

A globally important migration staging site for Sociable Lapwings *Vanellus gregarius* in Turkmenistan and Uzbekistan

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Since 2010, several Sociable Lapwings fitted with satellite transmitters on the breeding grounds in Kazakhstan have been tracked on southward migration to an area that straddles the border between southeastern Turkmenistan and southern Uzbekistan. The birds tracked along this migration route stopped at this site, called Tallymerjen in Turkmenistan and Talimarzhan in Uzbekistan, for prolonged periods, suggesting that it might be an important staging site for birds en route to wintering grounds in India and Pakistan. In September and October 2015, we undertook coordinated counts on either side of the border to assess the number of birds using the site, their habitat use and diet and the threats they may face. Counts of 4225 in Uzbekistan and 3675 in Turkmenistan represent the highest numbers of the species recorded anywhere since the 19th century. Movements of birds between the two countries were hard to quantify because of the restricted border zone, but the total number of birds using the area was estimated at between 6000 and 8000. This may represent the species' entire eastern flyway population and perhaps half of its global population. Field observations and data from two satellite-tagged birds present at the same time suggested a complex pattern of daily movements and resource use, which may have been influenced in part by the intensity of moonlight. Birds moved between heavily grazed steppe-like areas, irrigated arable fields and the shoreline of a large reservoir. The large number of birds present and the long period they remain here on south-bound migration make this one of the most important sites in the world for this critically endangered species. The sensitive border zone is likely to deter hunting by people, a significant threat in other areas of the species' flyway. There has been a huge expansion of irrigated agriculture on both sides of the border since the mid 1970s, with a consequent loss of steppe-like habitats. Desertification caused by overgrazing has caused the appearance of shifting sand dunes in areas where they were not previously present. Many of the key areas for Sociable Lapwings fall within two existing Important Bird and Biodiversity Areas (IBAs), which are listed for their importance for other species. Regular monitoring of this staging area and the number of Sociable Lapwings using it will be a key action in global efforts to protect the species and reduce threats to it. The discovery of this staging site is an example of the significant contribution that even small numbers of satellite tracking devices can make to our knowledge of threatened species.

INTRODUCTION

The breeding range of the Sociable Lapwing *Vanellus gregarius* is now limited almost entirely to the steppe zone of Kazakhstan, although small numbers still breed in southern Russia. Historically the species bred from Ukraine in the west to western China in the east (Kamp *et al* 2010). It is confined as a breeding bird to heavily grazed steppe, which due to changes in steppe management since the breakup of the former Soviet Union is now restricted largely to the immediate surroundings of villages (Kamp *et al* 2009). The Sociable Lapwing is listed by IUCN as Critically Endangered on the basis of severe declines in population and range (Eichhorn & Khrokov 2002), and current trends in land use suggest further declines are likely (Kamp *et al* 2011). Although the demographic drivers of this decline are still unclear, it seems more likely to be driven by poor survival than by low productivity, probably resulting from hunting pressure along its migration routes and in its wintering grounds (Sheldon *et al* 2013). For this reason, a research project on the species' migration strategy and winter distribution was established in 2007 using a combination of analyses of historical records, targeted field surveys, colour-ringing and satellite tracking. Preliminary results of this ongoing work suggest that there are two distinct migration flyways; a western flyway through the Caucasus and Syria to wintering grounds in the

Arabian peninsula and eastern Africa, particularly Sudan, and a much shorter eastern flyway to wintering grounds in Pakistan and northwestern India. The western route is now reasonably well known and a number of important staging areas have been identified along it, some of which hold hundreds or thousands of birds each autumn (eg Field *et al* 2007, Hofland & Keijl 2008, Biricik 2009). The eastern flyway is less well known, but all five of the Sociable Lapwings satellite-tagged in Kazakhstan 2010–2014 that took the eastern flyway visited an area known in Turkmenistan as Tallymerjen, and in Uzbekistan as Talimarzhan, which straddles the border between the two countries (Figure 1). The area comprises the pediment of Gaurdak mountain, c60 km to the east, and is made up of alluvial soils around the Amu Darya river and loess and clay deserts and semi-deserts in the north.

There have been very few documented records of the species from either Uzbekistan (Martin *et al* 2014) or Turkmenistan (Rustamov 2015), and no records of large flocks until c200 were seen in Uzbekistan in October 2010 (Golder Associates 2011). However, the consistent and lengthy use of this small area by tagged birds over several years suggested the presence of a regular staging site. This prompted a series of visits to a reservoir on the

