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NINA Report

Rapid assessments of wildlife in Turkmenistan 2018

Petra Kaczensky, Eldar Rustamov, Shirin Karryeva, Petar Iankov, Nurmuhamet Hudaykuliev, Jumamyrat Saparmyradov, Atamyrat Veyisov, Aleksandr Shestopal, Shaniyaz Mengliev, Hojamyrat Hojamyradov, Aknabat Potaeva, Aman Kurbanov, Arazmyrat Amanov, Garly Khekimov, Charymyrat Tagiyev, Tatjana Rosen, John D. C. Linnell



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NØKKELOORD

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asiatisk villese
kulan
persisk leopard
steppesau
skruegeit
gaupe

Abstract

Kaczensky, P., Rustamov, E., Karryeva, S., Iankov, P., Hudaykuliev, N., Saparmyadov, J., Veyisov, A., Shestopal, A. A., Mengliev, S., Hojamyradov, H., Potaeva, A., Kurbanov, A., Amanov, A., Kekimov, G., Tagiyev, C., Rosen, T. & Linnell, J. D. C. 2019. Rapid assessments of wildlife in Turkmenistan 2018. NINA Report 1696. Norwegian Institute for Nature Research.

Although Turkmenistan supports many wildlife species there is very little up-to-date and accessible information on its status. Since 2014 we have been conducting a series of expeditions to protected areas throughout the country. The primary objective has been to clarify the status of Turkmen kulan (*Equus hemionus*), however, we have also had a secondary focus on other large mammals, especially the Persian leopard (*Panthera pardus*) and its potential prey species, urial (*Ovis orientalis*), goitered gazelle (*Gazella subgutturosa*), markhor (*Capra falconeri*), bezoar (*Capra aegagrus*), and wild boar (*Sus scrofa*). In addition, several expeditions have been accompanied by ornithologists and herpetologists availing of the platform to obtain up-to-date records of these species. Finally, the expeditions have been used to assist networking and experience exchange between the staff of the different protected areas.

The purpose of this report is to provide a record of our activities from 2018, with details of large mammals, birds and reptiles seen in the different ecosystems. An appendix provides a short summary of large mammals seen during similar expeditions in 2015. Furthermore, we provide a brief summary of the situation of kulan and leopard based on the combined survey effort from 2014-2018 (and 2019). Our methods were based on collecting all possible information; including direct observations of animals and their tracks / signs, interviewing protected area staff and shepherds about wildlife observations, and collecting the data from camera traps that had been distributed in previous years.

In 2018 we conducted a series of expeditions in April, May, June and December which covered most of the ecosystems and major protected areas in Turkmenistan where kulan, leopard, urial, goitered gazelles, bezoar and markhor have occurred in recent years. In total, we visited 5 Nature Reserves, 5 Wildlife Sanctuaries and 18 Important Bird Areas using 39 days of activity. During the expeditions we recorded observations of all target large mammals (kulan, leopard, urial, goitered gazelle, markhor, bezoar, wild boar) along with records of other large and medium sized mammals, particular wolf (*Canis lupus*), striped hyena (*Hyaena hyaena*), Eurasian lynx (*Lynx lynx*), smaller cats (caracal (*Caracal caracal*), wild cat (*Felis lybica*), jungle cat (*Felis chaus*), Pallas' cat (*Otocolobus manul*)) and honey badger (*Mellivora capensis*). We opportunistically also recorded golden jackal (*Canis aureus*), red fox (*Vulpes vulpes*), corsac fox (*Vulpes corsac*), Eurasian badger (*Meles meles*), steppe polecat (*Mustela eversmanni*), and porcupine (*Hystrix indica*). In addition, we observed a total of 191 species of birds and 38 species / sub-species of reptiles.

The status of kulan is serious. They have become functionally extinct in Badhyz Nature Reserve, with no confirmed observations since 2015. Some few individuals (<15) persist in the Tersakan valley west of Sunt Hasardag Nature Reserve and the Gury Howdan Wildlife Sanctuary, and a group of 15-25 individuals occupy the border security zone and adjacent areas of Uzbekistan to the north and west of Sarygamysh Lake. There may be a handful of other individuals ranging around Meana Chacha Wildlife Sanctuary and Gaplanyr Nature Reserve. It is highly likely that the species will become totally extinct in Turkmenistan in the near future because none of these isolated remnants is likely to be viable. The situation for leopard and their prey is better. Leopards are widespread in the mountains along the Iranian border (from Badhyz in south to Sunt Hasardag in west), and through the Balkan range. Urial were found in all mountain protected areas visited, and markhor were present in Koytendag Nature Reserve. Gazelles were also present in many protected areas, and occasionally outside. However, the scarcity of urial outside

protected areas, and the general low density of gazelles point to targeted poaching as being the main driver of decline of all the large herbivores (kulan, urial, gazelles).

The expeditions have provided a broad impression of the current state of Turkmenistan's wildlife, using rapid assessments and camera trapping. The country is home to an amazing diversity of species and ecosystems which are clearly deserving of more study and better protection. There is a need for more detailed and targeted follow-up studies of all the species that we have documented in this report to better understand their ecology and the required actions needed for their long-term survival. However, unless serious action is taken to address poaching and improve the investment in protected area and rangeland management many other species could soon follow the kulan into decline and extinction.

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Sammendrag

Kaczensky, P., Rustamov, E., Karryeva, S., Iankov, P., Hudaykuliev, N., Saparmyadov, J., Veyisov, A., Shestopal, A. A., Mengliev, S., Hojamyradov, H., Potaeva, A., Kurbanov, A., Amanov, A., Kekimov, G., Tagiyev, C., Rosen, T. & Linnell, J. D. C. 2019. Rapid assessments of wildlife in Turkmenistan 2018. NINA Rapport 1696. Norsk institutt for naturforskning (NINA).

Selv om Turkmenistan har mange viltarter, foreligger det svært lite oppdatert og tilgjengelig informasjon om deres status. Vi har siden 2014 foretatt en rekke ekspedisjoner til verneområder i landet. Hovedformålet har vært å klargjøre statusen til turkmensk kulan (asiatisk villesel) (*Equus hemionus*), men vi har også hatt fokus på andre store pattedyr, særlig persisk leopard (*Panthera pardus*) og dens potensielle byttedyrarter, urial (steppesau) (*Ovis orientalis*), svarthalegazelle (*Gazella subgutturosa*), markhor (skruegeit) (*Capra falconeri*), besoargeit (villgeit) (*Capra aegagrus*) og villsvin (*Sus scrofa*). I tillegg har flere ekspedisjoner hatt med ornitologer og herpetologer som har bidratt til å fremskaffe oppdaterte funn av disse artene. Og ikke minst, har ekspedisjonene blitt brukt til å hjelpe med nettverksbygging og erfaringsutveksling mellom tilsatte i de ulike verneområdene.

Formålet med denne rapporten er å presentere data fra vår aktivitet i 2018, med detaljer på store pattedyr, fugler og reptiler sett i de ulike økosystemene. Et appendiks gir en kort oppsummering av store pattedyr sett på lignende ekspedisjoner i 2015. Vi gir videre en enkel oppsummering av situasjonen for kulan og leopard basert på en samlet undersøkelsesinnsats fra 2014-2018 (og 2019). Våre metoder var basert på å samle all mulig informasjon; inkludert direkte observasjoner av dyr og deres spor, intervjuer ansatte i verneområdene og gjeterne om viltobservasjoner, og innsamling av data fra viltkameraer som var satt ut i tidligere år.

I 2018 foretok vi en rekke ekspedisjoner i april, mai, juni og desember som dekket det meste av økosystemer og de viktigste verneområdene i Turkmenistan hvor kulan, leopard, urial, svarthalegazelle, besoargeit og markhor har forekommet i de siste årene. Totalt har vi besøkt 5 naturreservater, 5 viltreservater og 18 viktige fugleområder (IBA) i løpet av 39 dager med aktiv feltinnsats. Vi har i løpet av ekspedisjonene registrert observasjoner av alle fokusartene av store pattedyr (kulan, leopard, urial, svarthalegazelle, markhor, besoargeit, villsvin) sammen med registreringer av andre store og mellomstore pattedyr som ulv (*Canis lupus*), stripehyene (*Hyaena hyaena*), gaupe (*Lynx lynx*), mindre katter (caracal (*Caracal caracal*) afrikansk villkatt (*Felis lybica*), jungelkatt (*Felis chaus*), pallaskatt (*Otocolobus manul*) og honninggrevling (*Mellivora capensis*). Vi observerte tilfeldigvis også gullsjakal (*Canis aureus*), rødrev (*Vulpes vulpes*), steppeperv (*Vulpes corsac*), grevling (*Meles meles*), steppeilder (*Mustela eversmanni*) og indisk hulepiggsvin (*Hystrix indica*). Vi har i tillegg observert i alt 191 fuglearter og 38 arter/underarter av reptiler.

Situasjonen for kulan er alvorlig. Den er funksjonelt utryddet i Badhyz naturreservat, med ingen bekreftede observasjoner siden 2015. Noen få individer (<15) er tilstede i Tersakan-dalen vest for Sunt Hasardag naturreservat og Gury Howdan viltreservat, og en gruppe på 15-25 individer holder til i sikkerhetssonen på grensen og tilstøtende områder i Uzbekistan til nord og vest for innsjøen Sarygamysh. Det kan være en håndfull andre individer i området rundt Meana Chacha viltreservat og Gaplanyr naturreservat. Det er høyst sannsynlig at arten vil bli totalt utryddet i Turkmenistan i nær fremtid da ingen av disse isolerte restbestandene er levedyktige. Situasjonen for leoparden og dens byttedyr er bedre. Leoparden er vidt utbredt i fjellene langs den iranske grensen (fra Badhyz i sør til Sunt Hasardag i vest), og gjennom Balkan-fjellkjeden. Urial ble funnet i alle fjellverneområder som ble besøkt, og markhor var tilstede i Koytendag naturreservat. Gazeller var også tilstede i mange verneområder, og av og til utenfor. Imidlertid peker knappheten på urial utenfor verneområder og den generelt lave tettheten av gazeller på målrettet krypting som viktigste driver for nedgangen av alle store herbivorer (kulan, urial, gazeller).

Ekspedisjoner har fremskaffet det første brede inntrykk av staten Turkmenistan's viltfauna. Landet er hjem for en fantastisk diversitet av arter og økosystemer som klart fortjener flere studier

og bedre vern. Det er behov for mer detaljerte og målretta oppfølgingsstudier av alle arter som vi har dokumentert i denne rapporten for bedre å forstå deres økologi og de tiltak som kreves for deres langsiktige overlevelse. Dersom ikke alvorlige tiltak settes inn mot krypskyting, og at det bevilges mer penger til verneområder og forvaltning av beiteland, så vil andre arter snart følge etter kulanen med bestandsnedgang og utryddelse.

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Резюме

Качински П., Рустамов Е., Каррыева Ш., Ианков П., Худайкулиев Н., Сапармурадов Д., Вейисов А., Шестопап А., Менглиев Ш., Ходжамурадов Х., Потаева А., Курбанов А., Аманов А., Хекимов Г., Тагиев Ч., Розен Т. И Линнел Д. 2019 Быстрая оценка дикой природы Туркменистана, 2018. Отчет 1696, Норвежский институт исследований природы (NINA).

Хотя Туркменистан поддерживает многообразие видов дикой природы, но современной и доступной информации о ее статусе очень мало. С 2014 г. мы провели серию экспедиций в охраняемые природные территории по всей стране. Главная цель заключалась в определении современного статуса туркменского кулана (*Equus kulan*), во вторую очередь – других крупных млекопитающих, особенно, переднеазиатского леопарда (*Panthera pardus*) с его потенциальными видами-жертв – уриал (*Ovis orientalis*) и безоаровый козёл (*Capra aegagrus*), а также винторогого козла (*Capra falconeri*) и джейрана (*Gazella subgutturosa*). В нескольких экспедициях принимали участие орнитологи и герпетологи, которые используя нашу возможность, также получили современные данные о птицах и рептилиях территории страны. Наконец, экспедиции использовались для налаживания связей и обмена опытом между сотрудниками различных ООПТ Туркменистана.

Цель данного отчета – предоставить результаты нашей деятельности с 2018 г. с подробным описанием состояния крупных млекопитающих, а также птиц и рептилий в различных экосистемах Туркменистана. В Приложении изложено краткое состояние крупных млекопитающих, отмеченных во время подобных экспедиций в 2015 г. Кроме того, мы предоставили краткое резюме ситуации с куланом и леопардом, основанной на объединенном усилии деятельности за 2014-2019 гг.. Методы работы были основаны на сборе всей возможной и доступной информации, в том числе прямые наблюдения за животными и/или следами их жизнедеятельности, интервью сотрудников ООПТ и пастухов об их наблюдениях в дикой природе, а также сбор данных с фотокамер-ловушек.

В 2018 году мы провели наиболее масштабные экспедиции в апреле, мае, июне и декабре, которые охватили большинство экосистем и крупных ООПТ. За 39 дней работы посетили 5 заповедников, 5 заказников и 18 Ключевых орнитологических территорий. В ходе экспедиций регистрировались все особи не только указанных выше видов крупных млекопитающих, но кроме того: лисица (*Vulpes vulpes*), корсак (*Vulpes corsac*), волк (*Canis lupus*), шакал (*Canis aureus*), полосатая гиена (*Hyaena hyaena*), степной (*Felis lybica*) и камышовый (*Felis chaus*) коты, медоед (*Mellivora capensis*) и степной хорь (*Mustela eversmanii*). Из птиц и пресмыкающихся было зарегистрировано, соответственно, 191 и 38 видов/подвидов.

Состояние кулана оказалось очень серьезным: он практически вымер в Бадхызе, с 2015 г. мы не смогли получить никаких подтвержденных фактов его присутствия там. Несколько особей (<15) сохраняются пока в долине Терсакана к западу от Сюнт-Хасардагского заповедника (за его пределами) и в заказнике Гуры-Ховдан, а группа из 15-25 особей обитает в пограничной зоне и прилегающих участках Узбекистана к северу и западу от Сарыкамышского озера; наконец, возможно единичные особи ещё встречаются в районах заказника Меана-Чача и заповедника Гаплангыр.

Весьма вероятно, что в ближайшем будущем этот вид полностью исчезнет в Туркменистане, поскольку ни одна из указанных групп не может считаться жизнеспособной. Ситуация с леопардом и их объектами питания лучше. Леопарды распространены в горах вдоль туркменско-иранской границы (с юга от Бадхыза и на запад до Сюнт-Хасардага), а также в горах Большие Балханы. Уриалы обнаружены во всех горных заповедниках, а мархур только в Койтендагском. Джейраны также отмечались в ряде ООПТ, однако, отсутствие джейранов и уриалов за пределами ООПТ и их очень

низкая численность указывают на браконьерство как основной фактор сокращения диких копытных животных в стране.

Экспедиции впервые обеспечили информацией о статусе дикой природы Туркменистана. Туркменистан является домом для удивительного разнообразия видов и экосистем, которые явно заслуживают большего внимания, изучения и лучшей защиты. Существует необходимость в более детальных и целенаправленных исследованиях всех видов, чтобы лучше понять их экологию и осуществлять необходимые действия, необходимые для их выживания. Если не будут приняты серьезные меры по борьбе с браконьерством и улучшению инвестиций в управление ООПТ и пастбищами, многие виды вскоре окажутся на грани исчезновения.



Milking a camel. Photo: P. Kaczensky

Gysgaça beýany

Kaçinski P., Rustamow E., Garryýewa Ş., Iankow P., Hudaýgulyýew N., Saparmyradow J., Weýisow A., Şestopal A., Meňliýew Ş., Hojamyrow H., Potaýewa A., Gurbanow A., Hekimow G., Tagyýew Ç., Rozen T., Linnel J. 2019. Türkmenistanyň ýabany tebigatyna çalt baha bermek. 1696-njy hasabat, Norwegiýanyň tebigaty barlamak instituty (NINA).

Türkmenistanyň ýabany tebigatynyň görnüşleriniň köpdürlüligini gorap saklaýandygyna garamazdan, onuň häzirki ýagdaýynyň derejesi baradaky elýeterli maglumatlar azlyk edýär. 2014-nji ýyldan başlap biz ýurduň dürli künjeklerindäki aýratyn goralýan tebigy ýerlere köpsanly ekspedisiýalar, meýdan iş saparlaryny gurnadyk. Türkmen gulanynyň (*Equus kulan*) häzirki wagtdaky derejesini anyklamagy öz öňümizde esasy wezipe hökmünde belledik, ikinji nobatda bolsa beýleki iri süýdemdiriji haýwanlaryň, aýratyn-da alajagaplaňyň (*Panthera pardus*) we onuň esasy iýmitlenýän görnüşleri bolan aýragyň (*Ovis orientalis*) we umganyň (*Capra aegagrus*), şeýle hem burma şahly umganyň (*Capra falconeri*) we keyigiň (*Gazella subgutturosa*) tebigatdaky ýagdaýyny kesgitlemegi maksat edinip goýduk. Birnäçe ekspedisiýalara ornitologlar we gerpetologlar gatnaşdylar we olar guşlar hem-de süýrenijiler barada täze maglumatlary toplamaga mümkinçilik aldylar. Galyberse-de, bu gurnalan ekspedisiýalar Türkmenistanyň dürli goraghanalarynyň işgärleriniň arasyndaky özara gatnaşyklarynyň has ysnyşykly alnyp barylmagy we tejribe alyşmaklary üçin hem ýaramly boldy.

