan et al, 2004; Awan, 2011; Dar, 2006; Khan et al, 2006; Ridley & Islam, 1982), Machiara National Park (Islam & Crawford, 1986), and Neelum valley (Roberts, 1991) including Salkhala Game Reserve (Mirza, 1978). Despite the variety of these early reports, early records points can actually create difficulties in accurately detecting the species (Rattray, 1905; Whistler, 1930) by compounding compounded statements of scarcity or estimates of abundance (Baker, 1930; Osmaston, 1927; Ward, 1926).

Typically, cheers are most frequently found on

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steep, rocky terrain between 1 200−3 000 m (Johnsgard, 1999; Birdlife International, 2012), but also sometimes as low as 600 m in Pakistan (Roberts, 1991). Compared to most other Galliforms of the region this species is relatively sedentary (Whistler, 1926; Roberts, 1991; Ali & Ripley, 1998), showing little seasonal altitudinal movement (Johnsgard, 1999). Cheers likewise seem to favour open forest and scrub, particularly juniper and rhododendron scrub, with tall grassy cover (Ali & Ripley, 1998; Gaston et al, 1981; Garson et al, 1992; Roberts, 1991; Singh et al, 2011), and as such cheers are strongly associated with successional grasslands, the ultimate outcome of which is a naturally fragmented population (BirdLife International, 2012).

To date, the known population of cheer is declining due to hunting and egg collection, conversion of grasslands to agricultural land, burning and livestock grazing, all of which result in habitat degradation, loss and isolation, and disturbance from the collection of non-timber forest products (BirdLife International, 2012). While the global conservation status of the cheer is currently listed as Vulnerable, there is evidence to support upgrading the species to Endangered on the grounds of a lower existing population size than originally predicted (BirdLife International, 2012). Several surveys back this assertion: they found several small subpopulations (Islam & Crawford, 1986; Roberts, 1991; Young et al, 1987) that in some cases are considered on the brink of local extirpation (Chaudhry, 1993). In Pakistan, records of cheer in Machiara National Park (Islam & Crawford, 1986) and the Pir Chinasi area of Jhelum valley (Young et al, 1987) were the first recordings of the birds seen in decades, as the species was previously thought to be nationally extinct (Severinghaus, 1979). Further wider and more recent surveys have recorded the species elsewhere in Jhelum valley and Phalla Game Reserve, confirming its current presence in Pakistan (Awan et al, 2004; Awan, 2011; Dar, 2006; Khan et al, 2006).

On one hand, these studies offer some hope for the status of cheers in Pakistan, as they confirm that the species was still present in the area. On the other hand, several studies show that the cheer is totally absent in other areas it previously inhabited. For example, while the cheer were encountered frequently in Salkhala Game Reserve, Neelum valley (Mirza, 1978), it now appears locally extirpated from the reserve (Awan et al, 2012). Likewise, reintroduction attempts in the Margalla National Park and Province of Khyber Pakhatoon Khawa have proven unsuccessful (Mirza, 2005). Consequently, the remaining areas of cheer inhabitation, the Jhelum valley in particular, are an extremely important site for the conservation of cheer in Pakistan. In the present study we aimed at providing an updated survey to estimate the present density and population size of cheer and provide recommendations for future monitoring efforts to identify the threats to the species in Jhelum valley.

METHODS

Study area

Jhelum valley is situated between an elevation range of 750−3 765 m in the foothills of the western Himalaya, Azad Kashmir, in northeast Pakistan (N34°12′, E73° 43′; Figure 1). Covering 589.8 km^2 it comprises habitats of the Himalayan subtropical pine forests dominated by *Quercus*, *Pinus* and *Rhododendron* species. The majority of the human population in the catchment (90%) is spread across small, rural settlements; the remaining 10% is settled in comparatively large towns (AJ & K Government, 2011). In the area, livelihoods are based mainly upon subsistence agriculture, distributed as small, scattered farms, and livestock farming. People living in this region also depend directly or indirectly upon the valley's natural resources, especially during habitation of the summer houses they use when farming (AJ & K Government, 2011). This dependence creates some unique circumstances, especially since the human population in Azad Kashmir has grown from 2.973 million in 1998 to 4.059 million in 2011, of which 88% live in the rural areas. This increasing population and associated development of infrastructure is putting increasing demands on the natural resources of the area (Awan, 2011) but the area lacks a conservation management plan for natural resources and biodiversity (AJ & K Government, 2011; Awan, 2011).