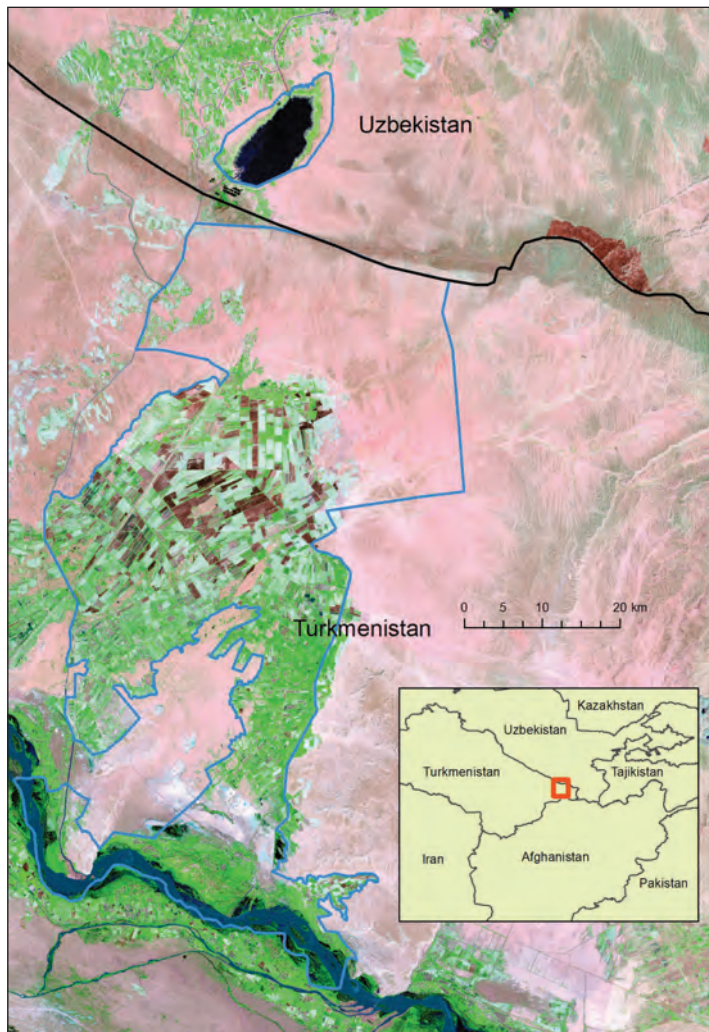


Figure 1. False-colour Landsat 8 TM image of the study area, taken in August 2015. Green and brown areas are irrigated arable land, pink and grey areas are pseudo-steppe and semi-desert. The Amu Darya river is in the bottom left of the Landsat image. The two IBAs are outlined in blue, the dark area filling most of the IBA in Uzbekistan is Talimarzhan reservoir. The boundary of the southern half of the IBA in Turkmenistan was drawn to follow the edge of the agriculture.

Uzbek side of the site September–November 2012, when up to 400 Sociable Lapwings were counted (Kashkarov *et al* 2012). At the time this was the largest count of the species ever made in Uzbekistan.

We describe the results of an expedition late September–mid October 2015 that involved field teams on each side of the border between Turkmenistan and Uzbekistan. The aims were to assess the numbers and habitat use of birds using the site, and to identify any threats they may face there.

METHODS

Satellite tracking

Sociable Lapwings have been fitted with Argos solar-powered PTT-100 satellite tags (Microwave Telemetry Inc, USA) on the breeding grounds in central Kazakhstan using a custom designed Rappole-Tipton leg-loop harness (Rappole & Tipton 1991). The first three birds, tagged in 2007, were fitted with 9.5-g tags, but since then only 5-g tags have been used. We tagged a total of 28 birds, 6 of whose tags or harnesses failed, or which died between tag attachment and autumn migration, leaving usable data from 22 birds. Tagged birds were also fitted with unique combinations of plastic colour rings. These tags deliver locations every two or three days via the Argos satellite system, which estimates locations using Doppler shift. The estimated accuracy of the locations is also given, although true accuracy and precision may be considerably lower than these estimates suggest (Boyd & Brightsmith 2013), and Central Asia (aka Middle Asia) may be a poor region generally for Argos Doppler tags (Dubinin *et al* 2010). However, the frequency and quality of locations received improved greatly between 2007 and 2015. Furthermore, our experiences of following tagged birds suggested that even locations with low estimated accuracy (Argos accuracy classes 0, A and B) could be sufficient for locating flocks in the field, and in many cases accuracy appeared higher than estimates of error suggested. We used satellite location data from five birds tagged before 2015 that migrated towards India and Pakistan to plan field surveys in advance. Data from the two birds tagged in 2015 that were present throughout our visits were downloaded in the UK and shared immediately with the field teams through mobile phone text messages. Locations from these two birds helped in the location of flocks and one of the tagged birds was sighted and photographed in Uzbekistan.

Numbers, movements and habitat use

Field teams were present intermittently 25 September–13 October 2015 in Uzbekistan, and continuously 3 October–13 October 2015 in Turkmenistan. In Turkmenistan, flocks were first found in the field by visiting locations from a satellite-tagged bird that was present at that time. Observations soon revealed that large numbers of birds were consistently using the same relatively small area of closely-grazed steppe-like habitat in a predictable way. Birds started to arrive at c14.00 h and continued to arrive till dusk. We therefore undertook counts late afternoon–dusk either by counting birds on the ground in flocks (on 3, 7 and 10 October), or by counting birds as they flew into the site (on 4, 5 and 13 October). Counts were coordinated between two field teams at the site, using walkie-talkie radios to avoid double counting. As the survey progressed, it became clear that many of the birds arriving at this site were then moving on towards arable agricultural areas (mostly wheat, cotton and lucerne) to the south, a pattern matched by one of the two satellite-tagged birds present and by birds recorded previously at stop-over sites elsewhere (Field *et al* 2007, Biricik 2009), so efforts were then made to locate birds in the arable areas. However, access in arable areas was difficult because of farming operations such as irrigation and the area to be searched was huge. In Uzbekistan, birds were counted regularly as they roosted

along the shoreline of Talimarzhan reservoir, and then followed out into adjacent steppe-like areas where they flew to feed.