Şu hasabatnyň maksady – Türkmenistanyň dürli ekoulgamlaryndaky iri süýdemdirijileriň, şeýle hem guşlaryň we süýrenijileriň ýagdaýyny doly beýan etmek bilen, biziň 2018-nji ýyldan bäri geçiren işlerimiziň netijelerini açyp görkezmekden ybarat. Goşundyda 2015-nji ýylda gurnalan şeýle ekspedisiýalarda hasaba alnan süýdemdirijileriň gysgaça ýagdaýy beýan edildi. Şeýle hem, 2014-2019-njy ýyllarda bilelikde alnyp barlan işleriň netijelerine esaslanyp, gulanynyň we alajagaplaňyň ýagdaýy baradaky gysgaça maglumatlar beýan edildi. Işiň usulyýeti elýeterli bolan ähli maglumatlara, şol sanda haýwanlara göni ýa-da olaryň işjeňligine gözegçilik etmek, goraghanalaryň işgärleri we çopanlar bilen olaryň ýabany tebigatda gören täsin zatlary barada geçirilen gürrüňdeşlik esasynda, şeýle hem herekete duýgur surata düşüriji enjamlar arkaly alnan maglumatlara esaslanandyr.

2018-nji ýylyň aprel, maý, iýun we dekabry aýlarynda biz ýurduň esasy ekoulgamlaryny we iri goraghanalarynyň öz içine alýan has uly möçberli ekspedisiýalary gurnadyk. 39 günüň dowamynda 5 goraghana, 5 sany çäkli goraghanalara we 18 sany guşlar üçin möhüm ähmiýetli ýerlere (möhüm ornitologik ýerlere) baryp gördük. Ekspedisiýalaryň dowamynda diňe bir ýokarda sanalyp geçilen görnüşler däl-de, eýsem iri süýdemdirijileriň ähli duş gelen görnüşleri, ýagny tilki (*Vulpes vulpes*), garsak (*Vulpes corsac*), möjek (*Canis lupus*), şagal (*Canis aureus*), syrtlan (*Hyaena hyaena*), ýabany (*Felis lybica*) we gamyş (*F. chaus*) pişikleri, itaýy (*Mellivora capensis*) we agymtyl porsugüzen (*Mustela eversmanii*) hasaba alyndy. Guşlaryň we süýrenijileriň deňişlilikde 191 we 38 görnüşü/aşaky gşrnüşü hasaba alyndy.

Gulanynyň ýagdaýynyň örän çynlakaýdygy anyklandy: Bathyzda doly ýitip barýar diýen ýaly, 2015-nji ýyldan bäri ol ýerde gulanynyň bardygyny tassyklaýan maglumatlary alyp bolmady. Häzirki wagtda birnäçe gulanlar (<15) Sünt-Hasardag döwlet tebigy goraghanasynyň günbatar tarapynda (goraghananyň çäginde daşarda) ýerleşýän Tersakan jülgesinde we Köpetdag döwlet tebigy goraghanasynyň Guryhowdan döwlet çäkli goraghanasynda duş gelýärler, 15-25 gulandan ybarat bolan topar bolsa Sarygamyş kölüniň günbatar we demirgazyk taraplarynda, Özbekistan bilen araçäkleşýän serhetýaka zolagynda saklanýar, şeýle hem gulanlaryň käbirleriniň Mäne-Çäçe çäkli goraghanasynda we Gaplaňgyr döwlet tebigy goraghanasynda duş gelýän bolmagy mümkin.

Ýakyn geljekde bu görnüşüň Türkmenistanyň çäginde doly ýitip gitmegi mümkin, çünki agzalyp geçilen toparlaryň hiç birini hem ýaşayşa ukyply diýip hasap edip bolmaýar. Alajagaplaňyň we onuň iýmit obýektleriniň ýagdaýy gowurak. Alajagaplaňlar türkmen-eýran serhetýakasy bilen

uzalyp gidýän dag ulgamlarynda (günorta-gündogarda Bathyzdan günbatarda Sünt-Hasardaga çenli), şeýle hem Uly Balkan daglarynda ýaýran. Aýraklar daglyk ýerlerdäki ähli goraghanalarda, burma şahly umga bolsa diňe Köýtendag goraghanasynda hasaba alyndy. Keýikler hem birnäçe goraghanalarda hasaba alyndy, emma keýikleriň we aýraklaryň aýratyn goralýan tebigy ýerleriň çäginde daşynda duş gelmezligi we olaryň sanynyň pes derejede bolmagy ýabany toýnakly haýwanlaryň bikanun awlanmagynyň esasy sebäpleriň biridigini görkezýär.

Gurnalan ekspedisiýalar Türkmenistanyň ýabany tebigatynyň häzirki ýagdaýy barada giňişleýin maglumatlary toplamaga mümkinçilik berdi. Türkmenistan görnüşleriň we ekoulgamlaryň örän özboluşly dürlüliginiň mekanydyr, şonuň üçin hem aýratyn üns berilmäge, öwrenilmäge we has oňat goralmaga mynasypdyr. Ähli görnüşler boýunça olaryň ekologik aýratynlyklaryna göz ýetirmeklik we saklanyp galmaklary üçin zerur çäreleri geçirmek maksady bilen, has düýpli we maksadalaýyk geçirilmegi wajyp bolup durýar. Eger-de bikanun aw awlanylmagynyň garşysyna göreşmek hem-de aýratyn goralýan tebigy ýerleriň ulgamyny we öri meýdanlaryny dolandyrmaklyga maýa goýumlaryny çekmek boýunça düýpli çäreler geçirilmese, gulan bilen birlikde beýleki köp görnüşleriň ýitmek howpy artýar.



Turkmen yurt in the Karakum. Photo: P. Kaczensky

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Foreword

In 2012, at the instigation of the President of Turkmenistan, Gurbanguly Berdymukhamedov, the Turkmen Government decided to nominate Koytendag Nature Reserve as the country's first UNESCO Natural World Heritage Site. The first stage in this process was the organisation of a major scientific expedition and conference in spring 2012. With the participation of experts from over 20 countries this provided an opportunity to highlight and review the international importance of the site. A major outcome of this expedition and conference was the signing of a Memorandum of Understanding (MoU) between the Ministry of Nature Protection of Turkmenistan (now the Ministry of Agriculture and Environment Protection of Turkmenistan) and the Royal Society for the Protection of Birds (RSPB). Under this MoU the RSPB has provided, and continues to provide, technical support to several Nature Reserves, including Koytendag and Badkhyz, assisting with the preparation of the World Heritage nomination dossiers for both these sites, production of up to date site management plans, and the provision of resources and training for key reserve staff. All of the subsequent work in Turkmenistan detailed in this report was carried out under this Memorandum of Understanding within the Project on "Improvement of the status of birds and other biodiversity in Turkmenistan". The RSPB provided funding for the Turkmen team, equipment, transport, travel and field logistics, while the salary for the Norwegian participation was covered by the Norwegian Institute for Nature Research & the Research Council of Norway, and travel costs in 2018 by the Fondation Segré. A total 49 camera traps deployed in 2018 and 2019 and related field equipment and expenses, including the participation of T. Rosen were financed by the Any Hope for Nature fund and the National Geographic Society. The authors are especially grateful to Stephanie Ward, Mark Day and Geoff Welch (RSPB) for their long term commitment to making these expeditions possible. We are all exceptionally grateful to the Turkmen government for giving us permission to visit so many parts of their beautiful country and to the many staff of the protected areas who shared their knowledge of the areas to whose protection they have dedicated their lives.

John D. C. Linnell, NINA for the authors & Stephanie Ward for RSPB (August 2019)



Local herder with flock. Photo: P. Kaczensky

1 Introduction

Central Asia constitutes an extremely biodiverse region because of the close proximity of diverse habitats (mountains, deserts, steppes) and its location at the intersection of several biogeographic regions (Asian Development Bank 2010). However, nature conservation in the region as a whole suffers from a general lack of up to date knowledge about the distribution, status and ecology of the biodiversity (e.g. Jacobsen et al. 2016). This is especially true for Turkmenistan from which there is almost no information available to the outside world since the break-up of the Soviet Union (Atamuradov et al. 2008; Fet & Atamuradov 1994; Rustamov & Rustamov 2007).

During the last decade, the UK based Royal Society for the Protection of Birds (RSPB) has negotiated an MoU with the Turkmen government to provide assistance with biodiversity conservation. Under this MoU the RSPB has facilitated and sponsored a series of expeditions to Turkmenistan by international experts. Most of these recent expeditions have focused on two sites, Koytendag and Badkhyz Nature Reserves, with the objective of helping the Turkmen government prepare nomination dossiers for World Heritage Site status. The presence of intact ecosystems with large mammal communities has been a central component of both sites' value. Since 2014 we have been engaged in efforts to produce up-to-date information on these species. The initial focus has been on Asiatic wild ass, or kulan (*Equus hemionus*) which has been a key species for the Badkhyz ecosystem, and was the main motivation for its initial protection in the 1940's. Following our initial assessment of Badkhyz based on an expedition in 2014 (Kaczensky & Linnell 2015) we expanded our surveys to cover all areas in which kulan have occurred in Turkmenistan in recent decades. At the same time as clarifying the distribution of kulan in Turkmenistan we have collected available information on other wildlife species, especially the large herbivores (urial *Ovis orientalis*, bezoar *Capra aegagrus*, goitered gazelle *Gazella subgutturosa*, markhor *Capra falconeri*) and large carnivores (leopard *Panthera pardus*, wolf *Canis lupus*, lynx *Lynx lynx*, striped hyaena *Hyaena hyaena*) with a special focus on leopards and their prey.

As the series of expeditions has continued, every effort has been made to ensure the maximum knowledge gains by inviting other experts to join, allowing the registration of a wider range of species. The lack of accessible knowledge from the region implies that all species distribution registrations represent a significant value. This report summarises our series of expeditions conducted in 2018. While the focus was on kulan and other large mammals, we also recorded observations of birds and reptiles. We also include a short summary of similar expeditions conducted in 2015 as an appendix. Combined with our initial report from 2014 (Kaczensky & Linnell 2015) and parallel reports on camera trapping studies (see Welch & Stoev 2019) we hope that these reports will be of value to create a wider appreciation of the wildlife of Turkmenistan and stimulate strengthened efforts to conserve it for the future, as well as providing some documentation of species distribution and status.

2 Overview of expeditions in 2018

In 2018 we conducted our most ambitious series of expeditions yet in Turkmenistan, visiting all areas where kulan have occurred in the country in recent decades, as well as other important wildlife areas, including Nature Reserves, Wildlife Sanctuaries and Important Bird Areas. The following sections detail the participants, travel routes and main activities of these expeditions (Tables 1-6 and Figs 1-5).

2.1 Expedition #1: April-May 2018

Table 1. Overview of expedition participants, April-May 2018.

Participants	April 2018					May 2018										
	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11
Petra Kaczensky	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Petar Iankov	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Eldar Rustamov	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Atamyrat Veyisov	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Aman Kurbanov	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Aleksandr Shestopal	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Shirin Karryeva	X	X	X	X	X	X	X	X								
Hojamyrat Hojamyradov	X	X	X	X	X	X	X	X				X	X	X	X	X
Charymyrat Tagiyev														X	X	
Arazmyrat Amanov			X	X	X	X	X									
Garly Khekimov			X	X	X	X	X									
Yashin Atajanov			X	X	X	X	X									

Table 2. Expedition travel routes and main activities, April-May 2018.

Date	Expedition travel route April-May 2018
26 April	Ashgabat – Central Karakum – village Erbent (refuelling) – Rustamov memorial site Garajulba – water crater near Darvaza – inselberg Oyligizil (overnight).
27 April	Oyligizyl – village Atagui – depression of Akdjagaya (IBA) – village Rukhybelent (refueling) and meeting with the car and representatives of the Gaplangyr Nature Reserve – chink (cliff) Tarimgaya (overnight at its northern corner).
28 April	Tarimgaya (future IBA) – Butentau – Goyungyrlan.
29 April	Along the eastern and then southern shore of Lake Sarykamys (IBA) to the Dusheklidash ranger station (overnight).
30 April	Arazmyrat, Sasha & Garly attempt to registration for ungulates survey north of frontier outpost Burchliburun; but fail to get permission. The remaining team surveyed the Prisarykamys plain, the plateau of the Gaplangyrsky Nature Reserve with the southern half of the chink and IBA Karashor.
1 May	Survey of the plateau of the Gaplangyr Nature Reserve and the northern chink of Karashor (IBA) – 15 km to the east of northern chink Karashor (overnight).
2 May	Plateau Gaplangyr – tomb Shaltay (trigpoint 185.5m) – eastern part of plateau Gaplangyr – fishermen camp Vepa near Atabayshor lake (lunch) – to the south along the canal Malyab – village Balaishem (refueling and overnight 3 km south-east of the village).
3 May	Village Balaishem – village Gyzyljaburun – village Islam – village Atagui (the same we visited 27 April, lunch) – village Beary – village Bokurdak – Ashgabat.
4 May	Ashgabat – rest and administration day.
5 May	Ashgabat (refuelling) – village Artyk – village Babadurmaz – village Soltandesht – to the north – Garajaovlak tract (IBA) – Singerly lake (IBA) – village Adjical (overnight).
6 May	Adjical – to the north-west – Mollakurban lakes (future IBA) – to the south – village Chorly & Bozkol – game reserve Mergen (IBA) – Ashgabat.
7 May	Ashgabat (refueling) – Serdar (meeting with Hojamyrt) – village Iskander – spring Egshem – well Annapolat – 17 km to south-west (overnight).
8 May	Overnight stop – Khodjaguly well – village Bekibent (lunch) – Kemendere ravine (overnight).
9 May	Kemendere – Shirbekir shrine – village Madau (lunch) – village Karaagach – village Gyzylbair – frontier outpost – Tersakan valley (meeting with Charymyrat Tagiev) – Kulmach crest (overnight at the foothills).
10 May	Foot survey of Kulmach crest and surroundings – 12 km from Koshan well, Tersakan valley (overnight).
11 May	Tersakan valley & monticulate area – frontier outpost (not allowed to travel beyond village of Makhtumkuli) – Igarly spring at the mountain foothills. Drive Khasardag – Serdar – Ashgabat.



Fig. 1. Spring expedition to northern Turkmenistan. From left to right: Hojamyrat Hojamyradov, Petar Iankov, Garly Khekimov, Arazmyrat Amanov, Petra Kaczensky, Shirin Karryeva, Eldar Rustamov, Aman Kurbanov, Aleksandr Shestopal, Atamyrat Veyisov.



Fig. 2. The team of the June 2018 expedition. From left to right: Aziza Beshimova, Aleksandr Shestopal, Petar Iankov, Nurmuhamet Hudaykuliev, Jumamyrat Saparmyradov, Atamyrat Veyisov, Aman Kurbanov, Eldar Rustamov, Shaniyaz Mengliev.

2.2 Expedition #2: June 2018

Table 3. Overview of expedition participants, June 2018.

Participants	June 2018															
	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	22
John Linnell	X	X	X	X	X	X	X	X	X	X	X	X				
Petar Iankov	X	X	X	X	X	X	X	X	X	X	X	X				
Eldar Rustamov	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Atamyrat Veyisov	X	X	X	X	X	X	X	X	X	X	X	X	X			
Aman Kurbanov	X	X	X	X	X	X	X	X	X	X	X	X	X			
Aleksandr Shestopal	X	X	X	X	X	X	X	X	X	X	X	X				
Shirin Karryeva	X	X	X	X												
Hojamyrat Hojamyradov	X	X	X	X												
Jumamyrat Saparmyradov								X	X	X	X	X				
Nurmuhhamet Hudaykuliev				X	X	X	X	X	X	X	X	X	X			
Kurban Geldyev	X	X														
Byashim Rejepov	X	X														
Aknabat Potaeva	X	X						X								
Aziza Beshimova								X	X	X	X					
Shaniyaz Mengliev								X	X	X	X					
Arazmyrat Amanov														X	X	X
Garly Khekimov														X	X	X

Table 4. Expedition travel routes and main activities, June 2018.

Date	Expedition route(s) June 2018
5 June	World Environment Day Conference in Ashgabat
6 June	Leave Ashgabat – visit Gury Howdan Wildlife Sanctuary, Animal Breeding Centre of Kopetdag Nature Reserve at Novrekcheshme, and arrive Meana Chacha Wildlife Sanctuary. Stay overnight in Meana. Meeting with Azat Pranov (Director of Gury Howdan Wildlife Sanctuary) and rangers at Meana Chacha.
7 June	Travel through Meana Chacha Wildlife Sanctuary from Meana to Gannaly. Stay overnight in Gannaly.
8 June	Travel to Badhyz Nature Reserve. Arrive at Agarcheshme ranger station. Camp overnight on escarpment edge with view over Yeroylanduz.
9 June	Travel through Badhyz plateau and Gyzylyar canyon. Leave for reserve HQ at Kuska. Stay overnight in Serhetchi. Meeting with Gurbannazar Kuliyeu (Director of Badhyz Nature Reserve)
10 June	Leave Serhetchi. Travel through Garachop IBA and area between Kuska and Kashan. Visit Saryyazy IBA and reservoir. Spend night camping next to reservoir.
11 June	Travel through Garabil foothills and South-eastern Karakum. Spend night at Arap.
12 June	Cross the Arap-Obruchev steppe. Follow Karakorum canal. Visit Kelif lakes and Zeit reservoir. Arrive Kerki. Stay overnight in Kerki.
13 June	Visit Tallymerjen IBA. Travel to Koytendag Nature Reserve. Stay overnight at reserve HQ. Meeting with Nurmuhammet Imamov (Director of Koytendag Nature Reserve).
14 June	Travel to Maydan ranger station visit Koytendag. Spend day walking through area.
15 June	Leave Koytendag. Visit landscape between Hojaburjibelent Wildlife Sanctuary and Tallymerjen IBA. Stay overnight in Dowletli.
16 June	Examine area between Tallymerjen IBA and Hojaburjibelent Wildlife Sanctuary. Stay overnight in Dowletli.
17-18 June	Return to Ashgabat.
19 June	Rest and administration day. Flight from Ashgabat to Dashoguz.
20 June	Dashoguz – Burchliburun.
21 June	Border security zone north of Burchliburun.
22 June	Southern shore of lake Sarygamysh – Malyab canal towards lake Zengibaba.
23 June	Return to Ashgabat.