Population surveys of cheer

For observing the cheer population in the Jhelum valley, the valley was divided into three zones, A (Pir Chinasi), B (Gari Dopata) and C (Chinari) (Figure 1). The Pir Chinasi zone is situated in Muzaffarabad district while the other two zones are located in Hattian district southwest of Muzaffarabad city. Himalayan pheasants are best surveyed in May−June, when they are breeding and tend to be most vocal (Gaston, 1980), although cheer also call frequently in October−November (Ali & Ripley,

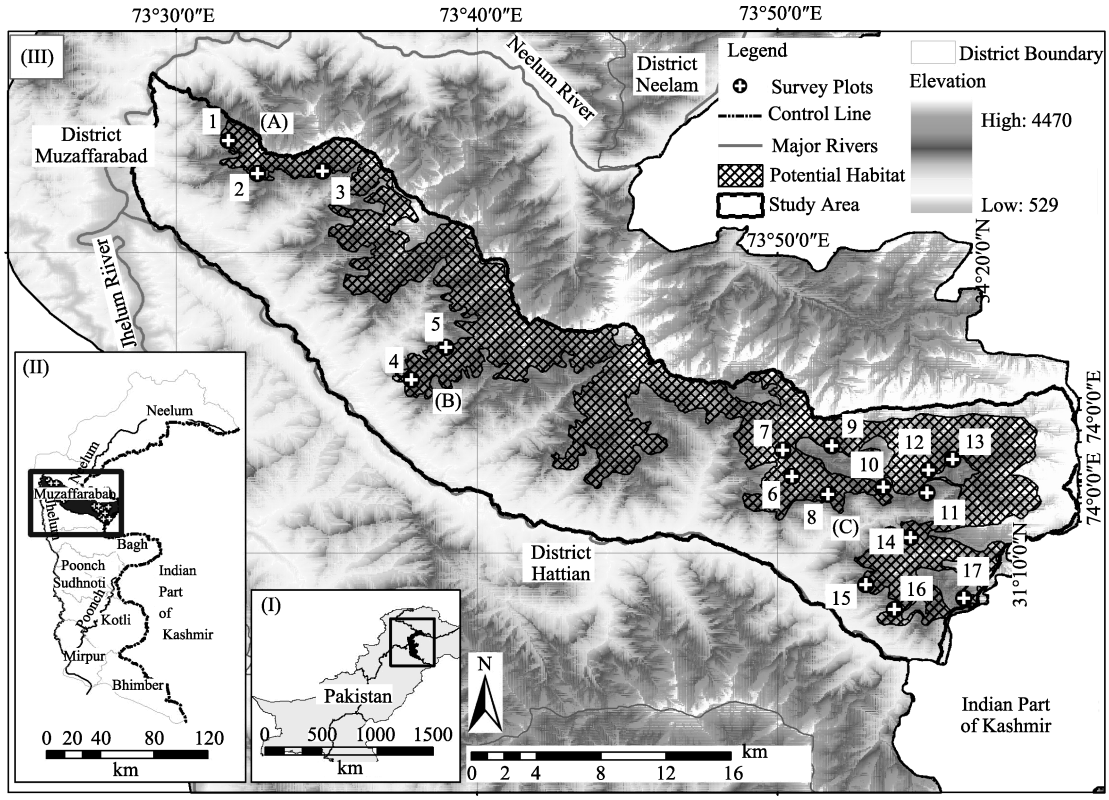

Figure 1 Map of 2011 survey points (CH01-17) along with habitat identified as potentially suitable for cheer habitation in the Jhelum valley (From AJ & K, Pakistan)

1998). Both male and female cheer gives loud calls in the early morning and evening during these months (Young et al, 1987). In May 2011, we counted calling cheer using a dawn call count technique (Gaston, 1980) that has been widely used in surveys of Himalayan pheasants (e.g. Singh et al, 2011; Awan et al, 2004). Totally, across the three regions, 17 points, including 11 points used in previous surveys in the valley (Dar, 1997; Awan et al, 2004), were positioned in potential cheer habitat as follows: three points in Pir Chinasi (Points 1−3), two in Gari Dopata (Points 4−5), and 12 in Chinari (Points 6−17; Table 1). The locations of the six new survey points were based on discussions with Wildlife Department field staff, hunters and local communities. Points were established at vantage points at least 600 m apart to minimise double counting birds and maximise the area surveyed in each zone. Observers arrived at points the night before a survey. Counts started before dawn (04：30) and lasted for 60 minutes (Awan et al, 2004). The direction and distance to each calling bird heard within a 300 m radius of each point was estimated by the observers. Each point was surveyed once and all surveys were led by the main author with additional field observers from the Wildlife Department.