Diet and food availability

In order to assess what Sociable Lapwings were feeding on, we set a transect line of 12 pitfall traps filled with water near the main evening gathering site on the heavily grazed steppe-like area in Turkmenistan. These were emptied twice and the contents examined and identified by eye and photographed (we had no permit to export samples). We also collected c50 fresh faecal samples, presumed to be those of Sociable Lapwings as they littered the area in which large numbers of this species, and no other species of equivalent size, had been feeding overnight. These were dried, then broken up in water and examined under a binocular microscope.

RESULTS AND DISCUSSION

Movements of satellite-tagged birds

Of the 22 birds satellite tagged during 2007–2015 for which the migration route could be unambiguously assessed, seven took the eastern route towards India and Pakistan, including two birds tagged in 2015. The tagged birds arrived at Tallymerjen between 9 and 22 September, and stayed in the area for between 32 and at least 59 days (Table 1). The five birds for which a large number of locations were available differed in their patterns of distribution and habitat use during their stay at Tallymerjen (Figure 2). One bird (123083) remained in Uzbekistan for the whole of its visit but was never recorded at the reservoir, spending most of its time in arable fields. One (123087) divided its time between semi-natural habitats and arable areas in Turkmenistan, and was never recorded on the Uzbek side of the border. Two birds (123082, 142944) moved between steppe-like semi-desert and arable areas in Turkmenistan and the reservoir in Uzbekistan. Finally, one bird (142940) remained in Uzbekistan, moving between the reservoir and adjacent steppe-like habitats.

Numbers, movements and habitat use

In Turkmenistan, birds were initially located on 1 October using the Argos Doppler locations from a tagged bird present in the area. Thereafter, birds were followed as they moved to or from this site. The locations of the two tagged birds present in the area at the time of the surveys matched well the location of birds found in the field (Figure 2). Initially, birds were found only in an area of heavily sheep-grazed steppe-like habitat with little or no vegetation other than a sparse ground layer (Plate 1). These habitats are formed on loess and clay semi-deserts and resemble true steppe in the short, open sward of the

Table 1. Approximate arrival and departure dates of seven satellite-tagged Sociable Lapwings at Tallymerjen, 2010–2015. All birds were fitted with 5-g Argos PTT-100 tags in central Kazakhstan in May–Aug of the same year. One bird (55023) had too few data to estimate arrival and departure dates precisely. Two birds (55094, 123082) arrived at the site but did not leave, due either to death or tag detachment/failure.

Tag number	Year	Arrival	Departure	Days
55023	2010	(2 Sept–1 Oct)	(1 Oct–12 Nov)	<71
55094	2010	22 Sept	-	-
123087	2013	18 Sept	15 Nov	59
123082	2014	9 Sept	-	-
123083	2014	19 Sept	5 Nov	48
142940	2015	11 Sept	12 Oct	32
142944	2015	18 Sept	30 Oct	42