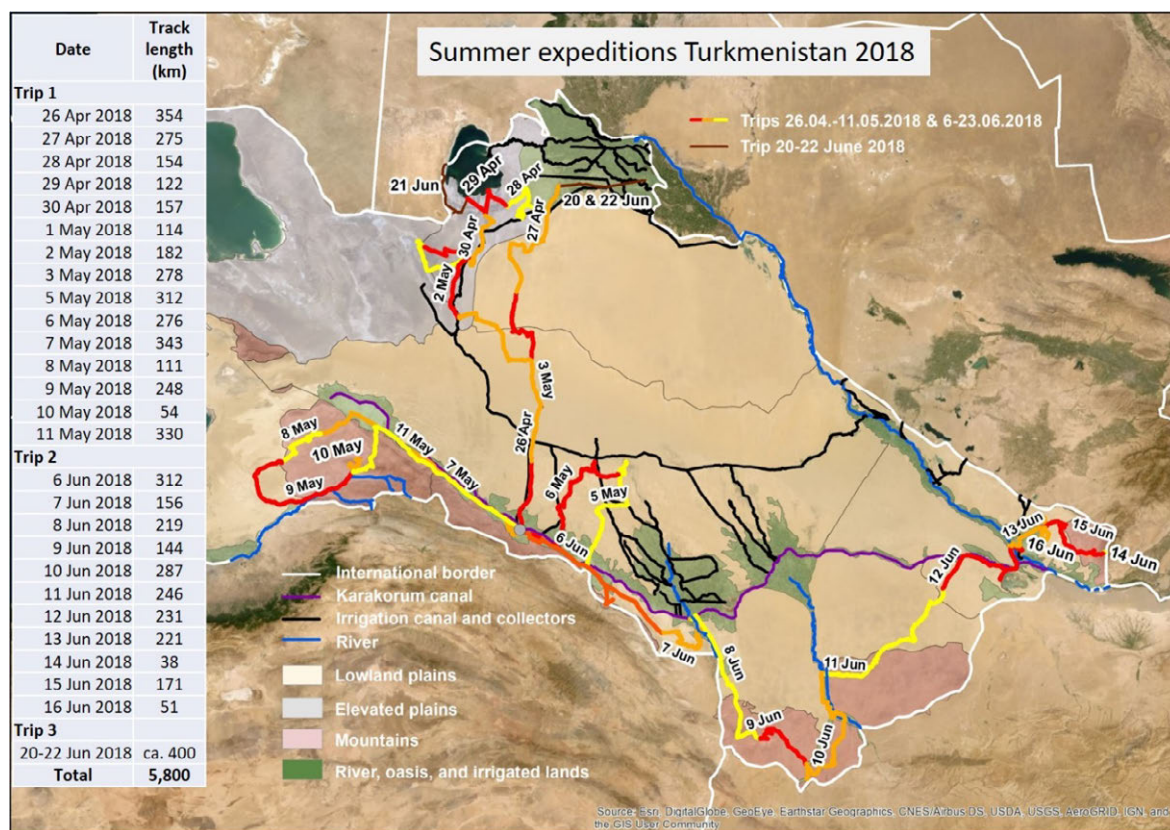


Fig 3: Track of the summer expeditions in April-May and June 2018.

2.3 Expedition #3: December 2018

Table 5. Participants of the December 2018 expedition.

Participants	December 2018						
	10	11	12	13	14	15	16
John Linnell	X	X	X	X	X	X	X
Tatjana Rosen	X	X	X	X	X	X	X
Shirin Karryeva	X	X	X	X	X	X	X
Aman Kurbanov	X	X	X	X	X	X	X
Aknabat Potaeva	X	X	X	X	X	X	X
Nurmuhamet Hudaykuliev	X	X	X	X	X	X	X
Shaniyaz Mengliev	X	X	X	X	X	X	X
Hojamyrat Hojamyradov	X	X	X				
Charymyrat Tagiyev	X	X	X				

Table 6. Expedition travel routes and main activities, December 2018

Date	Expedition route December 2018
10 December	Ashgabat – Serdar – Magtymguly (formerly Kara–Kala; HQ of Sunt Hasardag Nature Reserve).
11 December	Day trip to Sunt Hasardag – hike from Galalygouz ranger station – visit to tomb of Abubekir Shibli pilgrimage site.
12 December	Hike along valley to crest of the Sunt Hasardag ridge.
13 December	Horse ride along canyon in eastern section of Sunt Hasardag Nature Reserve.
14 December	Drive to Kopetdag reserve – hike into mountains.
15 December	Hiking through Kopetdag Nature Reserve.
16 December	Hike along canyon rim in Kopetdag – Return to Ashgabat.

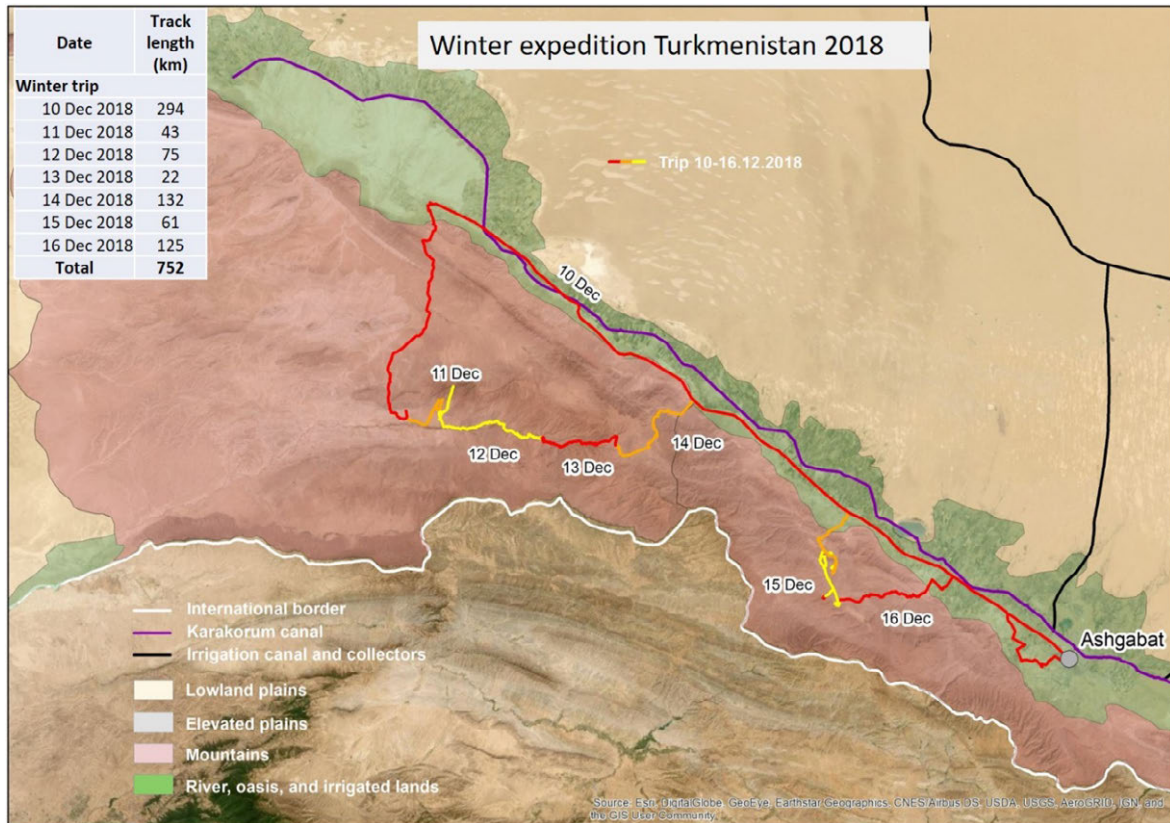


Fig 4. Track of the winter trip in December 2018.



Fig 5. Part of the December expedition team in the Kopetdag mountains. From left to right: Aman Kurbanov, John Linnell, Shaniyaz Mengliev, Aknabat Potaeva, Tatjana Rosen, Shirin Karryeva.

3 General area descriptions

Because of the lack of accessible literature on Turkmenistan the following sections provide an overview of the landscapes and ecosystems of the country, gathered from various sources. Most data has been gathered from Fet & Atamuradov (1994), Zon & Kostianov (2014), Rustamov & Rustamov (2007) and the work associated with the designation of the Turkmen network of Important Bird Areas (Rustamov et al. 2009). However, we have also used knowledge provided by local experts for which no accessible references are available.

3.1 Glossary of Russian terms

Because there are no direct translations for many common Russian / Turkmen terms for habitats and landscape features used by our local colleagues we have retained many such original language terms in the text (see Fig 6). The following is a brief explanation of the most common terms.

Adyrs = a landscape with many small, low hills arranged in a complex pattern.

Barkhan = crescent-shaped sand dune.

Chink = sandy cliffs as a result of erosion of outcrops of limestone and chalk, shaped in the form of steep slopes with many niches and small caves or incisions and landslides with ravines of temporary watercourses.

Jaram = dry river bed.

Jar = ravine.

Kyr = open areas devoid of vegetation.

Sais = a dense network of ravines.

Serozems = a type of grey desert soil.

Solonchaks (shors) = Solonchak is a reference soil group of the World Reference Base for Soil Resources. It is a pale or grey soil type found in arid to subhumid, poorly drained conditions. The word is Russian for "salt marsh".

Takyr = meaning "smooth, even, or bare", is a type of relief occurring in the deserts of Central Asia, similar to a salt flat in the southwestern United States. A takyr is usually formed in a shallow depression with a heavy clay soil, which is submerged by water after seasonal rains.

Tugai forests = deciduous forest along river (poplar, ash-tree, tamarisk, willow etc.)

Uzboy = ancient river beds of the Amu Darya river.

Zakaznik = generally translated as "Wildlife Sanctuary", is equivalent to the IUCN categories IV or VI (Habitat & Species Management Area or Protected Landscape).

Zapovednik = generally translated as "Nature Reserve" or "State Nature Reserve" is equivalent to the IUCN category Ia (*Strict Nature Reserve).



*Fig. 6: Some biomes and their Russian terms frequently used in the species description section.
Photos: A. Shestopal*

3.2 Landscapes of Turkmenistan

Turkmenistan can be roughly divided into two unequal parts, the northern lowlands (85% of the surface area) and the southern uplands / mountains (15% of the surface area). The lowlands primarily consisting of deserts (73%), intermixed with oases, wetlands, and irrigated areas (Rustamov 2014, Fet and Atamuradov 1994). The lowest point of the country is found in the Trans-Unguz Karakum in the north (Akchagaya basin: -92 m) and the highest points in the Kopetdag mountains (Chopan Mountain: 2,889 m, Shakhshakh Mountain: 2,912 m) in the south and the Koytendag mountains (Ayry Baba Mountain: 3,139 m) in the extreme southeast. The plains of Turkmenistan have a general declination in western and northerly directions towards the Caspian Sea and the Sarygamysh lake, respectively. This gradient (intersected by river basins, natural oasis, and irrigated lands), contains three major bio-geographic regions which are further subdivided into regions (Fig. 7).

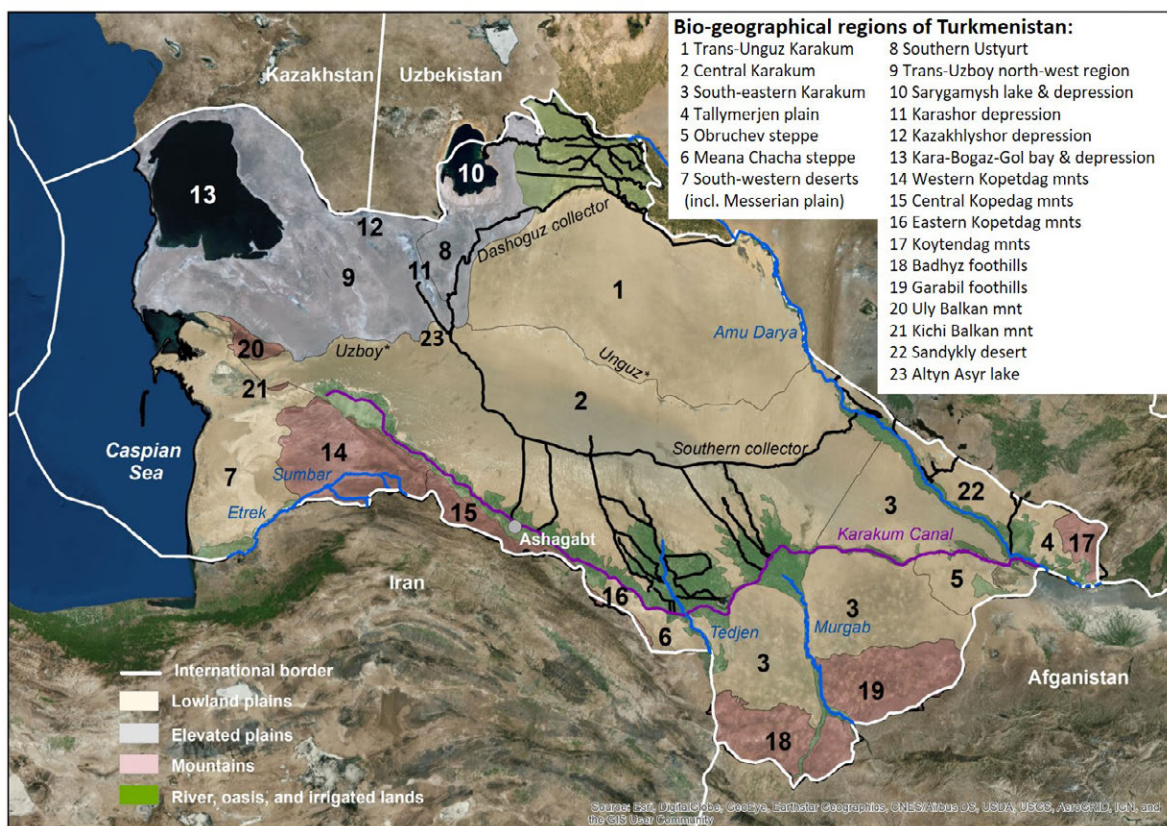


Fig. 7 : Landscapes and biogeographic regions and sub-regions referred to in this report.

[Names of major rivers and canals are given in *italics*. *The Uzboy and Ungaz fault are ancient riverbeds.]

3.3 Biogeographic regions

(1) The lowland plains include the Karakum desert (Central, Trans-Unguz, South-eastern), the South-western deserts, the Sandykly desert, the Obruchev steppe, and four main river valleys (Amu Darya, Murgab, Tedjen, Etrek/Sumbar) and their associated irrigation canals and irrigation drainage water collectors (subsequently referred to as collector) network. The Central Karakum desert stretches from the ancient Uzboy river channel in the west (currently occupied by the Altyn Asyr channel in its upper course) to the Kelifs Uzboy in the east (currently occupied by the Karakum canal valley in its upper reaches), and from the Unguz depressions in the north to the central section of the Karakum canal in the south. The Trans-Unguz Karakum is delineated in the west and south by a narrow chain of small depressions along the Unguz fault, in the east by the Amu Darya valley, and in the north by the Sarygamysh depression. The Trans-Unguz Karakum desert is a vast area with large, overgrown sand dunes, and rather narrow vegetation-free gravelly ridges. The South-eastern Karakum desert stretches from the middle reaches of the Karakum Canal in the north to the Badhyz and Garabil hills in the south-east. The Eastern Karakum or Obruchev Steppe is located east of the Murgab delta and stretches to Unguz in the north, and the Amu Darya and Karakum canal in the east and south, respectively. In the west, the South-western or coastal deserts stretch to the west of the Kopetdag mountains and south of the Balkan mountains.

(2) The elevated plains in the north and north-west were formed from Tertiary plateaus and include the Trans-Uzboy north-west region (also known as the Krasnovodsk plateau), the South Ustyurt plateau (Gaplanyr) and associated smaller uplands, namely the Butentau, Duzgur, Tarimgaya, Kangakyr, Zengibaba, Eshchekankrenkyr uplands (north of Akchagai). The Trans-Uzboy north-west region covers the peninsula and extends to the northwest to the Oktumkum sands, to the north to the Kara-Bogaz-Gol bay and depression, and to the southeast to Chilmamedkum. To the northeast, it reaches into the Tuarkyr uplands with the Ersarybaba and Babashi mountains, and the Begenjalykyr, Tyuverkyr, Akkyr, Tekedykik and Koymatdag chinks. The Southern Ustyurt Plateau covers the central part of northern Turkmenistan and includes uplands plateaus (Chelyungkyr, Gaplangyr) alternating with depressions occupied by the Uchtagankum and Kumseshen sands and the Kazakhlyshor and Karashor salt pens (planned to become the future Turkmen Altyn Asyr lake).

(3) The main mountain ranges of Turkmenistan are the Kopetdag mountains in the south-west of the country (highest peak 2,889 m; part of the Turkmen-Khorasan mountain system). In the south are the Badhyz (highest peak 1,267 m) and Garabil hills (highest peak 984 m; the Parapamiz spurs), and in the far southeast the Koytendag mountains (highest peak 3,139 m; the spurs of the Gissar ridge of the Pamir-Alay mountain system). The mountains of Turkmenistan are considered low and medium altitude. They are devoid of permanent snowfields, and are strongly influenced by the neighbouring desert climate.