Data analysis

While previous abundance estimates of cheer from call count data in Jhelum valley were based on a 60-minute count period (Awan et al, 2004) we consider this too long for reliable population assessment. Himalayan pheasants appear to move after remaining stationary for the first 15−20 minutes following waking at their roosts (Kaul & Shakya, 2001). Consequently, it stands to reason that there is a high chance for a cheer to either moving into a survey area once the count has started (Granholm, 1983) and after 15−20 minutes of the first calls or being double-counting due to undetected movement within a survey area (Fuller & Langslow, 1984; Reynolds et al, 1980; Scott & Ramsey, 1981), resulting in an over-estimation of abundance. Accordingly, based on count period length employed elsewhere for surveying cheer (Singh et al, 2011), we analysed the field data using a shorter count period of 15 minutes from the time of the first call heard in each of the original 60-minute dawn counts.

A fixed radius approach was used to estimate cheer density wherein numbers of calling birds heard at each

Table 1 2011 Survey point description and density estimates

Survey location[a]	Coordinates	Elevation (m)	Aspect	Number of birds[b]	Density (pairs/km^2)
Zone A – Pir Chinasi:					
CH01 – Siki*	N34°23'44.4", E73°31'44.2"	2 090	SW	1 (0)	1.8
CH02 – Hari Wala Par*	N34°22'37.9", E73°32'41.9"	2 387	SW	6 (2)	10.6
CH03 – Ban Wali Gali**	N34°22'42.8", E73°34'51.9"	2 067	SW	8	14.1
Zone B – Gari Doppata:					
CH04 – Tarari**	N34°15'46.2", E73°37'49.3"	1 971	SW	0	0
CH05 – Low Gali*	N34°16'51.6", E73°38'58.1"	2 155	SW	0 (1)	0
Zone C – Chinari:					
CH06 – Nanga Tuk*	N34°12'33.1", E73°50'29.7"	3 023	W	8 (4)	14.1
CH07 – Thera Gali*	N34°13'25.6", E73°50'10.6"	2 813	SW	5 (3)	8.8
CH08 – Garang*	N34°11'57.9", E73°51'40.6"	2 419	SW	5 (4)	8.8
CH09 – Shinger*	N34°13'33.9", E73°51'49.1"	2 530	SW	7 (0)	12.4
CH10 – Cheeta*	N34°12'12.1", E73°53'31.4"	2 080	S	10 (12)	17.7
CH11 – Batal*	N34°11'59.9". E73°54'58.3"	2 666	SW	7 (5)	12.4
CH12 – Copra Gali**	N34°12'45.7", E73°55'01.6"	2 930	SW	8	14.1
CH13 – Shanger Bari*	N34°13'07.1", E73°55'50.4"	2 330	W	8 (6)	14.1
CH14 – Khatar Nar*	N34°10'31.7", E73°54'25.6"	2 202	S	6 (2)	10.6
CH15 – Tal Patra**	N34°08'56.8",E73°52'56.8"	2 158	SW	12	21.2
CH16 – Soka**	N34°08'07.8", E73°53'53.8"	1 455	W	10	17.7
CH17 – Nalai**	N34°08'29.7", E73°56'12.6"	2 244	SW	12	21.2

[a] Points also surveyed in 2002−2003 are indicated by *; new survey points are indicated by **. [b] Where available, the number of birds counted in the 2002−2003 survey are in parentheses.

point was then used to calculate encounter rates and densities (with standard deviations, *SD*) for each survey zone and the overall valley, based on the assumption that all birds were heard calling within 300 m of a point (single point area=0.28 km^2). Cheer encounter rates in the three zones were compared using a Kruskal-Wallis test with non-parametric post-hoc test, while densities were compared using *Z* test (P<0.05). Where comparable data were available, we also compared counts of cheer from those points surveyed in this and the previous survey (Awan et al, 2004) using a Wilcoxon signed rank test, though the results of this are speculative at best, since because in this study we used a shorter count period.