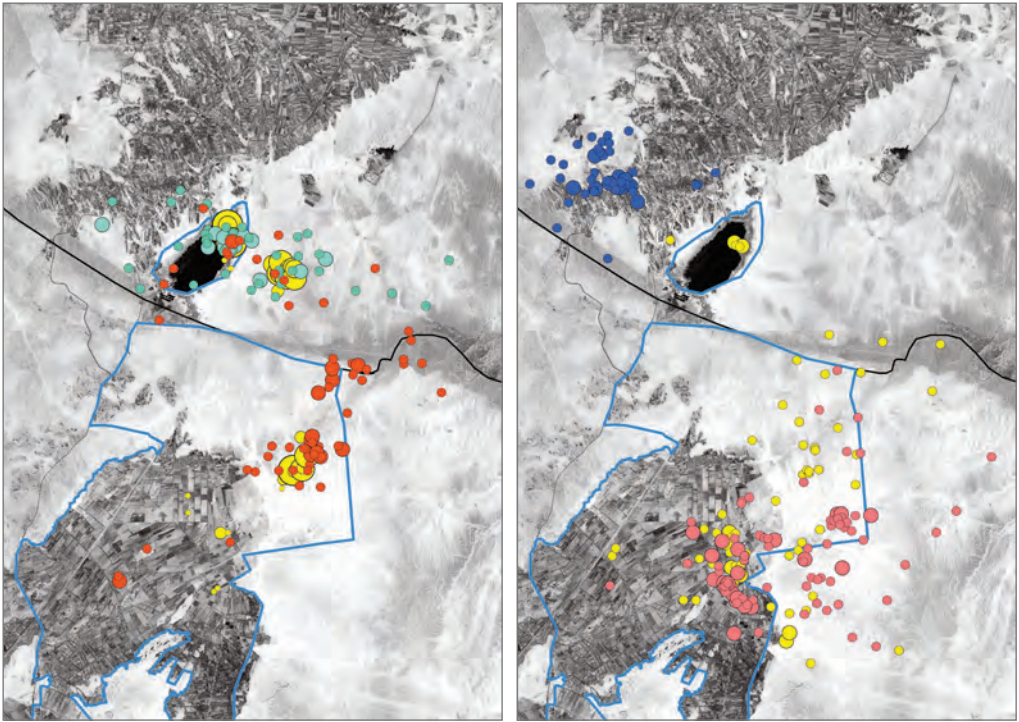


Figure 2. (left) Locations of two satellite-tagged Sociable Lapwings at the study area in 2015 (pale blue and red circles) and the location of birds found during field surveys in October 2015 (yellow circles). The size of the yellow circles is proportional to the number of birds seen. **(right)** Locations of three satellite tagged birds present in 2014 (dark blue and yellow circles) and 2013 (pink circles). Larger circles for tagged birds in both figures indicate those with higher location accuracy (Argos location classes 1, 2 and 3).



Plate 1. In Turkmenistan, Sociable Lapwings *Vanellus gregarius* favoured an area of heavily-grazed steppe-like habitat, where they roosted from mid afternoon onwards and fed at night. No birds were seen in moult, indicating that moult is complete by the time birds leave the breeding grounds in Kazakhstan. Turkmenistan, October 2015. © Paul F Donald

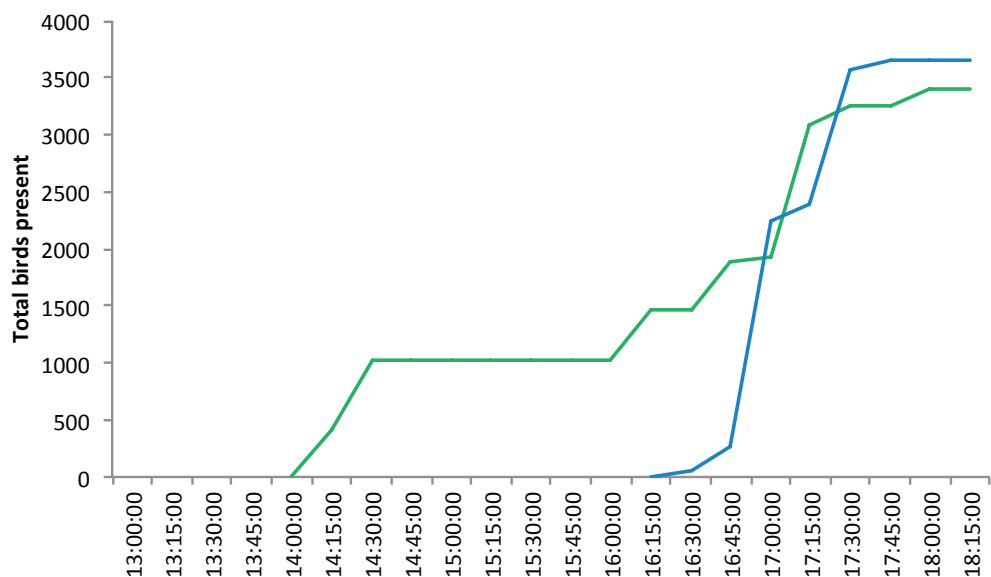


Figure 3. Count of Sociable Lapwings at the pseudo-steppe site in the Turkmenistan part of Tallymerjen in relation to time of day on 4 October 2015 (green line) and 13 October (blue line). Sunset was c18.00 h.



Plate 2. Although very large flocks of Sociable Lapwings *Vanellus gregarius* were encountered, birds moved between sites in smaller groups, which coalesced to form very large aggregations at a few regular sites. Turkmenistan, October 2015. © Paul F Donald

vegetation, although there are no true steppe vegetation communities in Turkmenistan or Uzbekistan. Areas of steppe-like habitats nearby that had a scattering of low bushes were avoided by birds. The heavily grazed open areas used by birds were fairly restricted in extent, estimated at no more than a few square kilometres in the areas visited in Turkmenistan. An area of similar habitat 11 km to the south, which had been extensively used by a tagged bird in 2013, was checked several times but no birds were seen.