3.4 Regions and protected areas visited 2014-2018

Our expeditions in May, June, and December 2018 crossed the following areas: Central Karakum, Trans-Unguz Karakum, South Ustyurt with Karashor depression, Sarygamash depression, irrigation areas, Western Kopetdag, South-Western plains, Meana Chacha steppe, South-East Karakum, Badkyz & Garabil foothills, Tallymerjen, and Koytendag (Fig. 8). The expeditions visited multiple protected areas, including Nature Reserves and their associated Wildlife Sanctuaries, as well as Important Bird Areas (IBAs; www.birdlife.org). In the following sections we provide a brief description of each area.

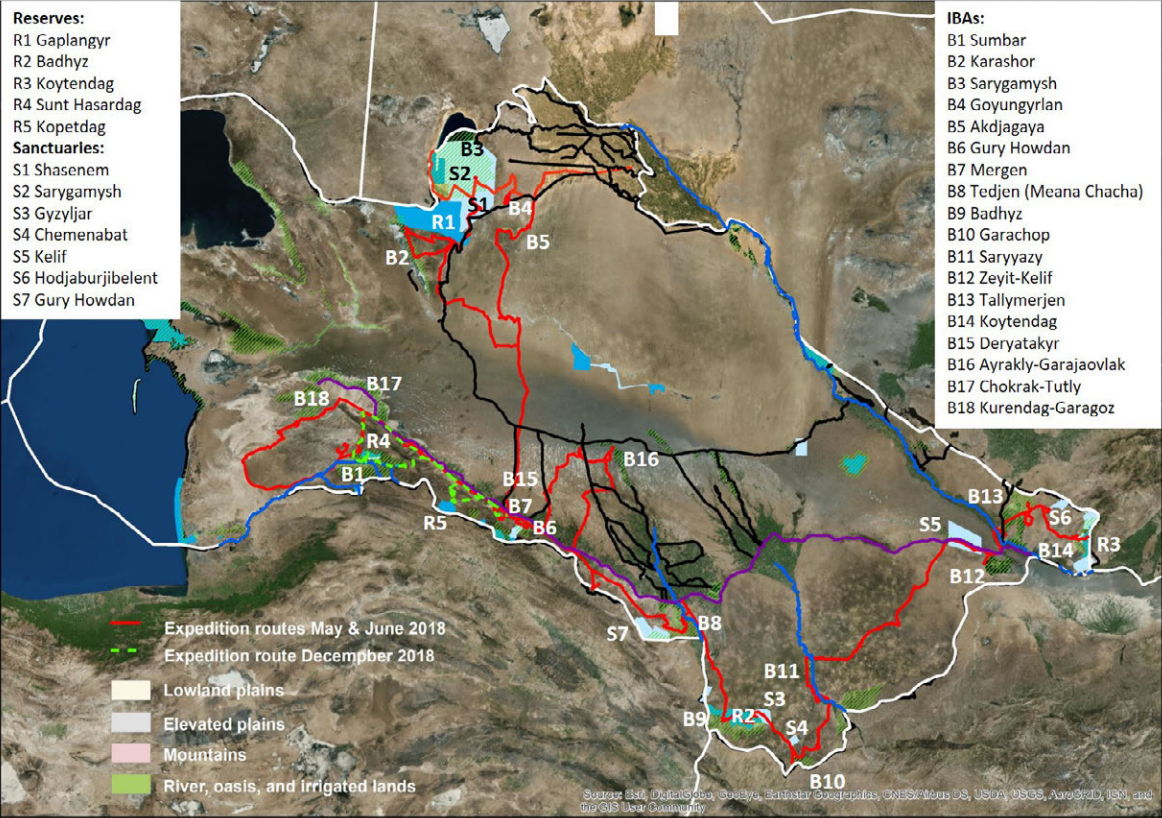


Fig. 8: Track-log of the 2018 expeditions and codes for protected areas and Important Bird Areas (IBAs) which are used in later sections of the report as spatial references for species locations.

3.4.1 Central Karakum

Our expedition visited the Unguz region between the Garacolba and Oyligyzyl remnant mountains, as well as the area of the southern water-collector of the planned Altyn Asyr lake. The central Karakum is characterized by large dunes, reaching 3-15m, with a predominant north-south direction. Takyr-like soil forms on the clay plains. Takyr-like soils are found in combination with sandy areas especially in the southern part of the central Karakum. Salt pans (*Solonchaks*) are formed at the the bottoms of basins where the groundwater is located close to the surface.

The southern water-collector of the Altyn Asyr lake was constructed from 2008-2010 and primarily runs from east to west (Zon & Kostianoy 2014). Due to precipitation in winter and spring, temporary spills occur which flood nearby salt pans and takyrs. Groundwater is predominantly saline and mineralized, and in sandy areas located at depth of up to 20m and in depressions at depths of 0.4-1.0m. Freshwater wells are scarce.

The Central Karakum is characterized by a continental climate with high temperatures (annual mean: 15°C), low humidity (monthly relative humidity varies from 17% in July to 64% in January), low precipitation (99-124mm), and a high annual temperature range of 80°C between maximum and minimum temperatures).

The flora of the Central Karakum (Fig. 9) consists of 293 species, of which 210 are higher plants. The main plant communities are formed by a combination of 16 species of trees and

shrubs, 19 species of dwarf shrubs and dwarf shrubs, 57 species of perennial and 118 species of annual grasses. The following plant communities are typical: *Haloxylon persicum*-*Carex* spp. and *Calligonum* spp. are found on overgrown sands; in lower parts *Calligonum caput-medusae* predominate; on weakly overgrown sands *Ammodendron* spp., *Aristida* spp. and *Astragalus* spp. are mainly found; on takyrl-like soils and around takyrs groups of *Salsola orientalis* and *Artemisia kemrudica* predominate. In the spring, ephemeral forbs are found interspersed among the plant communities described above. Salt pans are devoid of vegetation.

Almost all animal species which are characteristic of the Karakum desert as a whole, are found in the Central Karakum, including more than 1,200 species of invertebrates and 250 species of vertebrates, many of which are endemic. Many species originated from the arid expanses of the Turan Plain, particularly sand loving (psammophile) insects, lizards and rodents. Although Turanian and Iranian-Turanian species and subspecies prevail in the fauna (Rustamov 2011), there are additionally species of African, Persian and Central Asian origin (Rustamov 1954; Rustamov 1994).

We visited two Important Bird & Biodiversity Areas (IBAs) in the Central Karakum, both of which are located in the zone of the southern collector of the Altyn Asyr Lake, and an additional one on the plains that border onto the Kopetdag foothill.

TM032 IBA Ayrakly-Garajavak (http://birdlaa8.miniserver.com/dz_uat/site/factsheet/20728) consists of two sections - Ayrakly (eastern) and Garadzhaovlak (western). The entire IBA area consist of alternating flooded inter-ridge depressions and elevated sections of ridge-hilly, overgrown, sometimes semi-overgrown, sands. On sandy areas there is a silt cover and bushes of *Salsola richteri*, *Haloxylon* spp., *Calligonum* spp., *Astragalus* spp. occur (Fig 10). Along the water edge and in low areas there are reed beds. No ornithological experts have visited this IBA since 2009.

TM030 IBA Deryatakыр (http://birdlaa8.miniserver.com/dz_uat/site/factsheet/22124) is located in the Deryadakyр depression running south to north for 32 km. The IBA is a flooded area in the hilly-takyr complex and is fed by drainage waters from agricultural land in the foothills of the Central Kopetdag. The relief is defined by hilly fixed sands, with takyr-desert soils. The main vegetation consists of *Salsola*-grass, *Calligonum*-*Salsola* with grasses, grasses with ephemerals, and *Karelinia*-*Alhagi*-*Phragmites* communities.

We also visited **TM031 IBA Mergen**

(http://birdlaa8.miniserver.com/dz_uat/site/factsheet/22125), located on the border between the Central Karakum and the plains adjacent to the Kopetdag foothills. Mergen covers 6 km² on the territory of the Mergen hunting and fishing concession, established in 1998. The habitat consists of flat, undulating and overgrown sands, pastures and wetlands. The drainage system from the Karakum Canal feeds two reservoirs. Access is limited as the entire area is fenced. Typical vegetation cover is: *Salsola*-grass, *Calligonum*-*Salsola* with grasses, grasses with ephemerals, and *Karelinia*-*Alhagi*-*Phragmites* communities. The hunting concession allows a license based hunting for waterfowl in the autumn-winter period, but it also feeds birds, especially in extreme winters.



Fig 9. Central Karakum, 26 April 2018. Photo: P. Kaczensky



Fig 10. IBA Ayrakly-Garajavak, 6 May 2018. Photo: P. Kaczensky

3.4.2 Southern Ustyurt & Gaplanyr

The Sarygamysh depression is a shallow basin with gentle slopes. The northern part is occupied by the Sarygamysh lake (3,470 km²) (Fig. 11, Fig.12), the southern part by a series of small wetlands (Zengibaba, Uzinshor). Saline clay and gravelly-sandy areas are widespread throughout the depression. To the west, the depression borders the Gaplanyr Plateau of the Southern Ustyurt. The dominant landscapes are flat and sometimes undulating clay or sandy-clay plains. Along the western edge, the plateau drops more than 200m to the Karashor depression (Fig. 13). The northern border is formed by the Sarygamysh soil-sandy cliffs (chinks). In the east, the Sarygamysh depression meets the Amu Darya river delta, which is composed of ancient alluvial and modern sediments, both sandy and sandy-clay. The Amu Darya delta is developed for agricultural land. In the south, the Sarygamysh depression borders the Trans-Unguz Karakum desert.

The vegetation falls into the desert-steppe subregion and consists of almost 400 species. Main plant communities consist of *Salsola arbusculiformis*. Considerable areas of the Gaplanyr Plateau are occupied by *Anabasis salsa*, *Salsola gemmascens* and *Haloxylon aphyllum* homogeneous communities with presence of *Artemisia* spp. In depressions or along ravines, thorny bushes – *Salsola arbuscula*, *Caragana* spp., *Atraphaxis* spp. – can be found. The *Haloxylon aphyllum* communities are widespread, mainly in the Sarygamysh depression, where the species composition of communities changes depending on the soil cover. The habitat mosaic is more pronounced here than in other areas of the surveyed territory, which is very important for species richness.

The **Gaplanyr Nature Reserve** was established 1979 with an original size of 5,700 km², but in 1991 was reduced to 2,828 km² (by removing the areas on the Gaplanyr Plateau, which have significant environmental value (Chernov and Chernova 1990)). Nevertheless, the Gaplanyr Nature Reserve remains the largest reserve in Turkmenistan (Herman et al. 1990). Adjacent to the reserve are two wildlife sanctuaries: Sarygamysh (2,120 km² established in 1980) and Shasenemsky (2,700 km² established in 1983). The Gaplanyr Nature Reserve, together with **Sarygamysh and Shasenem Wildlife Sanctuaries, TM022 IBA Sarygamesh** (http://birdlaa8.miniserver.com/dz_uat/site/factsheet/20727) and **TM021 IBA Karashor** (http://birdlaa8.miniserver.com/dz_uat/site/factsheet/22107), which cover the chinks along the Karashor depression), form a large network of protected areas, which we crossed or touched at several points.

Two additional IBAs in northern Turkmenistan which we visited are located at the border with, or along the edge of, the Trans-Unguz Karakum desert.

TM026 IBA Akjagaya (http://birdlaa8.miniserver.com/dz_uat/site/factsheet/20754) is located in a 48 km² depression in the north-western Trans-Unguz Karakum (Fig. 14). The lowest elevation in the western part is -92 m (being the lowest point in Turkmenistan) and in the eastern part -30 m. The northern border of the IBA, the edge of the Eshekangyrankyr Plateau, consists of gravelly-clayish cliffs with numerous gullies and ravines (and steep chinks in two places), which descend into a vast salt pan depression. The length of the slopes are from 80 to 200 m, with no vegetation, creating badlands. The southern part of the IBA is a flat sandy-loess plain with sparse ephemeral *Salsola* spp. vegetation. In the depressions, the vegetation is also represented by *Salsola* communities. Although the elevated parts of the southern part are fixed, the vegetation is very sparse consisting of *Haloxylon* spp., and rare areas with *Salsola richteri*. In the eastern part of the depression there are small streams resulting from an artesian well with bitter-salty water.

TM025 IBA Goyungyrlan http://birdlaa8.miniserver.com/dz_uat/site/factsheet/20726. The IBA covers a 15 km long chain of small lakes formed as a result of irrigation overflow water filling the Goyungyrlan depression (7 km north-west of Zengibab upland) with collector-drainage water coming from irrigated agricultural areas around Shasenem (Fig. 15). The northern edge is steep, but the southern and eastern edges are flat. The lakes regularly freeze in winter for up to 40 days. On the sandy sites of the southern and eastern shores xerophytic vegetation grows, mainly *Artemisia* spp., with the participation of *Salsola richteri* and other salt tolerant species. On the depressions and near the shore, the moisture-loving vegetation is *Phragmites* spp., in places *Karelinia* spp. and *Alhagi pseudalhagi*.



Fig 11. Along Dashoguz collector in the Gaplangyr Nature Reserve, 30 April 2018. Photo: P. Kaczensky



Fig 12. Gaplangyr Nature Reserve, Sarygamysh lake shore, 29 April 2018. Photo: P. Kaczensky



Fig 13. Karashor depression from Gaplangyr chink, 1 May 2018. Photo: P. Kaczensky



Fig 14. IBA Akjagaya, 27.04.2018. Photo: P. Kaczensky



Fig. 15. IBA Goyungyrlan with chink (top) and chain of lakes (bottom), 28.04.2018. Photo: P. Kaczensky

3.4.3 Western Kopetdag mountains

The western Kopetdag was mainly formed in the Pliocene-Quaternary periods and consists of Paleogene and Neogene sediments. Ancient chalk rocks are exposed particularly in the northern and eastern parts. The relief is highly dissected and in places forms a complex mixture of hilly relief (*adyrs*), badlands, canyons and depressions. In the lower part of Sunt-Hasardag, Montjukly, Doyran mountain ranges and other areas, Paleogene sediments occupy most of the territory. Elevations range from 600 m (Torgoy mountain) to 1,900 m (Uchkui mountain) and the relief is dominated by high hills, low foothills (inter-ridge) and medium altitude mountains, which in places are intersected by gorges and canyons (Figs. 16-18).

The low-mountain areas are protected from cold and dry northern winds by latitudinal and sublatitudinal ridges, and towards the west they are open to the influx of moist and warm air masses. As a consequence, the south-western part of the Sumbar and Chendyr river valleys have a dry, subtropical climate and many subtropical plants grow here naturally or are cultivated. The middle mountains and low mountains between the Sumbar floodplains, Chendyr, Ajider and Tersakan are represented by loess and clay plain areas with low hills.

The climate of the Western Kopetdag is characterized by dry and hot summers and mild winters, especially in the southern part. Snow cover tends to be shallow and quickly disappears, and heavy snowfalls are rare. Annual rainfall averages 330mm and peaks between November and April. In some years, heavy rainstorms occur in the summer. The main water source of the region is the Sumbar River, which begins at the confluence of the Dainesu and Kulankasi rivers. The width of the river floodplain in the upper reaches is 10–25 m and then varies between 40–100 m. The Sumbar water is used for irrigation, especially below the city of Makhtumkuli, and for 2–5 months a year the river is dry. The Sumbar river has three tributaries - Chendyr (the largest), Aydere and Tersakan. In the middle sections, the Chendyr is completely utilised for irrigation. Almost all suitable areas of floodplains are occupied by agriculture.

The vegetation of the hilly lowlands is mostly semi-desert, *Artemisia* - ephemeral, with the participation of *Salsola* spp., there are also rare sections with *Zygophyllum* spp., *Paliurus spina-christi*, etc. The steep hillsides are sometimes devoid of vegetation. Rarely there are patches occupied by *Juniperus* spp. and *Tamarix* spp. The former grows along the slopes mixed with deciduous trees and in places forms thick juniper plots. The upper parts of the middle elevations have a smoother relief. Here, the smallest amount of precipitation and good soil cover favour the formation of meadow vegetation and the growth of *Crataegus* spp., pear, apple, almond, etc. In some areas of the middle elevations, ancient farming methods are still employed, such as rainfed grain cultivation.

The Western Kopetdag is extremely rich in biodiversity with about 2400-2500 invertebrates and 392 terrestrial vertebrates (4 amphibians, 36 reptiles, 276 birds and 76 mammals) identified so far (Rustamov 2011).

The **Sunt Hasardag Nature Reserve** was established in 1979, initially covering 398 km². However, it was gradually reduced to its current size of 265 km² and is fragmented into three disjunct parts: the 134 km² Central part (covering the southern slopes of the Sunt Hasardag ridge), the 36 km² Ayderinsky part (covering a gorge of the same name) and the 95 km² Chendyrsky part (covering the northern slope of the Palvan ridge). A small part of the territory is represented by low foothills, but the foothill plains and the upper belt of mountains are practically not covered (Fig. 16). This latter area also overlaps with the **TM020 IBA Sumbar** (http://birdlaa8.miniserver.com/dz_uat/site/factsheet/20721). We additionally visited small parts of the **TM014 IBA Kurendag-Garagoz**

(http://birdlaa8.miniserver.com/dz_uat/site/factsheet/22116) and touched the TM019 IBA Chokrak-Tutly (http://birdlaa8.miniserver.com/dz_uat/site/factsheet/22110).