Using a Geographical Information System-based overlay analysis of key habitat variables in ArcGIS 9.3 we were able to calculate the area of potential habitat suitable for cheer in Jhelum valley. The variables used were as follows: elevation (from ASTER Global Digital Elevation Model of 30 m spatial resolution); slope; aspect (derived from the Digital Elevation Model); land cover variables (derived from ALOS AVNIR 2 multispectral satellite data of 10 m spatial resolution); drainage; settlements; roads/tracks digitized from topographic sheets of scale 1:100 000; and the sighting data collected during the field surveys. We then used the habitat suitability analysis results and survey densities to estimate the breeding population of cheer in Jhelum Valley. The breeding popular estimates were based on the assumption that cheers are paired during the breeding season, similar to the Hainan partridge where both male and female call, and this could indicate a fixed pair in cheers (Singh et al, 2011; Yang et al, 2011).

RESULTS

Cheers were recorded at all points except the two located in Zone B (Gari Dopata) where none were detected (Table 1). Totally, 113 cheers were heard calling at a mean encounter rate of 6.6±3.66 per point. The number of calling cheer recorded was significantly different across all three zones (H_2=6.45, P=0.040), with the highest being Zone C (Z=2.394, k=3, P<0.05) and the lowest in Zone B were no calls were heard. Overall cheer density was estimated at 11.8±6.47 pairs per km^2 and

highest in Zone C (Table 2). Density was significantly different between Zones A and C (Z=2.181, P<0.05). On the whole, Cheer counts at the 11 points previously surveyed (Awan et al, 2004) differed significantly between 2002−2003 and 2011 (T=7.5, n=11, P=0.022). On average, more cheers were recorded per point in the 2011 survey (5.7±2.97) than in 2002−2003 (3.5±3.42), though this may be explainable by differing methodologies in measurement

Table 2 Cheer encounter rates (day^{-1}±*SD*) and pair densities (km^2±*SD*) for the three study areas and Jhelum valley

Study zone	Survey effort	Encounter rate[a]	Density
A – Pir Chinasi	3	5.0±3.61 (15)	8.8±6.38
B – Gari Dopata	2	(0)	(0)
C – Chinari	12	8.2±2.41 (98)	14.4±4.26
Overall	17	6.6±3.66 (113)	11.8±6.47

[a]: Number of encounters are in parentheses.

Habitat analysis classified 211.15 km^2 (35.8%) of the survey area as suitable cheer habitat (Figure 1). At an average density of 11.8 pairs/km^2, this would give a total potential breeding population in Jhelum valley of 2 490 pairs (1 840−3 140; 95% CI).

DISCUSSION

Totally, cheers were recorded in two of the three zones at a mean density of 11.8±6.47 pairs/km^2. The results of this survey suggest a significant breeding population of cheer persists in Jhelum valley (2 490±650 pairs) despite a growing human population and utilization of natural resources. Cheer breeding has been further confirmed by Awan and Lee (2013), who found on average, 0.5±0.21 *SE* nests per search and at a density of 0.1±0.06 *SE* nests/km^2 in suitable cheer pheasant habitat. Our estimate is at the upper end of the range of densities from most other surveys (5 to 12.4 pairs/km^2; Gaston & Singh, 1980; Garson, 1983; Lelliott, 1981; Singh et al, 2011), although densities of up to 24 pairs/km^2 have been estimated in India (Subedi, 2003). This is especially true considering the global population is currently estimated to number 2700−4 000 mature individuals (BirdLife International, 2012). Our estimates may be somewhat optimistic, since cheers are extremely susceptible to hunting and local eradication (Young et al, 1987). Our estimates may instead reflect the carrying capacity of the valley and be distorting the reality of the situation. This possibility underscores the need to thoroughly survey and monitor other locations in Jhelum valley to quantify the actual area of occupancy, rather than relying on the basic approach we have employed here to gain a population estimate. Furthermore, it would be useful to consider the conservation genetics of cheer in the valley to assess population viability; since cheers are capable of raising large clutches (Johnsgard, 1999), these small, isolated subpopulations may be particularly vulnerable to inbreeding (Corder, 2013).