Birds began to arrive from a northeasterly direction from c14.00 h in the first week of October, and from c16.00 h in the second week (Figure 3). They arrived in flocks of tens to c1000 birds, flying in low across the desert at estimated heights of 5–20 m (Plate 2). Birds arriving at the site in smaller groups coalesced to form larger flocks; the maximum

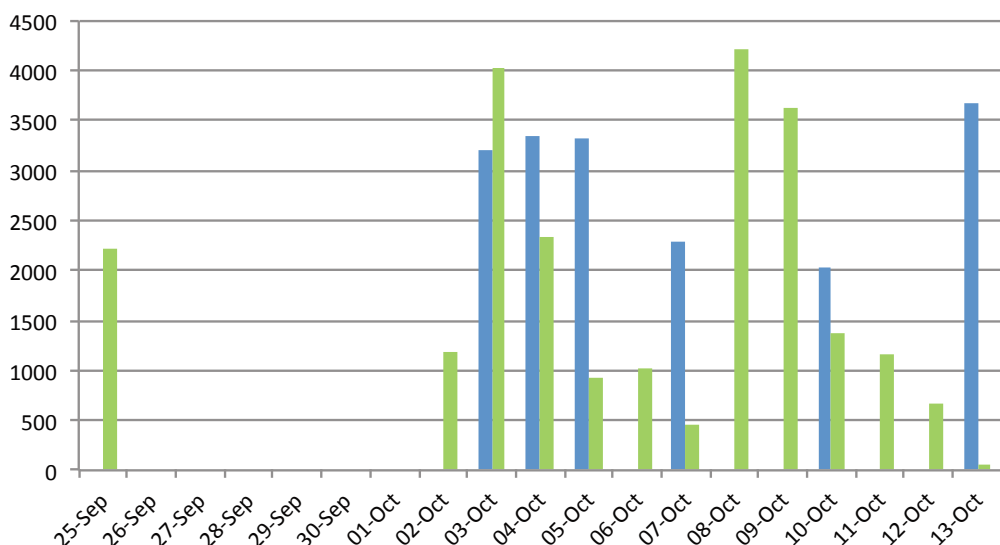


Figure 4. Maximum counts of Sociable Lapwings recorded in Turkmenistan (blue bars) and Uzbekistan (green bars). These counts were generally not simultaneous, so the overall total present is not necessarily the sum of the maximum counts in each country.

recorded single flock size was 2650. By dusk, three or four larger flocks formed: the later arriving birds forming flocks to the northeast of the earlier arrivals with a distance of 1–2 km between the widest separated flocks. Birds arriving early spent the afternoon resting (many of them sitting on the ground rather than standing) and preening but by the evening some flocks started to spread out and birds started to feed in a typical lapwing ‘walk, stop-and-scan, peck’ manner. Total counts of birds at this site varied between 2000 and 3764 (Figure 4). Dawn visits to the same area

showed that birds were still spread widely across the steppe-like areas and still feeding, and the abundance of fresh droppings suggested that the birds had been feeding all night. These birds started to leave the site in a northeasterly direction not long after dawn and by 08.30 h very few birds were left. Due to security constraints, we were unable to approach the border, so we could not ascertain where the birds that left the steppe-like site to the northeast, in Turkmenistan, in the morning and returned to it from the same direction in the afternoon, had spent the day. Movements of the single tagged bird in this group (Figure 2) suggested that they may have moved to an area very close to the border, with some birds continuing on to the reservoir. Birds departed in, and arrived from, a northeasterly direction, suggesting that they were not moving directly to or from Talimarzhan reservoir, which lies to the northwest of the site (Figure 1).

In Uzbekistan, birds moved between Talimarzhan reservoir, where they were recorded in highest numbers resting and bathing during the middle of the day on the dried mud along the edge of the water (Plate 3), and an area of steppe-like habitat c10 km to the east



Plate 3. Sociable Lapwing *Vanellus gregarius* bathing in Talimarzhan reservoir, Uzbekistan. October 2015. © Asif Khan



Plate 4 (left). In Uzbekistan, the steppe-like areas used by roosting and feeding Sociable Lapwing *Vanellus gregarius* contained a higher proportion of taller grass stems, faintly visible in the photo, than the site used by birds in Turkmenistan. Uzbekistan, October 2015. © Asif Khan

Plate 5 (right). Birds allowed close approach and a few colour-ringed Sociable Lapwings *Vanellus gregarius* were detected during the surveys. This bird had been ringed as a chick in central Kazakhstan in 2010. Uzbekistan, October 2015. © Asif Khan

(Figure 2, Plate 4). Here, birds were seen roosting during the day (as they were on steppe-like habitats in Turkmenistan) suggesting that these birds were also feeding at night. The movements of the single tagged bird on that side of the border conformed to this pattern of movement (Figure 2). This habitat differed from that used in Turkmenistan in that there was a greater cover of taller grass stems. Few birds remained at the reservoir by the evening, with birds heading south towards the border, although the timing of departure from here and the arrival of birds at the steppe-like site in Turkmenistan, which came from a northeasterly direction, suggested that not all of them could have been heading to the known steppic site, and that there must have been other nocturnal feeding areas in between.