Fig 16. Sunt Hasardag Nature Reserve and IBA Sumbar, Western Kopetdag mountains, 11.05.2018 and 12-13.12.2018 Photos: J. Linnell and P. Kaczensky (top left)

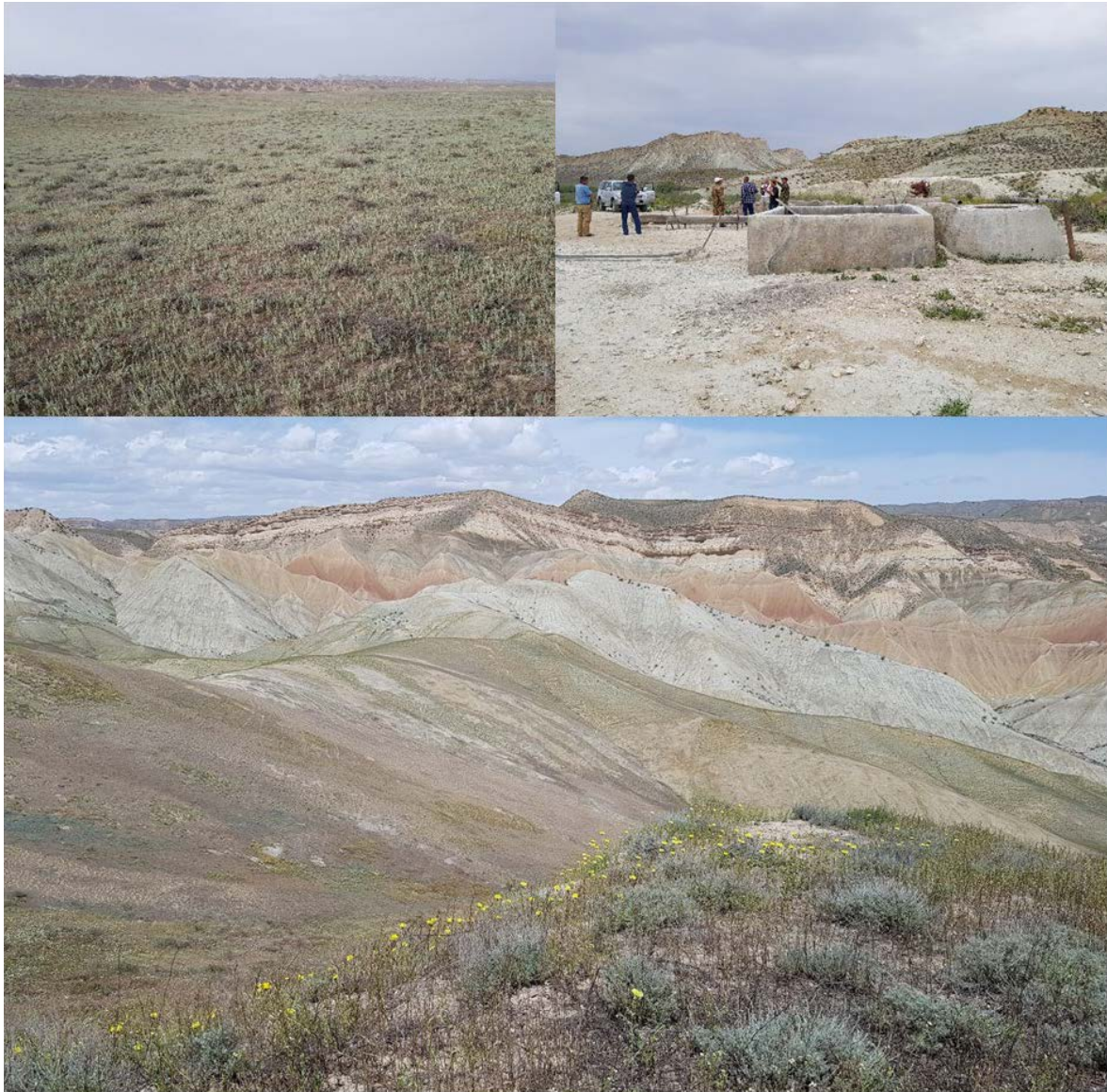


Fig 17. Tersakan valley and area around Kulmach ridge, 9.05.2018. Photos: P. Kaczensky



*Fig 18. Kemendere ravine at the southern edge of the IBA Kurendag-Garagoz, 8.05.2018.
Photo: P. Kaczensky*

3.4.4 Central Kopetdag mountains

The **Kopetdag Nature Reserve** covers 497 km², is located in the central Kopetdag Range, and was established in 1976. The reserve is located in the middle mountain belt and the landscape is characterized by deep gorges with many springs. Elevations range from 700 to 2,800 metres (Fig. 19). The cool climate on the high plateau results in meadow vegetation, even during the summer heat. The flora is extremely diverse, containing more than 40% of the total plant biodiversity of Turkmenistan. In addition, many relic, rare and endemic plants can be found which are included in the Red Book of Turkmenistan and the IUCN Red List; (Potayeva 2016).

Kopetdag-Khorasan endemic taxa include the evergreen Turkmen juniper or archa (*Juniperus turcomanica*), the main forest forming tree. Its sparsely distributed trees cover more than 200 km², constituting more than half of the total area of archa forests of the Kopetdag mountain range. The tree grows slowly, but can reach ages of 600-800 years at which heights may be 20m and trunk girths 3m. Other trees include wild walnut, Persian and Turkestan mountain ash, and wild Turkmen pears and apples. The understory and meadows of the Kopetdag mountains are rich in grasses and many wild ornamental and medical plants are found.



Fig 19. Kopetdag Nature Reserve, central Kopetdag mountains, 15.11.2018. Photo: J. Linnell

3.4.5 Gury Howdan & Meana Chacha steppes

The landscapes are characterized by slightly hilly foothill plains, talus and stony-gravelly areas, stony peaks and slopes, flat plains and open intra-mountain valleys. The river network is poor with watercourses drying up in summer and only a few springs. The area has a desert climate. Parts of the floodplains are used for agricultural crops (irrigated), as well as fruit and vegetable production. We visited two IBAs in this region.

TM029 Gury Howdan IBA (http://birdlaa8.miniserver.com/dz_uat/site/factsheet/20723) overlaps the **Gury Howdan Wildlife Sanctuary**, which borders the network of Kopetdag nature reserves. The IBA covers the lower zone (up to 1,100 m) of the Central Kopetdag and is dominated by relatively low mountains with round tops and slightly inclined plains dissected by a network of small gorges and ravines (Fig. 20). Water in the form of springs and rivers is rare, with most watercourses drying up in summer. The climate is characterized by a large temperature amplitude, with hot summers (up to 48°C) and cold winters (as low as -29°C). The annual precipitation is 180–220 mm. The dominating vegetation types are communities of *Poa bulbosa*, *Carex* spp., *Salsola* spp., and *Artemisia* spp. In the floodplain of the Keltechinar River there are *Tamarix* spp. and riparian vegetation. Large parts of the plain are used for agricultural crops, tree plantations, and vegetable plantations.

The **TM034 IBA Tedjen** (<http://datazone.birdlife.org/site/factsheet/22111>) / **Meana Chacha Wildlife Sanctuary** consists primarily of a plain situated in the foothills of the Eastern Kopetdag mountains. The southern part runs along the Turkmenistan-Iran border, in the west the border crosses the plain around Chacha (Fig. 21). The northern border follows the channel of the Karakum canal, and in the east the valley of the Tedjen river. The plain (200-350 m) consists of loess loams, neogene and anthropogenous sandy loams and clay divided by mudflows. Soils are dominated by light sandy-loams (sierozems) with small saline depressions. The vegetation consists of sod forming *Poa-Carex* ephemeral communities and *Haloxylon*-halophytic forbs. The climate closely resembles that of the desert with an average annual temperature of 15°C and extremes between -36°C and 48°C. Precipitation falls primarily during the winter-spring season and the annual average is 143 mm. The Tedjen and several small rivers (Meana, Chehelkaman, Chacha and Sarygamysh) cross the area but dry-up in summer. The flow of the Tedjen is controlled by a transboundary dam further upstream such that it doesn't flow in many years. There are a few wells (Kemek) and springs (Zarmi, Sad). The majority of settlements are located on the northern edge of the plain. The land is used mainly for livestock grazing and small areas of croplands, irrigated land for cotton and vegetables, and dry farming of wheat and barley (BirdLife International (2019)). The dominating vegetation types are communities of *Poa bulbosa-Carex* spp., *Salsola* spp., and *Artemisia* spp. as well as low grass communities with *Haloxylon* spp. and *Salsola* spp. On the flood plain of the Tedjen, riparian forest (tugai) vegetation is found with a variety of deciduous species (*Tamarix* spp., *Populus euphratica*) and reed-beds *Phragmites* spp. In the northern part of the IBA, there are fields of grain and crops, occasionally cotton; smaller areas are used for orchards and to grow melons and vegetables. In the drier parts, the area is used for livestock grazing.



Fig 20. Gury Howdan Wildlife Sancturay and IBA, 6.06.2018. Photo: J. Linnell



Fig 21. Meana Chacha Wildlife Sanctuary / IBA Tedjen, top: 5.09.2015 Photo: P. Kaczensky, bottom: 8.06.2018 Photo: J. Linnell.

3.4.6 Badhyz & Garabil foothills

Badhyz Nature Reserve was established in 1941 to protect the unique relict pistachio woodlands and Turkmen kulan population. In 1951, the original area of the Nature Reserve was reduced from 8,000 km² to 750 km². In 1962, and again in 1970, some adjacent areas were added to the west and south expanding the reserve to 877 km² ha. In 2014 the reserve was again enlarged to its current size of 1,404 km². Including the buffer zone, the three adjacent wildlife sanctuaries, and an ecological corridor, the Badhyz ecosystem complex covers a total area of 2,893.5 km². There are five main landscapes features in Badhyz, the 18 km long Gyzylyar canyon, the Badhyz plateau (grasslands), a 45 km long escarpment with chinks, the Yeroylanduz and Namakar depressions, and the Pistachio savannah of the Gezgadik hills (Rustamov and 2007, Kaczensky and Linnell 2015; Fig. 22). The formal aims of the Badhyz Nature Reserve are the study, protection and rehabilitation of the unique ecosystems of the territory (Sokolov et al. 1990).

The Badhyz region, which includes the Badhyz Nature Reserve, the IBA Badhyz, as well as Gyzylyar and Chemenabat Wildlife Sanctuaries is characterized by mountainous areas (800–1000 m) in the west, rolling hills and plains in the north and drainless saline depressions in the south, of which the largest is Yeroylanduz (106 km² at an altitude of 500m). In the east, the Gyzylyar canyon runs for 18 km. The sides of the canyon are steep with 40–60 m high chinks and ledges with large gravel-loess deposits. There are very few water sources within the ecosystem. Around 5-6 natural springs produce salty water at the base of the chinks in Gyzylyar and Yeroylanduz. Another 2-3 natural springs are also found in the hills in the west of the reserve. In addition, artificial sources (pumps and tanker provided water) are present at several locations in the reserve. The river Tedjun flows year round to the west of the reserve, and the Egrigek and Kushka rivers flow for most of the year to the southeast and east, outside the protected areas. Furthermore, there are multiple pumped water sources provided for livestock in the area surrounding the reserve. The climate is dry, but slightly wetter than the typical desert climate. The average annual temperature is 16°C, with monthly means of 29°C in July and 3°C in January. The word Badhyz means "the country of the winds", which mostly come from a northern and northeastern direction. The main vegetation communities are *Poa bulbosa*-*Carex* spp., *Salsola* spp. with a variety of herbal species as well as *Artemisia* spp. mixed with shrubs like *Salsola* spp. The area features one of the largest remaining remnants of wild pistachios savannah habitat (including the 760 km² Pulihatam grove). In drier regions, sparse stands of *Haloxylon* spp. are also found. In the summer, fires occur. **TM038 IBA Badhyz** (<http://datazone.birdlife.org/site/factsheet/22112>) overlaps with most of the Badhyz Nature Reserve.

TM041 IBA Garachop (<http://datazone.birdlife.org/site/factsheet/22113>) is the southernmost IBA in Turkmenistan and Central Asia. It covers the highest elevation hills along the frontier with Afghanistan between the Kushka and Kashan rivers. The landscape typically consists of bare hills, dissected by large and small, sometimes deep, ravines (Fig. 23). These ravines are flooded by runoff water during heavy rain events. The main feature in the west of the territory is the pistachio savannah habitat with the largest stand covering 150 km². Due to the artificial planting of pistachios, the border of the pistachio forest has extended considerably to the north. There are practically no water sources. The climate is dry and hot with an average annual temperature of 18°C and monthly means of 30°C in July and 2°C in January. The vegetation communities consists of *Carex* spp., *Poa bulbosa*-*Salsola* spp. with a mixture of herb species, as well as *Artemisia* spp. In the low shrublands. In the summer fires occur and shape the vegetation, along with heavy livestock grazing.

TM042 IBA Saryyazy (<http://datazone.birdlife.org/site/factsheet/22126>) is located in the Murgab river valley, slightly north of the Badhyz-Garabil foothills (Fig. 24). It covers the Saryyazy reservoir and its shoreline. We surveyed the area on the way from the Garabil foothills through the South-Eastern Karakum to Zeyit. The southern part of the Saryyazy reservoir is shallow (up to 2 m) and the northern part has the greatest depth (at the dam up to 10–12 m). Filling of the reservoir usually occurs in winter and spring, with discharge happening in summer-autumn. The climate is under the influence of the surrounding South-eastern Karakum. The vegetation along the shore is mainly hygrophilous – *Phragmites* spp., *Tamarix* spp., *Salsola* spp., *Alhagi pseudalhagi*, and also desert vegetation - *Carex* spp. cover with the participation of *Calligonum* spp. and *Salsola richteri*.



Fig 22. Badhyz Nature Reserve. Yeroylanduz depression (top) and wild pistachio savannah, 8.06.2018. Photo: J. Linnell.



Fig 23. IBA Garachop with planted pistachios and bare hills, 10.06.2018. Photo: J. Linnell



Fig 24. IBA Saryyazy, 10.06.2018. Photo: J. Linnell

3.4.7 Zeit & Kelif wetlands

TM048 IBA Zeyit-Kelif (<http://datazone.birdlife.org/site/factsheet/20757>) is partly located (26%) within the **Kelif Wildlife Sanctuary**. The area is a typical wetland of Central Asia, which was artificially formed in the 1980s by diverting the Amu Darya river into the Kelif Uzboy and flooding the neighbouring Uynshor. This created the Zeyit reservoir (ca. 700km²) which is the largest in Turkmenistan at the start of the Karakum canal. The IBA consist of an extensive network of big and small lakes, marshlands, and pools; it also includes multiple islands. The IBA consists of two parts: The large Zeyit in the southeast and the smaller Kelif in the north-west (characterized by shallow, silted and overgrown lakes). The two parts are connected by the Karakum Canal.

Winters are relatively mild with average temperatures of -2°C to 4°C; cold spells with temperatures dropping to -20°C can occur, but are very rare. The vegetation season lasts up to 240 days. The wetland vegetation is dominated by reed-beds of *Phragmites* spp., with the participation of the *Tamarix* spp., *Karelinia* spp., *Alhagi pseudalhagi*; to a lesser extent, *Salsola richteri* and other *Salsola* spp.; in some places in the north-western part *Elaeagnus* spp. and Turanga (*Populus* spp.) occur. On the sandy areas of the communities of *Carex* spp.-*Poa bulbosa*-*Salsola* spp. cover with undersized *Calligonum* spp., rarely *Salsola richteri* and *Haloxylon* spp. Some areas are used for agriculture. The area provides good conditions for nesting and wintering wetland birds.

3.4.8 Koytendag mountains

The Koytendag region is located close to the border with Uzbekistan in southeastern Turkmenistan (Fig. 25). The highest peak is Ayry Baba and with 3,137m it is also the highest point in Turkmenistan. The region is famous for the Umbar Dere canyon with its 28m waterfalls, the Plateau of Dinosaurs, with 438 fossilized dinosaur footprints, its sulphate hot spring and karst caves (Welch & Stoev 2019). The **Koytendag Nature Reserve** was established in 1986. It is situated on the western slopes of the Koytendag mountains. The reserve covers 2,714 km² of mountain habitat. The main aim of the reserve is the protection of the unique nature of the Kugitang mountain range and its bordering territories with its canyons, caves, waterfalls, springs and fossilized dinosaur tracks. The Koytendag Nature Reserve is also the only place in Turkmenistan where markhor are found and hence the protection of this rare species of mountain ungulate is a high priority (Welch & Stoev 2019).

The **TM050 IBA Koytendag** (<http://datazone.birdlife.org/site/factsheet/20586>) is partly (36%) located within the Koytendag Nature Reserve. The IBA covers the southwestern slope of the Koytendag Mountains at the southwestern tip of the Gissar Range of the Pamir-Alay mountain system in the middle and high mountain zone at elevations from 900 to 3,139 m. Depending on the altitude zone the region is characterized by a hot desert to moderately cold mountain climate, with an annual precipitation of up to 350mm.

The main source of water is the Koyten Darya river, with additional small streams originate in snowfields located at altitudes of about 3,000 m. Other water bodies include karst lakes and dips (Kattakul, Khurzhumkul, Garlyk, etc.), freshwater springs (Bulakly, Koyten) and hydrogen sulfide springs (Khodjakainar, Hojapil, Bazartepe). Juniper (*Juniperus seravschanica*) forest is found at elevations between 1700–2800 m, occupying a total area of 108 km². Human use in the area includes transhumant animal husbandry and some smaller scale agriculture in the lower areas.



Fig 25. Koytendag Nature Reserve and IBA, 14.06.2018. Photo: J. Linnell

3.4.9 Tallymerjen plains

TM049 IBA Tallymerjen (<http://datazone.birdlife.org/site/factsheet/20746>) is dominated by agriculture (Fig. 26). Tallymerjen consists of two parts, the Amu Darya river plain in the south and the foothill plains of the Gissar-Kugitang (Koytendag) mountain system in the remaining much larger area. The IBA is an alluvial-proluvial clay plain developed for agriculture (mainly arable farming). Developed a network of irrigation channels. The southern edge of the territory covers the valley of the Amydarya river with associated oasis vegetation. Observations of large numbers of Sociable Lapwings (*Vanellus gregarious*) in autumn 2015, suggest that Tallymerjen is a globally important migration staging site for this Critically Endangered bird (Donald et al 2016, Iankov 2017). The climate is strongly continental, with long hot summers and short winters with little snow. The vegetation before ploughing was the same as that preserved in tiny virgin areas: *Halocnemum* spp. community with the participation of various ephemerae. At present, almost the entire territory is occupied by agricultural fields mainly growing wheat and cotton, but alternating with fallow lands.