While it appears from both this and the 2002−2003 surveys that the main breeding population is located in Chinari (Zone C), it is difficult to make any further inferences for two main reasons. First, we used a shorter count period (to reduce the potential problem of double counting) and yet recorded significantly more birds than in 2002−2003. Indeed, of the points surveyed in 2002−2003 and 2011, Awan et al (2004) estimated 39 calling birds while we estimated 63 calling birds from the same 11 points (Table 1). This might represent a real increase in numbers of breeding cheer, but the differences in methodology make it difficult to make a comparison, so such comparisons should be treated with caution. Second, it is not entirely clear how numbers of breeding pairs were estimated in the 2002−2003 surveys, making it impossible to compare our estimates with theirs in order to conduct additional analysis. The discrepancies between the two studies emphasizes the need for an agreed survey protocol to be put in place and adhered to annually for effective monitoring that supports conservation management of Galliforms in the Jhelum valley and, potentially, elsewhere in the region.

While we are confident that distances to calling birds were estimated consistently and accurately with only random, small errors, it is worth noting that cheer density estimates generated from this type of survey are susceptible to inaccurate distance estimation and either under- or over-estimating density (Symes, 2013). We attempted to make our results as accurate as possible, and , since the main author was active in all surveys, but still reliability of our estimates, and others, may also be influenced by the coverage of a comparatively small survey area around each point. To improve reliability in these abundance measurements, and to support ongoing monitoring of the species in this important location for its conservation in Pakistan, more efforts should be focused on training wildlife staff and standardizing an agreed monitoring protocol (Awan et al, 2012). While the basic dawn call count method remains suitable for

surveying this species (Gaston, 1980), consideration should be made for applying appropriate techniques for the imperfect detection of calling birds around survey points (Thomas et al, 2009).

While our survey results showed that the number cheer appears to have increased in Jhelum valley over the last decade, the cheer population remains under intense pressure due to an increasing human population and associated degradation, clearance and conversion of cheer habitat into agricultural land (Awan, 2011). This pressure is exacerbated by increased land conversion due to a local shortage of food following the Kashmir earthquake in 2005 that damaged and destroyed many of the existing agricultural lands in the area (Awan et al, 2012). As a consequence, in the rebuilding process more houses were built than originally present as this released greater amounts of financial relief from the government (Awan et al, 2012).

To mitigate the potential impact of the situation in the region, two approaches may help: 1) developing a strong conservation education and awareness campaign; and 2) improving the socio-economic condition of the communities within the valley to make them less reliant on natural resources, especially by focusing on community enterprise development for women (Awan, 2011). The success of these two actions will go a long way to determine the conservation future of cheer within the Jhelum valley.

Locally based initiatives, like those described above, are key in dealing with the situation in the region, but overall habitat degradation and over-hunting in the Himalayan foothills are thought to have severely reduced cheer populations over the past century, and in Pakistan its status is not secure (Garson et al, 1992). Nationally, increasing demands on natural resources across Pakistan has reduced the cheer population range, pushing it closer towards the line of control of the disputed area where there is far less human disturbance as a result of military tension in the area (Awan, 2011). The Jhelum valley is currently thought to hold the main population of this threatened species in Pakistan, but unfortunately the area lacks any protected area and clear wildlife management planning, something greatly needed (AJ & K Government, 2011; Awan, 2011). This area requires some degree of immediate protection to enable the effective conservation of cheer in Pakistan. Likewise, conservation efforts in the Jhelum Valley would benefit may other species: as Himalayan black bear (*Ursus thibetanus*; Vulnerable, Garshelis & Steinmetz, 2008), the Leopard (*Panthera pardus*; Near Threatened, Henschel et al, 2008), and Himalayan monal (*Lophophorus impejanus*), koklass pheasant (*Pucrasia macrolopha*) and kalij pheasant (*Lophura leucomelanos*).

The lack of protected area in the Jhelum valley weakens any conservation management of threatened species in the area, and the available resources are currently inadequate to effectively manage the biodiversity of the area. We strongly recommend that consideration should be made for designating at least some of the Jhelum valley as a protected area for cheer, and other threatened species, while also implementing a community-inclusive management plan to support the long term conservation of cheer in Pakistan. If action is not taken, pressure for resources and associated habitat disturbance, degradation and loss increases, the cheer population will be on decline in this site, ultimately resulting in its extinction in Pakistan. Consequently, a current and quantitatively informed conservation management action plan for natural resources and biodiversity in the area is required (AJ & K Government, 2011; Awan, 2011).

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