In the second week of October 2015, increasing numbers of birds in Turkmenistan left the evening gatherings on the steppe-like areas and headed further southwest at dusk towards arable agricultural areas, where over 500 birds were subsequently found (Figure 2). The same pattern was apparent from data from the single satellite tagged bird in Turkmenistan, which was only recorded in arable areas in the second week of October and after. This change in behaviour may have been due to reduced light for nocturnal foraging on the steppe-like areas as the new moon approached, with birds instead roosting in arable areas at night. Temperature may also have been a factor, since the very high daytime temperatures in the first week of October, which exceeded 35°C at times, had fallen considerably by the second week of October, perhaps making different prey groups more or less active. A fall was also noted in the number of birds recorded at the reservoir in Uzbekistan, with fewer than 50 birds recorded on 13 October, suggesting that this is used primarily when daytime temperatures are high. This may explain the variable use made of the reservoir by satellite tagged birds in different years. In Turkmenistan, birds roosted on dry fields without irrigation that may have been recently planted with wheat, though with wet fields close by. It is not clear why birds moved from the steppic site to roost in fields, involving flights of between 12 and 35 km, as birds were not seen to feed there, but it could be that when the fading moonlight precluded nocturnal foraging on the steppe-like area, a lower density of predators in the arable areas made the extra flight to a safe roost site worthwhile. Birds on the steppe-like area were very sensitive to the large number of raptors using the area, particularly Pallid Harriers *Circus macrourus*, and on two



Plate 6. For most of the time, roosting flocks of Sociable Lapwings *Vanellus gregarius* were very approachable, not flying far even when disturbed by fast moving motorcycles. Uzbekistan, October 2015. © Nodir Azimov/Anna Ten

occasions we saw flocks of Sociable Lapwings being attacked by Sakers *Falco cherrug* (both times unsuccessfully).

Because of the complex pattern of movements of birds around the area, and because we could not survey much of the area in the sensitive border zone between the main sites in Uzbekistan and Turkmenistan, it is not possible to estimate accurately the total number of birds present at Tallymerjen at the time of our visit. The maximum number of birds recorded at any one time was 4225, a count made in Uzbekistan on a day that the field team in Turkmenistan was searching extensive areas of arable land, and so did not make a simultaneous count at the main steppe-like site. However, there were rarely fewer than 2000 birds present at this site so a total of around 6000 may be a reasonable minimum estimate. Furthermore, the data from tagged birds suggest that movement between the main sites in Turkmenistan and Uzbekistan is not frequent, and that some birds never cross the border at all. It is therefore possible that the peak counts of 4225 birds in Uzbekistan (8 October) and 3675 in Turkmenistan (13 October) may have been largely or wholly independent, and that the total population in the area was 8000 or more. The highest combined count made on any one day was 7226 (3 October). The population of birds in the area surveyed was therefore likely to be between 6000 and 8000, although there may have been many more birds present in areas we could not access, or in the vast areas of arable land to the north and south of our surveyed area.

Diet

In a total of 61 h, the 12 pitfall traps set near the main nocturnal feeding site in Turkmenistan between them yielded 111 adult tenebrionid beetles (Coleoptera: Tenebrionidae: probably *Adesmia*), 6 unidentified ants (Hymenoptera: Formicidae) and 2 unidentified moths (Lepidoptera). The numbers captured, and possibly the species composition, were likely to

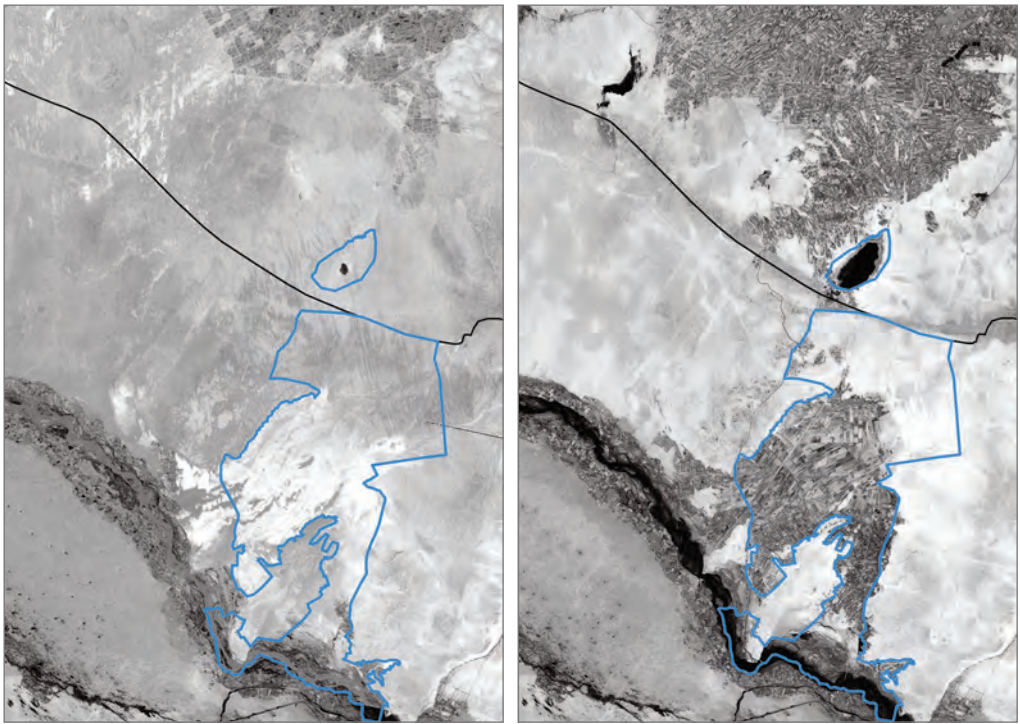


Figure 5. Landsat images of the Tallymerjen/Talimarzhan area in June 1975 (**left**) and August 2015 (**right**), showing the rapid spread of agriculture. In Turkmenistan, this has followed almost exactly the area showing up as white in the 1975 image; it represents a large *taky*r (see text). In 1975, Talimarzhan reservoir in Uzbekistan had only just been created and had not reached its present size. The blue outlines represent the two IBAs (see Figure 1).