Our expedition, also passed through the **Hodjaburdjibelent Wildlife Sanctuary**, located between Koytendag Nature Reserve and IBA Tallymerjen. This landscape consists of rocky hills and valleys and is subject to intensive livestock grazing (Fig. 27).



Fig 26. IBA Tallymerjen, 13.06.2018. Photo: J. Linnell



Fig 27. Hodjaburdjibelent Wildlife Sanctuary, 15.06.2018. Photo: J. Linnell

4 Observations of kulan and other large mammals in 2018

Concerning large mammals the 2018 field expeditions had a number of different objectives.

(1) To clarify the status of kulan in all potential areas where they have been known to occur in Turkmenistan. Kulan have been the main driver of the series of expeditions conducted since 2014, so these 2018 expeditions were intended to wrap up the countrywide survey.

(2) Continue to build up a an overview of the distribution and status of other large mammals, especially the large ungulates (goitered gazelle, urial, markhor, and bezoar) and large carnivores (with an emphasis on leopard).

(3) Collect the latest camera trapping data from Badhyz and Koytendag Nature Reserve (which has been ongoing since 2013), and initiate new camera trapping surveys in other areas.

In order to reach these goals the expeditions recorded all mammal species seen, conducted interviews with knowledgeable individuals encountered (science officers from the nature reserves, protected area field staff, and shepherds), and examined camera trap images (which will be presented in more detail in another report).

This report documents our observations from 2018 in detail, and then presents a summary of what we have learnt during the entire period 2014-2018 for some of the key species.

4.1 Meana Chacha Wildlife Sanctuary

Meana Chacha was visited from 7th – 8th June, during which we crossed the whole sanctuary.

4.1.1 Kulan observations

Two fresh tracks were observed when we drove through the reserve that could possibly be kulan. However, there are also domestic donkeys and domestic horses in the wildlife sanctuary; the dung samples were collected for genetical analysis (analysis still pending).

There were no regular sightings of kulan according to the rangers, although a number of single observations had been made:

- Rangers reported a single track observed at a salt lake in April 2018.
- Border guards reported sighting a group of unknown size in 2017 from a helicopter, but it was unclear which side of the border fence this was.
- Shepherds reported a group of 4-5 animals in March-April 2018 north of the Mary-Tedjen road.
- One ranger reported a group of 31 kulan inside the sanctuary in June 2017, but this was never registered in the wildlife sanctuary's reports, so remains unconfirmed.

Very few gazelles are resident in the parts of the sanctuary that lie north of the border fence and we saw only one track at a salt lake. Rangers report the presence of jackal, wolf, wild boar and recently again leopard presence (with reported reproduction), but mainly from the dry (and now heavily overgrown with shrubs) riverbed of the Tedjen.

As in many areas, 80% of the wildlife sanctuary lies in the border security zone beyond the border fence and is thus rarely visited. Unfortunately this is also the part of the sanctuary where there is most water. The day after our visit, science officer Aknabat Potaeva and some rangers visited the Chacha water source in the border security zone on the other side of the border fence. They

reported many tracks from gazelles and wild boar, but no kulan tracks. Border guards report that many urial are present in the area.

4.1.2 Water and pasture situation

The area was very dry and there were no natural water sources. Although we passed many shepherd camps, none were occupied, apart from one camel station. The area has been very heavily grazed. The Tedjen river that flows to the east of the sanctuary has not flowed since 1998, apart from the occasional spring flood. The former Tedjen reservoirs have now become covered in shrubs, and now provide cover for wolves and leopards. The only water available is from intermittent open irrigation canals that pump water in the south close to border fence and send it northwards to the fields. Some natural springs apparently still flow from the mountains in the border security zone which is fenced off by the border fence.

4.2 Badhyz Nature Reserve

We spent 8th – 10th June in Badhyz Nature Reserve, entering from the north to Agarcesme, passing across the plateau to the escarpment rim above Yeroylanduz and then to Gyzylyar canyon, before exiting to the east.

4.2.1 Kulan and other wildlife observations

There had been no sightings of kulan in Badhyz and the surrounding wildlife sanctuaries or wildlife corridors in recent years. On our visit we encountered many old kulan dung piles. There were no recent reports of kulan in the surroundings, although they also reported the same account that we heard from Meana Chacha about the observation from the military helicopter.

The area west and south of the border fence remained virtually off limits apart from two visits that were made by science officer Nury Hudaykuliev. In 2017 he was briefly able to visit the border security area on the south side of the border fence along the Afghan border where the Islim river crosses the border. Apparently, the river was dry due to being diverted for agriculture in Afghanistan, and the landscape offered little grazing. There were no signs of kulan. In November 2018 he was able to visit the border security area on the west side of the border fence along the Iranian border. Multiple gazelle, urial and wild boar were seen, but no kulan.

We saw 13 urial and 18 goitered gazelle, and tracks from both species in many locations. Three red foxes were also seen. Because this visit was in a different season to previous visits, and the weather was very hot - which clearly reduces animal activity - it is impossible to say anything about changes in abundance since our last visits in 2015. Camera trapping data (2016-2019) and observations document that leopard, wolf and striped hyena are still present, in addition to multiple images of urial, gazelles, and wild boar. However, the lack of systematic monitoring makes it impossible to document trends.

Camera trapping (Figs. 28-30) and direct observations also confirmed the presence of wild cat (*Felis lybica*). No images of caracal (*Caracal caracal*) or honey badger (*Mellivora capensis*) have been taken so far, but this may be entirely the result of camera placement and the limited number of cameras available in the first place (≤ 20). Red foxes were also commonly photographed.

The two artificial water sources in Gyzylyar were both in operation. There was very heavy grazing pressure from livestock in both Gyzylyar and Chemenebat Wildlife Sanctuaries (Fig. 31) between Badhyz and the west bank of the Kuska river which was reduced to a trickle of water and some pools.

There were 5 captive kulan in a set of two interconnected enclosures at the headquarters of the Badhyz Nature Reserve in Serkhetchi (Fig. 32). These consisted of an adult female that had been rescued from the wild in Badhyz in 2013, her female yearling (1.5 year old) a male foal, and an adult male and adult female that had been brought from Ashgabat zoo (both of which had parents which had been caught in the wild in Badhyz).

4.2.2 Human impact

Poaching is apparently still a problem. One poacher was even observed from a distance waiting at a waterhole in Yeroylanduz.



Fig 28 Camera trapping images of goitered gazelle, urial, and Persian leopard in Badhyz 2016-2019.



Fig 29. Camera trap images of other large or medium sized carnivores in Badhyz. From top left to bottom right: Wolf, stiped hyena, red fox, and wild cat.



Fig 30. Urial encountered in Yeroylanduz and Gyzljar canyon on 9.06.2018. Photo: J. Linnell



Fig 31. The lack of vegetation suggests heavy grazing pressure in the surrounding of the Badhyz Nature Reserve and inside Gyzylyar and Chemenebat Wildlife Sanctuaries, 9 June 2018. Photo: J. Linnell



Fig 32. Captive kulan at the Badhyz Nature Reserve headquarters, 6.06.2018. Photo: J. Linnell

4.3 Garabil hills and southeast Karakum desert

During 10th – 12th June we drove through the Garabil foothills and the south-eastern Karakum, from the east bank of the Kuska river through to the Karakum canal. The landscape immediately east of Kuska in and around IBA Garakachop offers good potential habitat as the rangelands / pistachio forests are in good condition, however there are no obvious natural water sources and few livestock wells that might provide an alternative source. In the area further to the northeast there are vast area of rangeland with frequent livestock camps. The livestock are watered from a large network of deep wells. However, all wells were associated with sheep camps and livestock guarding dogs were present at all sources, making it challenging for wildlife to access water. There was also heavy grazing pressure. None of the shepherds we interviewed had ever seen kulan, although they reported gazelles and wolves as being present. We saw 6 gazelles and 2 corsac foxes on our drive.

4.4 Gury Howdan Wildlife Sanctuary

Half a day was spend in Gury Howdan on 6th June 2018 during which we visited the main kulan range and interviewed both present and former rangers. This was the site of one of the early reintroductions in 1986-1987.

The situation seems to have changed little since 2015. The area available to kulan remains rather small because of agriculture and large-scale tree plantation as part of afforestation programs. Construction also appears to be ongoing along the northern edge.

4.4.1 Kulan observations

6 kulan (no young) were observed on wheat fields outside the sanctuary (Fig. 33). The rangers reported that this group consisted of 1 adult male 5 adult females. Rangers reported at least one other group of three kulan (reported as all males) that lived in higher areas, and possibly some roaming single individuals. There were conflicting reports about if a foal had been born this year or not. Overall it was estimated that between 9 and 12 kulan are found in the area.



Fig 33. Kulan on wheat field on 6.06.2018. Photo: J. Linnell

4.5 Animal Breeding Centre of Kopetdag Nature Reserve at Novrekcheshme

The breeding centre had urial and gazelles in one enclosure, in addition to various birds. One of the Kopetdag kulan releases was conducted here in 1976. Apparently, the population increased after release and began to cause conflicts with local agricultural in the 1990's. The centre's director mentioned that they were then "chased away" in 1995-96 and none had been seen in the area since. It was mentioned that urial and gazelles were relatively common in the adjacent mountains and border area.

4.6 Western Kopetdag – Tersakan valley

The Tersakan valley is not part of the Sunt-Hasardag Nature Reserve or Wildlife Sanctuary, but a hunting ban has been issued annually by ministry order on an area of 500 km² since the 1990s. In 1995, the population of kulan in the Tersakan valley was estimated at 58-60 animals. In 2012, V. Kuznesov estimated that there were no more than 20 kulan left (Kuznesov 2013 unpubl. Report).

We visited the Tersakan valley (Fig. 34) and area to the west and south during 7th – 11th May and encountered:

- Old tracks and scats of several kulan in the most remote part of the area (Kulmach ridge), where there currently were no livestock camps or people. The pasture condition there was good, with recent green vegetation and multiple flowers.
- One kulan was seen on 10th May when the team split up into three groups and walked the ridges to cover as much ground as possible. Tracks of the animal - which ran away at high speed - suggested it was alone (likely a single stallion).
- Fresh, and older tracks of 3-5 kulan were seen during a 4-hour hike in the area of the kulan observation.

Interviews with six local shepherds revealed the following recent kulan observations (see Fig. 34):

- No kulan were observed outside the Tersakan valley in recent years
- 2 years ago (2016), 11 kulan were seen on several occasions
- 1 year ago (2017), 7 kulan and one single stallion were seen on several occasions
- This year (2018), 3 kulan were seen in April at a well close to the area we later saw the single kulan

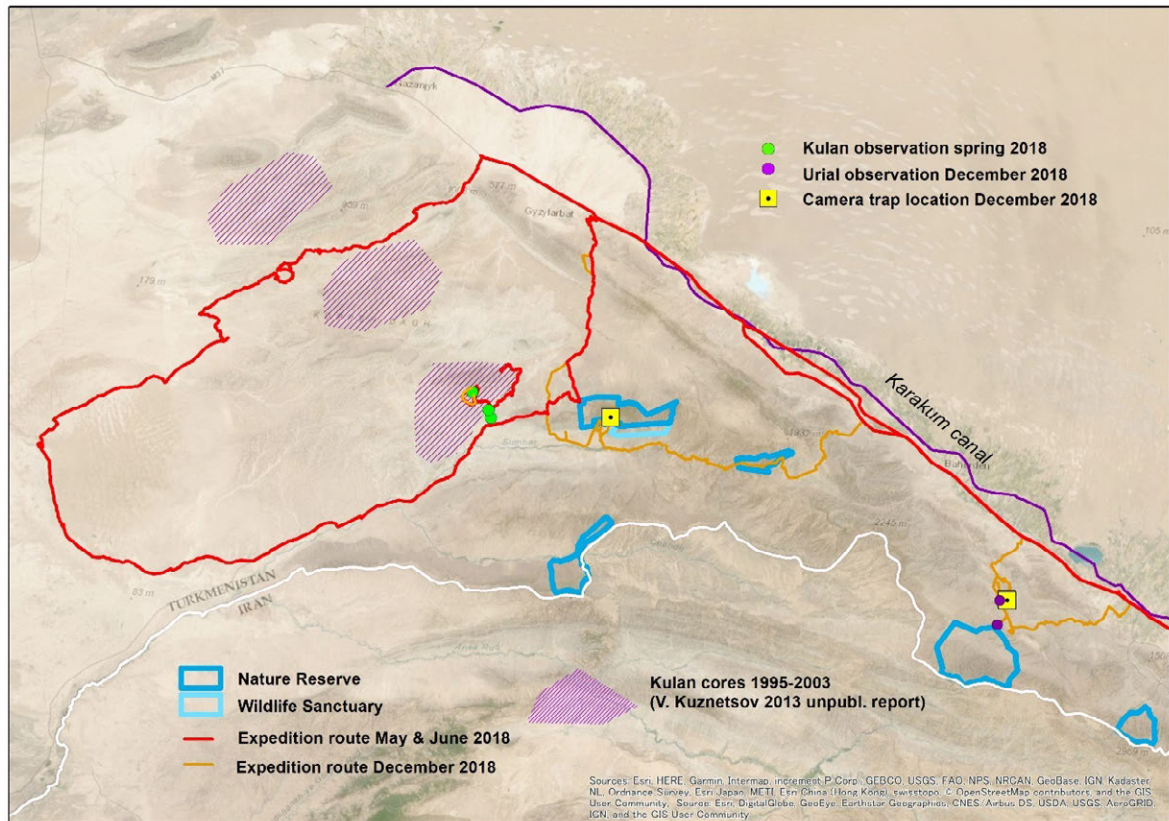


Fig. 34: Kulan and other wildlife observations in the Western and Central Kopetdag mountains in 2018.

4.7 Western Kopetdag – Sunt Hasardag and Central Kopetdag Nature Reserves

These mountain areas do not contain any kulan, but are known for their rich biodiversity. The primary objectives of the visit were to gain a first impression of the landscape and wildlife situation, conduct training in camera trapping, and deploy additional camera-traps in the area (Fig. 35).

4.7.1 Sunt Hasardag Nature Reserve

From the 10th – 14th December we visited the Central and Ayderinsky sections of the Sunt Hasardag Nature Reserve on foot and by horseback.

Tracks of mammals observed included: jungle cat, striped hyaena, leopard (female with kitten), urial and wild boar. Mammals directly observed included: one jackal and one jungle cat.

The few camera traps that had been deployed earlier in autumn 2018 recorded images of jungle cats. Currently (2019) there are 10 camera traps deployed in the Sunt Hasardag Nature Reserve. The first leopard was camera trapped in March 2019.

The science staff reported the presence of the following wildlife species in the Sunt Hasardag Nature Reserve: leopard, wolf, golden jackal, red and corsac foxes, badger, honey badger, striped hyaena, Pallas' cat, jungle cat, caracal, otter (*Lutra lutra*), porcupine, urial, bezoar, gazelle and wild boar. The staff had also recently received a photograph of a bear track from the southern part of the reserve that lies in the border security zone, along the Iranian border.

4.7.2 Central Kopetdag

From 14th – 16th December we visited the Central Kopetdag Nature Reserve, covering large areas by driving, hiking and scanning from vantage points.

Tracks of mammals observed included: leopard, porcupine, urial, bezoar. Mammals directly observed included: 13 urial.

The science staff reported the presence of the following wildlife species in the Kopetdag Nature Reserve: leopard, wolf, Pallas' cat (*Otocolobus marul*), red fox, stone marten (*Martes foina*), porcupine, striped hyaena, urial and bezoar with goitered gazelles occasionally present in lower ranges.

New camera traps were deployed following training. Leopards were already detected within a few weeks / months of deployment (Figs 36-38). In 2019, the camera in Dushak confirmed the presence of a Pallas' cat.

These mountain areas represented good habitat, with grasslands in the upper areas and scrubby forests in the valleys. Year round water sources were present in most valleys. The complex topography provides good escape terrain for mountain ungulates. The protected areas are quite fragmented, and the wider landscape is grazed by livestock and subject to patchy agriculture, however the human impact appears to be low. A large proportion of the protected areas are in the border security zone along the Iranian border and are therefore beyond the border fence. The science staff have intermittent access to the border zone and report high densities of urial and bezoar in the area.



Fig 35. Setting up the first camera trap in Kopetdag Nature Reserve (from left to right: Shaniyaz Mengliev, Nury Hudaykuliev, Aknabat Potaeva, Dortguly Seyitmuhamedov), 14.12.2018. Photo: J. Linnell



Fig 36. First leopard photographed in the Central Kopetadg Nature Reserve on 23.12.2018, just 9 days after deployment. Photo: A. Potaeva



Fig 37. First leopard photographed in the Sunt Hasardag Nature Reserve in March 2019. Photo: H. Hojamyradov



Fig 38. In the Central Kopetdag, camera traps were placed in Markow, Dushak Erikdag and in the border zone. The camera trap in Dushak Erikdag recorded a leopard in May 2019. Photo: S. Fateyew

4.8 Sarygamysh lake / Gaplangyr Nature Reserve

4.8.1 Kulan situation

From 27th April – 2nd May 2018, field research failed to observe any kulan or find fresh tracks or recent droppings on the Gaplangyr plateau between the Shasenem sector of the Altyn Assyr canal and the Karashor depression and the southern shore of Sarygamysh lake. We did however, encounter some old signs and heard about kulan observations from third parties (Fig. 39):

- In several locations, old droppings were found which are proof of past presence. In addition, the team came upon the remains of a dead kulan obviously poached in autumn 2017 or spring 2018 (the legs had been cut off and the remains of the skull had been crushed by vehicles; Fig. 40).
- Questioning of local herders and fishermen encountered did not reveal any recent sightings of kulan and very few sightings of gazelles. The last kulan observations date back to February 2018, when 4-5 kulan (of which one was said to be pregnant) were seen by local people along a canal breaking the ice to access water
- Prior to the trip, the team had also heard rumors of one kulan killed by poachers in February 2018 and this information was confirmed by local people (and it may have been the animal whose remains we found, because it was on a dirt road where it could be easily found). Additional rumors were later heard that during January and February 2018 many people who were hunting on the Gaplangyr plateau came back without killing any wild ungulates (particularly gazelles and possibly kulan).