have been affected by the tendency of the traps to fill with sand, allowing animals falling into them later to escape. Tenebrionid beetles are largely nocturnal and tend to be among the most abundant arthropods in many of the world's arid systems. In North Africa, tenebrionid beetles become active around dusk (Maeno *et al* 2014), the time at which Sociable Lapwings started feeding at Tallymerjen. Daytime temperatures at Tallymerjen exceeded 35°C during early October, temperatures likely to inhibit beetle activity. The specimens caught in the traps measured 1.5–2.0 cm and so were likely to be within the upper prey size range of Sociable Lapwings, and observations of feeding birds suggested that they were catching small numbers of larger items that required several bill movements to process. Analysis of Sociable Lapwing faecal samples suggested that tenebrionid beetles made up the bulk of the diet, but the shape of the mandibles and maxillae and the absence of fragments of elytra all pointed to larval stages being consumed, rather than adults. These are less mobile than adults and so less likely to be recorded in pitfall traps. Observations in Uzbekistan of feeding birds suggested that they were feeding during the day on termites, moths, dipteran flies associated with grazing herds and, at the shores of the reservoir, large mosquitoes.

Changes in land-use at Tallymerjen

We assessed long-term changes in land use in the area through visual interpretation of Landsat imagery. The reservoir in Uzbekistan first appears on Landsat images in 1975 as a small area of water and by 1976 it had grown to its current extent. In both Uzbekistan and Turkmenistan, the area of arable land increased greatly in the area after the 1970s.

The main crops here are cotton (cultivated for c3 years continuously), followed by 1–2 years of wheat, with lucerne planted at the end of the 5-year rotation as a break crop. All of these crops are heavily irrigated throughout the growing season with large quantities of water extracted from the Amu Darya river to flood over the crops. The spread of arable agriculture in Turkmenistan followed almost exactly the extent of an area that clearly shows up in Landsat images as a paler area that was quite different to the surrounding land cover types (Figure 5). This probably represents a large *takyr*, an area of heavy alluvial clay deposited in a shallow depression during periodic inundation from flooding of the Amu Darya that subsequently dries into a hard crust. The historic spread of arable agriculture suggests that the areas not so far converted to agriculture are inherently less suitable for it. Even in the earliest available Landsat images, the steppe-like area used by Sociable Lapwings in 2015 has a very different reflectance signature to the area that was converted to cropland, suggesting that the area converted was not pseudo-steppe. In Uzbekistan, however, crops have expanded into areas with a satellite reflectance signature very similar to that of pseudo-steppe, suggesting that there may have been considerable loss of such habitats there.

Further discussion

The existence of a migration stopover site at Tallymerjen had been suspected because of the previous occurrence here of satellite tagged birds, but the size of the population found to be using this site was unexpected. With the exception of a record of 8000–10 000 birds made in Kazakhstan in the late summer of 1898 (Dolgushin 1962), counts at Tallymerjen in October 2015 are the largest ever made of the species, exceeding the 3200 birds recorded along the western flyway at Ceylanpinar in eastern Turkey on 15 October 2007 (Biricik 2009). Although the size of the global population is not known with any accuracy, the 6000–8000 birds at Tallymerjen in October 2015 are likely to comprise a substantial proportion of the world population, which one estimate puts at c16 000 individuals (BirdLife International 2015).

All seven of the satellite tagged birds using the eastern flyway have stopped here, suggesting that the site holds most or all of the eastern flyway population at this time of year. No other staging sites are known along the eastern flyway, and there has been no consistent pattern in the data from our tagged birds to suggest that others exist. Birds arrive at Tallymerjen shortly after leaving their breeding grounds, and arrive in Pakistan shortly after leaving Tallymerjen, so if there are other regular gathering points along this flyway, they are not used for long. There have been very few records of the species from elsewhere in Turkmenistan and Uzbekistan and, prior to the record of 200 birds in 2010, none of large flocks. However, the fact that the very large population at Tallymerjen has hitherto evaded discovery suggests that other populations could remain undetected. Whether or not this is the only staging site on the eastern flyway, Tallymerjen is clearly an internationally important site for the species, both in terms of the number of birds using the site and the lengthy period they spend here. The site may be essential to birds preparing for their crossing of the mountains of Afghanistan on their way to wintering grounds in India and Pakistan. The site may also be important as a migration stopover site for other species. In October 2015, tens of thousands of Bimaculated Larks *Melanocorypha bimaculata* were seen moving, like the Sociable Lapwings, between irrigated arable land and semi-natural steppic habitats. The Bimaculated Lark has a winter distribution and habitat associations in Africa and India that are very similar to those of the Sociable Lapwing, and so may use the same stopover sites on migration.

Quite why Sociable Lapwings select this particular site is uncertain, but it is intriguing that Tallymerjen shares with Ceylanpinar the close proximity of open, heavily grazed

steppe-like habitats, irrigated cropland with a mix of wet and dry fields, open water and an international border. At Tallymerjen, Sociable Lapwings fed both on cropland and steppic areas, the latter particularly on moonlit nights. The combination of different types of open habitat in a small area may allow birds to adapt to different conditions during their lengthy stay. Large numbers of birds use Talimarzhan reservoir for resting, drinking and bathing, though data from tagged birds suggest that some birds rarely visit the reservoir and some may not use it at all, and numbers using the site appear to fall during cooler weather. The sensitive border zone may result in lower disturbance and reduced hunting pressure, and we found no evidence that birds using the site are being hunted. Birds showed no nervousness of cars and could easily be approached in vehicles, or even on foot to within 50 m (Plates 5, 6). Birds flying into the steppe-like site in Turkmenistan in the evening showed no reluctance to fly low over the heads of observers standing outside cars. However, observers in Uzbekistan noticed a change in behaviour over the period of observation. Before 9 October, birds showed no fear of people, cars or even dogs, whereas after that date, birds appeared much more nervous and would fly off long distances when approached. The reasons for this are unclear but coincided with a change in the weather, which became cooler and windier.

While hunting appears not to be a threat at Tallymerjen, it is clear that there have been a number of significant land use changes in the area that could affect the site's value to Sociable Lapwings. Irrigation canals from the Amu Darya, the source of the water in Talimarzhan reservoir, have allowed arable agriculture to spread far from the river and across the border into Uzbekistan, where satellite imagery suggests that significant areas of steppe-like habitats have been lost to arable agriculture since the 1970s. How much of a problem this is for Sociable Lapwings is unclear, because for some of the time at least, birds chose to roost and feed in arable land in preference to steppe-like areas. However, the birds showed a pattern of habitat use that suggests that both pseudo-steppe and agriculture are important to them under different conditions. Overgrazing by sheep and goats is causing desertification and extensive shifting sand dunes (barchans) have appeared in recent years where none were present before, some of them close to the areas of pseudo-steppe used by Sociable Lapwings. These are causing significant problems in the area by blocking roads and filling irrigation channels with sand. Changes to the current pasture grazing regulations to reduce grazing pressure could, conversely, lead to the growth of taller vegetation unsuited to Sociable Lapwings (Plate 7). There are a number of small oil wells and associated infrastructure in the area; currently none of these are close to the areas used by birds but any future discovery of oil in the area could lead to significant changes and loss of semi-natural habitats.

Satellite-tagged birds using the western flyway use known stopover sites for relatively short periods, with a consequent high rate of turnover. However, birds using Tallymerjen stay for prolonged visits of a month or more, so it is likely that most or all of the eastern flyway population is present at one time. This offers the possibility of using counts at this site to estimate trends in the overall population of the species, which is almost impossible to assess on the breeding or wintering grounds because birds are spread out over vast areas and because breeding site fidelity is known to be very low. Standardised counts at Tallymerjen could be used as an index of trends in the overall population, or at least the part of the population using the eastern flyway.

The species is already included in the Red Data Books of Uzbekistan and Turkmenistan, but there are no environmental protection measures in place in Tallymerjen. Much of the area used by Sociable Lapwings falls inside the two Important Birds and Biodiversity Areas (IBAs) in the area, UZ023 'Talimarzhan Reservoir' (Kashkarov *et al* 2008) and TM049 'Tallymerjen' (Rustamov *et al* 2009), which were designated for other species



Plate 7. The balance of grazing needed to maintain the open steppe-like habitats used by Sociable Lapwings *Vanellus gregarius* is a fine one; too much grazing and desertification sets in, too little and the vegetation grows too tall. Turkmenistan, October 2015. © Paul F Donald

(particularly winter aggregations of Common Cranes *Grus grus*, Greylag Geese *Anser anser* and other waterbirds), but this does not confer legal protection. The IBA in Uzbekistan needs to be expanded to include key steppic areas to the east and south of the reservoir, and both need recognition as sites vital to the survival of a critically endangered bird. A system of monitoring needs to be developed to track future changes and, if necessary, protective measures will need to be drawn up. The spread of arable agriculture, and perhaps desertification, can be monitored from satellite imagery, but periodic field visits should be undertaken to assess trends in numbers and threats to birds using the site. The AEWA international species action plan for Sociable Lapwing (Sheldon *et al* 2012) requires updating in the light of the discovery that both Turkmenistan and Uzbekistan are important range states. Our results indicate that the eastern flyway population is substantially larger than previously recognised, and that more work is required in range states along this flyway to ensure that threats are monitored and minimised.

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