4.8.2 Other ungulates and rare mammals

The field team did not observe any gazelles or urials and only found very few fresh tracks of these species. In contrast, fresh tracks and droppings of wild boar were regularly seen near water bodies (Uzynshor and Atabyshor) and one group of wild boars with young was observed while driving.

On 1 May, the team saw a steppe polecat obviously hunting for rodents (Fig. 41) and on 2 May, found a dead honey badger (Fig. 42), close to the dirt track where the remains of the poached kulan were found (Fig. 40).

In 2019, newly placed camera traps confirmed the presence of caracal (*Caracal carcal*) in the Gaplangyr Reserve.

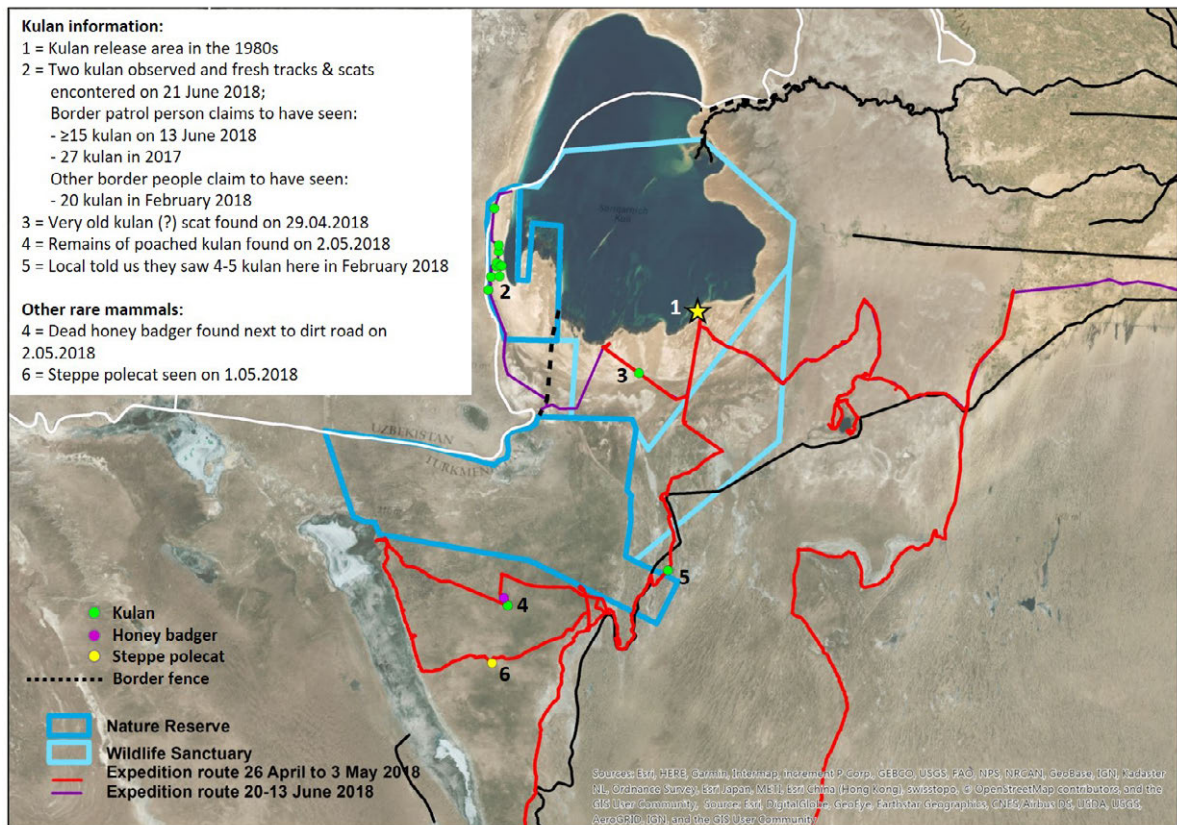


Fig. 39: Evidence of kulan presence and other rare mammals during two expeditions in Mai 2018 and June 2018.



Fig. 40: Remains of a kulan found next to the main dirt track on 2.05.2018. Photo: P. Kaczensky



Fig. 41: Steppe polecat (*Mustela eversmanii*) on 1.05.2018. Photo: P. Kaczensky



Fig. 42: Dead honey badger on next to a digging near the main dirt track on 1.05.2018. Photo: P. Kaczensky

4.9 Sarygamysh lake – southern and western shore

During a second trip in June 2018, it was possible to visit the border security zone north of Burchliburun for one day on 21st June as well as revisit the area south of Sarygamysh lake.

4.9.1 Kulan situation along western shore and border security zone

During the 148 km drive in the border security zone along the western shore of Sarygamysh lake, the team came upon kulan and their signs at multiple locations:

- Observation of 2 adult male kulan.
- Piles of fresh dung in several locations (13 + several + several + 1 + 8 + 41) and collected 10 dung samples for subsequent genetic assessment (analysis pending) (Fig. 43).
- Tracks in multiple locations of groups of kulan (10-12 + 2 + 4 + 1 + 2 (older) + 7).

The border security staff member that accompanied them further reported the following observations:

- 12 June 2018: 15 kulan (half of which were young ones).

4.9.2 Other ungulates

The team also documented:

- Observation of 31 goitered gazelles in 11 groups (1 female with 2 young, 1 male, 1 female, 3 individuals, 1 male, 1 female with 2 young, 2 adults, 2 young, 1 adult male, 10 individuals (incl. 2 males), 4 individuals).
- Tracks of multiple gazelles.
- Observation of 4 urial.

4.9.3 Kulan situation along the southern shore

The team did not see any kulan or their signs on the southern shore of Sarygamysh lake. However, they did encounter a few isolated gazelles.

4.9.4 Situation in adjacent parts of Uzbekistan and Kazakhstan

Some information on the status of kulan and other large herbivores on the Uzbek and Kazak sides of this transboundary ecosystem have recently become available due to a series of expeditions covered by the CADI (Central Asian Deserts Initiative) program. We include a summary of their findings here.

- First kulan observations in 2004 by border guards. Fishermen periodically see herds of kulan numbering 7-8, 10-30, and once even 100 (September 2013) individuals. Fishermen have seen kulan wander on the ice in winter (possible crossing between Uzbekistan and Turkmenistan!)
- Field expeditions 2012-2014 documented kulan especially along the western shore of Sarygamysh lake, but also on the Uztyurt plateau all the way to the border fence to Kazakhstan. For details see Marmazinskaya et al. (2012-2018).

- Although kulan are not permanently present on the Kazak part of the Ustyurt plateau, 1 kulan was observed on the Kazakh part of the Ustyurt next to the Kazakh / Ustyurt border fence on 27th April 2019 (CADI News 3 May 2019, <https://cadi.uni-greifswald.de/en/cadi-expedition-to-south-ustyurt-completed/>).

A total of 142 gazelles were observed (2011-2014). Gazelles are widespread throughout this area, but the greatest gazelle density was recorded in the south-western part along the shore of Sarykamys lake (western border with Turkmenistan). For details see Marmazinskaya et al. (2012-2018).

- During the CADI expedition in April 2019, 119 goitered gazelles were observed, which also underlines the significance of the southern Ustyurt for gazelle and the need for cross-border cooperation for conservation.



Fig 43. Kulan scats in the border security zone on 21.06.2018; in the background is the chink which delineates the border between Turkmenistan and Uzbekistan. Photo: E. Rustamov

4.10 Tallymerjen IBA and area in direction of Hojaburjibelent Wildlife Sanctuary

This landscape was very dry and very heavily grazed by livestock. There were many shepherd camps, but few livestock to be seen in this season.

There was no evidence of wild ungulates, although the cliffs closer to Hojaburjibelent Wildlife Sanctuary offered potentially good urial habitat and some salt water sources were present.

4.11 Koytendag Nature Reserve

Koytendag has been the target of multiple expeditions under the umbrella of the RSPB project to help the reserve prepare its World Heritage nomination dossier (see Welch & Stoev 2019). In 2018 our expedition spent 2 days in Koytendag (13th – 15th June), staying at the park headquarters and the Maydan ranger station, as well as spending day in the associated Hojaburjibelent Wildlife Sanctuary.

Kulan have never been present in Koytendag and the area does not represent suitable kulan habitat. The mountainous habitat is also not suitable for gazelles. Rather the reserve is known for its mountain ungulates – urial and markhor – and large carnivores – wolves and lynx. Leopards have not been seen in the area for more than 20 years. During an afternoon hike we saw 12 urial and 29 markhor, including both males, females, and young of the year of both species (Fig. 44). Ongoing camera trapping has confirmed the continual presence of lynx and wolves in the area. The habitat appears to be in very good condition, although there is some limited livestock grazing. The behaviour of the wildlife was much more tolerant of humans than in the other areas that we have visited, providing indirect evidence that disturbance and poaching are low.

The landscape of the Hojaburjibelent Wildlife Sanctuary consisted of alternating hilly steppe and cliffs and would therefore have been suitable for both urial and gazelle. However, our brief visit produced no signs of their presence. The area was extremely heavily grazed by livestock.



Fig 44. Markhor (upper photo) and urial (lower photo) in Koytendag Nature Reserve, 14.06.2018. Photo: J. Linnell

4.12 Summary of status of rare large mammalian wildlife in Turkmenistan

The following summaries are based on the entire series of large mammal focused expeditions that have been conducted since 2014 (Kaczensky & Linnell 2015, Kaczensky et al. 2016, Kaczensky et al. 2018, and this report), plus all other expeditions conducted under the umbrella of the RSPB projects (e.g. Welch & Stoev 2019), camera trapping conducted mainly in Badkhyz and Koytendag, and our conversations with the science officers and rangers of the relevant protected areas. As such it represents the most up-to-date impression of wildlife status on the ground in Turkmenistan.

4.12.1 Kulan

The existing evidence suggests that the population of Turkmen kulan in Turkmenistan has been decreasing over several years, including a decrease during the period since our surveys began in 2014, and is in very bad shape. The best possible estimate suggests a national total of 50-55 individuals, fragmented into 3-5 isolated areas (Fig. 45, Table 7). Without urgent and targeted conservation measures, the species will likely disappear from the territory of Turkmenistan within the next few of years. Of special significance is the functional extinction of the Badkhyz population which was the largest and only source population for Turkmen kulan in the region. All other populations in Turkmenistan (plus those in Kazakhstan and Uzbekistan) are descended from animals captured in Badkhyz and transported elsewhere (Pavlov, 1996; Lukarevskiy & Gorelov 2007, Kaczensky et al. 2016, Kaczensky et al. 2018). Furthermore, most of the remaining kulan in Turkmenistan are cut-off from the main area of the country by the border security fences. Kulan are apparently absent from the border areas on the Iranian side of the border, although the population in the north around Sarygamysh lake appears to be transboundary with Uzbekistan (Arebaevich & Asenovich 2016, Marmazinskaya et al. 2012-2018).

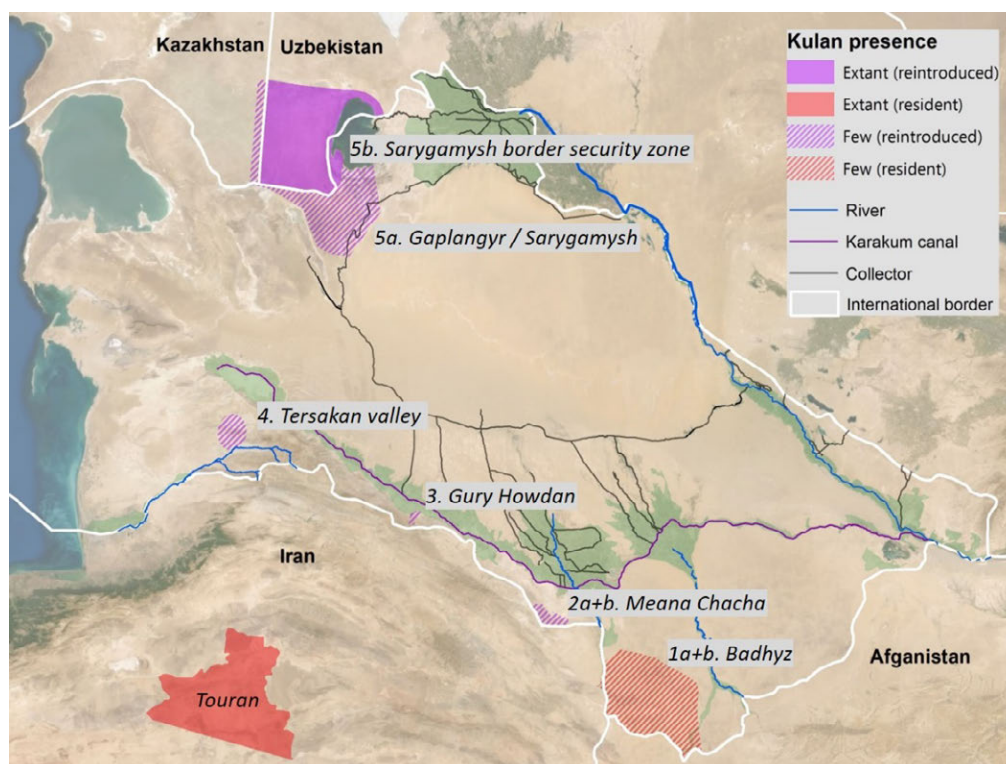


Fig. 45: Kulan distribution in Turkmenistan and adjacent areas in neighboring countries.

Table 7. Summary of kulan situation in Turkmenistan as of the end of 2018.

#	Region	Population status	Assessment based on data	Own data / observations
1a.	Badhyz	<10	Scientific staff estimate 2018	Rapid assessment 2014, 2015, 2018, camera trapping, genetic results
1b.	Badhyz border security zone*	?	Rumors	A short visit in 2017 & 2018 did not confirm kulan presence
2.	Meana Chacha*	<5	Ranger estimate 2018 [Rumors of sporadic kulan presence in the border security zone]	Rapid assessment 2015, 2018
3.	Gury Howdan	9-12	Ranger estimate 2018	13 seen on 4.09.2015 & 6 seen on 6.06.2018; genetic results
4.	Western Kopetdag – Tersakan valley	10-15	Scientific staff estimate 2018	1 seen on 10.05.2018 & tracks, observations by shepherds and rangers
5a.	Sarygamysh lake / Gaplangyr	<5		Rapid assessment 2018
5b.	Sarygamysh lake in the border security zone*	15-25	Border security personnel	2 seen and signs encountered on 21.06.2018, Observations by N. Marmazinskaya 2012-2018 on the Uzbek side of the border
	Total estimate for 2018	50-55		

*Kulan are unable to cross the border security fence and hence if kulan are present in the border security zone, they are cut off from kulan in the main territory of Turkmenistan.

4.12.2 Goitered gazelle

The most recent update on the status of goitered gazelles states “The former population in Turkmenistan has virtually disappeared.” (IUCN SSC Antelope Specialist Group 2017). This statement is certainly not true as gazelles or their tracks were encountered in all reserves we visited (Kopetdag, Sunt Hasardag, Badhyz, Meana Chacha (very rare), Sarykamys lake / Gaplangyr (very rare), and in parts of the Central and South-eastern Karakum (very rare), the Kopetdag foothills (e.g. Tersakan valley), and the Karabil foothills (very rare). Gazelles seem absent from the Koytendag Nature Reserve. However, numbers encountered were generally small and signs not overly abundant. Gazelles were present in the border security zone on the western side of Sarykamys lake, which is also in line with observations on the Uzbek side of the border (for a summary see Marmazinskaya et al. 2012-2018). No population estimates, based on systematic monitoring are currently available. In summary, gazelles mainly occur in the protected areas with only scattered individuals present outside.

4.12.3 Urial

Urial are present in the protected areas along the mountains that constitute the border with Iran, from Badhyz, through the Kopetdag range to Sunt Hasardag; they are also present in the Uly Balkan. In Meana Chacha they are only present in the area beyond the border fence (in the border security zone) whereas in Badhyz and Kopetdag they are present on both sides of the border fence. Numbers are reported as being higher in the border security zone. Urial are present in parts of the Balkan range. In the north, urial are found in low densities along the large chinks along the Gaplangyr, Karashor, and Kazakhlyshor depression. These occurrences in north-western Turkmenistan are in line with sightings of urial on the Uzbek and Kazakh side of the Ustyurt plateau and on the Uzbek side of Sarykamys lake (Marmazinskaya et al. 2012-2018, Pestov et al. 2017). In the southeast urial are only present in an isolated population in Koytendag. In summary, urial mainly occur in the protected areas with only scattered individuals or small, remnant populations present outside.

4.12.4 Markhor

The markhor population on the border between Koytendag in Turkmenistan and the neighbouring ranges in Uzbekistan represents an isolated outlier of global markhor distribution. Based on past counts and population trends on the Uzbek side of the Koytendag mountains, the markhor population in Turkmenistan has been estimated to number about 250 individuals in the most recent IUCN assessment from 2017 (Michel and Rosen Michel 2015) based on older counts (Weinberg et al. 1997). The reserve staff currently estimate almost 900 markhor in the Turkmen side of Koytendag (unpubl. Data 2015). Observations of large males and regular evidence of reproduction is supported by images from camera trapping and suggests the markhor population in Koytendag is doing well and may be increasing.

4.12.5 Leopard

The available data indicates that leopards are found throughout the mountainous regions of southwestern and western Turkmenistan (Table 8), from Badhyz in the south along the Iranian border through the Kopetdag range to Sunt Hasardag in the west. Furthermore, they are also present in the Balkan ranges to the northwest. Our data does not permit any estimate of numbers, but tracks and signs are common in the areas of distribution, and we can confirm that reproduction is occurring throughout this distribution. Leopards are abundant on the Iranian side of the border (Farhadinia et al. 2015, 2018) so that the animals in Turkmenistan are part of a much larger transboundary population shared with Iran. To the north there seem only a few incidental, the northernmost record being from the Ustyurt plateau in Kazakhstan (Pestov et al. 2019). However, based on what is known about Persian leopard ecology from studies conducted in Iran and in the Caucasus (Gavashelishvili & Lukarevskiy 2008; Farhadinia et al. 2014, 2018) the habitat and presence of prey throughout many parts of southwestern and western Turkmenistan seems to make these areas highly suitable for leopards. There is no up-to-date information on the extent of leopard livestock conflicts in the region which was a significant issue in the recent past (Lukarevskiy 2002).

Table 8. Summary of leopard situation in Turkmenistan as of the end of 2018

#	Region	Population status	Assessment based on data	Own data / independent observations
1.	Badhyz	Present	Scientific staff	Rapid assessment 2014, 2015, 2018, camera trapping 2013-18
2.	Eastern Kopetdag - Meana Chacha	Present	Ranger information	None
3.	Gury Howdan*	Present	Scientific staff	None
4.	Western Kopetdag – Sunt Hasardag	Present	Scientific staff	Tracks & sightings, camera trapping 2018-2019
5.	Central Kopetdag	Present, assumed to be increasing	Scientific staff	Camera trapping 2018-2019, tracks & sightings, telemetry from Iran (Farhadinia et al. 2018).
6.	Sarygamysh lake / Gaplangyr	Not present	Scientific staff	None, but closest camera trap record from KZ Ustyurt (see Pestov et al. 2019).
7.	Koytendag	Absent for >20 years	Scientific staff	Camera trapping since 2013
8.	Balkan range	Present	Scientific staff	Fresh scrapes, scat, herder testimony of encounter; camera trap image in 2019

*in border security zone in the mountainous part of the reserve

4.12.6 Wolf

Wolves are apparently present across the whole landscape, but likely have strongholds in the protected areas where the prey base is better and where conflicts over livestock depredation should be lower. Wolf population estimates based on the assessment of hunters and shepherds are 2,500. However, no systematic, evidence based monitoring exists and numbers are likely overestimated.

Wolves were regularly documented on camera traps in Koytendag. They were rarely seen on camera traps in Badhyz, although we once observed 5 animal and regularly encountered their tracks and scats.

4.12.7 Striped hyaena

According to the latest IUCN assessment, the striped hyaena is distributed throughout the southern part of Turkmenistan, including the Kopetdag and Koytendag mountains, the Badhyz and Karabil foothills and the central and south-eastern Karakum (AbiSaid and Dloniak 2015). The species is also found in the Balkan mountain range and long-distance dispersal brings the species throughout the flat parts of the country with animals documented in the Trans Uzboy, the Ustyurt, and the Amu Darya region (e.g. <http://www.panda.org/?93440/Rare-hyena-spotted-in-Turkmenistan>) and along the coast of the Caspian sea (Rustamov 2011, 2016). More detailed information on recent sightings is available, but compiling and verifying these information was beyond the scope of this report.

Striped hyaenas are regularly observed and show up on camera trap images in Badhyz and their presence is documented in the Kopetdag mountains (including camera trap images from 2019). Striped hyaenas did not show up in camera trapping images in Koytendag, but potentially the area covered by cameras is outside the preferred range of the species. On May 5, 2018 we learnt from local residents (village Ajikyal, Central Karakum) that in 2016 one hyena was caught in a trap 20 km away; supporting the aforementioned presence in the central Karakum.

Future camera trapping could confirm the species in other reserves. Using the stripe pattern of individuals would also allow to identify different individuals and get minimum estimates present (Harihar et al. 2010). The species is rather unknown and under-appreciated and could do with awareness raising to avoid accidental or intentional killing.

4.12.8 Eurasian lynx

Lynx (*Lynx lynx*) in Turkmenistan are apparently confined to the higher areas of Koytendag. They have been present in the Kopetdag mountains, with records from the central Kopetdag from 2002-2011 (Agryzkov and Fateev 2011), but have been absent from the western Kopetdag for decades. Lynx observations have also been reported from the lowlands, but these were likely misidentifications of caracal or jungle cats. Lynx are frequently picked up by camera traps in Koytendag, but videos make it hard to identify individuals to get population estimates. The large number of hares in the camera trap videos suggests that Koytendag may be a lynx-hare system similar to that found in Turkey (Mengülluoglu et al. 2018) which may result in relatively high lynx densities.

4.12.9 Small cats

Five small cat species are reported to occur in Turkmenistan, namely the caracal (in deserts and foothills), sand cat (*Felis margarita*; in deserts), wild or steppe cat (throughout the country), the jungle cat (in southern Turkmenistan) and the Pallas' cat or manul (in the higher reaches of the Kopetdag mountains; Kitchener et al. 2017, Rustamov 2011).

Small cats are regularly observed in the protected areas and show up on camera trap images from Badhyz and Koytendag. In Badhyz these small cats tend to be characterized as wild cat, whereas observations in the Kopetdag range seem to stem from both wild and jungle cats.

In 2019, a camera traps confirmed manul presence at Dushak in the Kopetdag mountains and caracal presence in the Gaplanyr Reserve. The caracal observation is in line with recent camera trap images of caracal from Uzbekistan (Gritsina 2019) and camera trap images from the Ustyurt State Nature Reserve in Kazakhstan (see: <https://cadi.uni-greifswald.de/en/media-gallery/> - CADI Expeditions findings III: Animals of the Ustyurt Plateau).

More awareness for the conservation and monitoring of small cats is needed. Future camera trapping should ideally aim at small cat species distribution throughout Turkmenistan.

4.12.10 Honey badger

According to the most recent IUCN assessment, the honey badgers should occur in the southern and western, and north-western part of Turkmenistan (Do Linh San et al. 2016). It is listed to occur in the Western Kopetdag (presence recently confirmed by a dead specimen) and Badkhyz (only historical records). We confirmed the species presence based on a dead individual also in the Southern Ustyurt. This find is also in accordance with the recent documentation of the species on the Uzbek Ustyurt (Marmazinskaya et al. 2012-2018). The species seems to be very secretive and occur at low densities, but potentially over a large range. Although honey badgers were documented in Badkhyz in Soviet times we have not detected the species in camera traps in the period from 2013 to 2018. The species is believed to be subject to poaching and attacks by shepherd dogs.

4.13 Available habitat

The entire area travelled represents a vast area of potential wild ungulate habitat of grasslands and desert. There is very little anthropogenic fragmentation of the landscape within Turkmenistan apart from the Karakorum canal, the parallel highway, and the associated agricultural land, two two-lane and lightly trafficked roads (Mary to Gushgy and the side road to Tahtabazar), a low-speed railway (Mary to Gushgy), and a few villages and some highly limited areas of agriculture along the Kuskaya river, its tributary the Kashan river. However, towards all neighboring countries, the border fence poses an impenetrable barrier for most large mammals, particularly the large ungulates.

The biggest constraint is access to water sources. Natural springs are limited, and unfortunately the rivers are where human activity is concentrated. Along the Kopetdag range, wildlife is often cut-off from springs and rivers in the mountains by the border fence. The same is true for Badkhyz, where the border fence cuts kulan and other wild ungulates off the Tedjen river and numerous springs along the Iranian border. In some areas, wild ungulates can potentially drink from the troughs at wells operated for livestock if they can get past the herders and guarding dogs at night.

Livestock grazing pressure appears very high in many parts of the landscape. However, by all accounts wild ungulate populations were much higher in the recent past (despite similar anthropogenic pressures). This and hard evidence encountered during several trips indicates that there is probably widespread illegal hunting both outside the protected areas and also inside protected area, including the prestigious Nature Reserves.

With political will and sufficient funds, there appears to be plenty of scope for wildlife conservation in Turkmenistan's multi-functional rangelands if (1) illegal killing can be brought under control, (2) livestock stocking densities can be kept to sustainable levels, and (3) access to water can be ensured.

4.14 Protected area infrastructure

Considering the apparent importance of protected areas for conserving wildlife in Turkmenistan it is important to assess their ability to conduct this task. All protected areas visited show clear signs of underfunding. Vehicles are few, old, and often of very poor quality. Many remain out of action due to lack of spare parts. Petrol budgets are insufficient to cover even a fraction of the necessary patrolling or monitoring activities.

The ranger stations are generally basic, often in poor condition and lacking maintenance. Radio communication equipment is generally absent. Basic equipment like binoculars, tents, sleeping bags and GPS units are generally absent apart from cases where donations have been made by foreign funded projects. Even uniforms and field clothing for staff are old and of poor quality.

Research and monitoring equipment is also primitive, with research staff only having limited access to computers, and no access to the internet. Overall, the level of equipment, infrastructure and economic investment is at a fraction of what is needed for the protected area staff to safeguard the natural heritage of Turkmenistan.

In contrast, everywhere we went we encountered rangers and research staff who were dedicated, highly skilled, and doing the best they can with the limited resources available. Most seemed to be investing some of their private funds from their limited salaries into fuel and basic equipment.

5 An update on birds in a selection of Important Bird and Biodiversity Areas (IBAs), protected areas, and other parts of Turkmenistan

5.1 Introduction

The main purpose of the survey was to expand on existing knowledge (Bukreev 1995+1997; Rustamov 1994; Rustanov 2015; Rustanov et al. 2009) and collect fresh field data about the birds of the IBAs in Turkmenistan with special attention to species of particular conservation interest: Globally threatened species (categorized by the IUCN Red List as Critically Endangered, Endangered or Vulnerable), Biome-restricted species (the group of species whose distributions are largely or wholly confined to one biome), and Congregations (seasonal congregations of any waterbird, seabird or terrestrial bird species) (BirdLife International 2019). This was necessary to assess the current state of the visited IBAs and to update the information about them in the BirdLife International World Bird Data Base. In addition we collected data about the birds included in the Red Data Book of Turkmenistan (2011).

5.2 Methods

Data were collected by visual and acoustic observations of the sites during the expeditions, especially the summer expeditions. Specific areas to be surveyed were planned by the Turkmenistan experts but to large extend they were determined by the possibility to get access to the most important parts of the sites. Due to the large distances and difficult terrain, we were unfortunately not able to visit many areas of great ornithological interest. Observations were made during the whole time of the journey. On the overnight sites special efforts were paid in the morning hours to reveal as much as possible of the breeding bird fauna. Observation was continued while travelling between sites, covering on average 500m belts on both sides of the track concerning middle-sized and large birds. At some points of interest more time was spent with an attempt to achieve maximum surveyed area. Binoculars and spotting scopes were used. All records were entered in a notebook on the spot. During the night some birds were identified by sound. Whenever possible, a subjective assessment of the size of the population within the particular IBA or area was done.

5.3 Summary results

All records of the Globally threatened, Biome-restricted species and Congregations with their geographical coordinates and other attributes have been provided to the representatives of the Ministry of Agriculture and Environment Protection of Turkmenistan for decision making purposes. Assessments of the population size of these species within each particular IBA are entered into the BirdLife International World Bird Database. Some of the results of general ornithological and conservation interest are presented below (Fig. 46, Table 9).

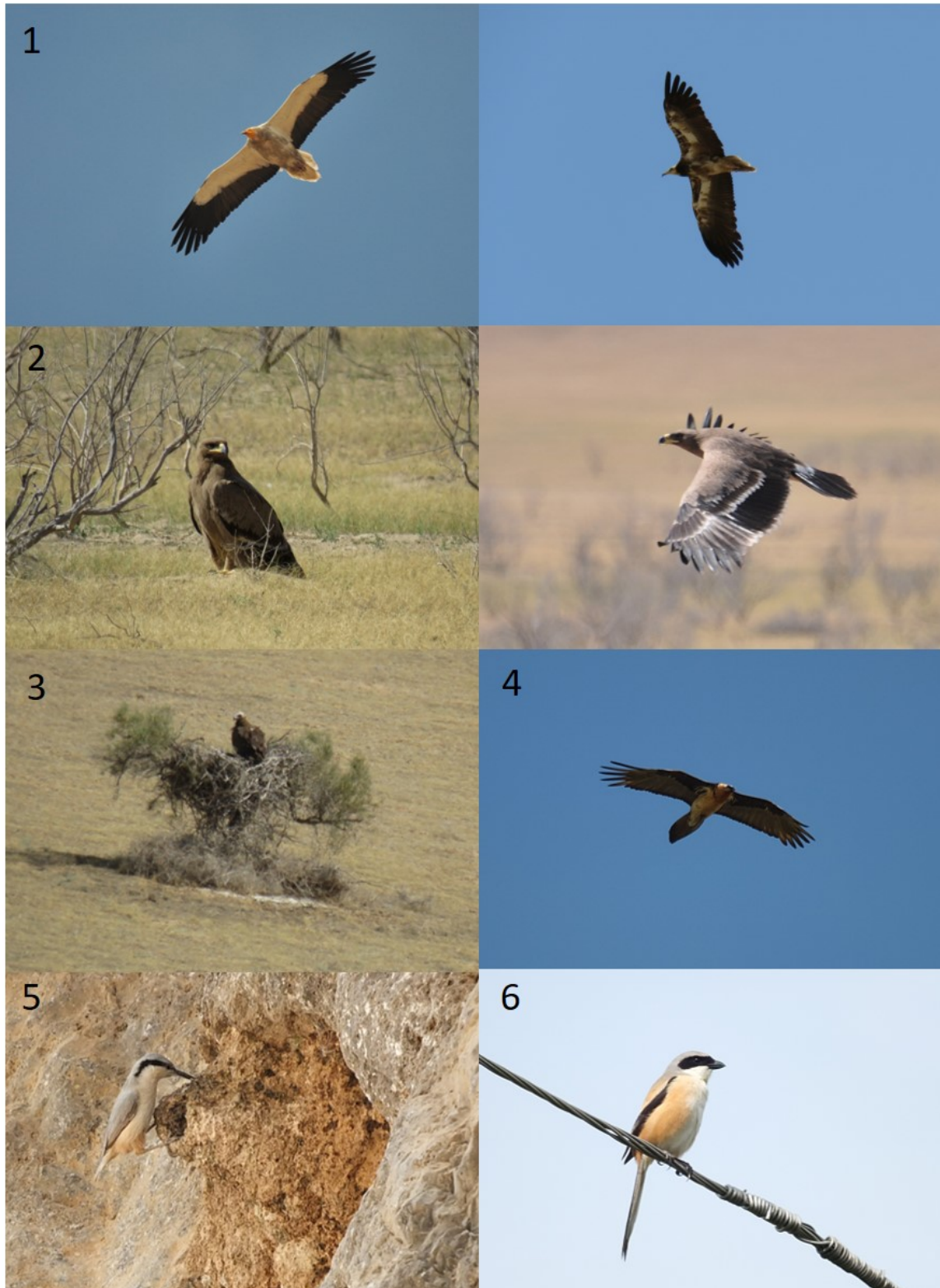


Fig. 46: Birds encountered in 2018: 1 = Egyptian vulturs *Neophron percnopterus* (adult & juvenile), 2 = Steppe eagle *Aquila nipalensis* (Photos: P. Iankov & P. Kaczensky), 3 = Cinereous Vulture *Aegypius monachus*, 4 = Bearded vulture *Gypaetus barbatus*, 5 = Eastern Rock Nuthatch *Sitta tephronota*, 6 = Long-tailed Shrike *Lanius schach* (Photos: P. Iankov).

5.4 List of the observed bird species

Table 9: Bird species observed in April-June 2018. [B=breeding, M=migrant, V=vagrant, E=escape]

Scientific name	Status	Presence in Protected Areas*	Presence in IBAs	Presence in geographical regions**	Additional information
<i>Alectoris chukar</i>	B	R4, R2, S6	TM020, TM026, TM038, TM050	1, 14, 17	abundant at Koytendag
<i>Ammoperdix griseogularis</i>	B	R2, S6	TM050	14, 17	locally common
<i>Phasianus colchicus</i>	B		TM032	2	very scarce
<i>Cygnus olor</i>	B	S1	TM022, TM025, TM032	8, 2	
<i>Anser anser</i>	M?		TM032	2	
<i>Tadorna tadorna</i>	B	S1	TM032, TM022	8, 2	
<i>Tadorna ferruginea</i>	B, M		TM025, TM048	4, 8, 5, 0	
<i>Marmaronetta angustirostris</i>	B		TM032	0, 2	
<i>Netta rufina</i>	B		TM031, TM032, TM048	8, 5, 0, 2	
<i>Aythya nyroca</i>	B		TM025, TM031, TM032	8, 0, 2	
<i>Aythya fuligula</i>	M?		TM025	8	
<i>Spatula querquedula</i>	M?	S1	TM022, TM025	8	
<i>Mareca strepera</i>	M?		TM025	8	
<i>Mareca penelope</i>	M?	S1	TM022	8	
<i>Anas platyrhynchos</i>	B		TM025	8	
<i>Tachybaptus ruficollis</i>	B		TM025, TM032	8, 0, 2	
<i>Podiceps grisegena</i>	B?		TM025	8	
<i>Podiceps cristatus</i>	M?		TM025, TM031, TM032	8, 0, 2	
<i>Columba livia</i>	B	R4, S4, S5	TM034, TM038, TM048, TM049, TM050	1, 14, 4, 8, 3, 5, 0, 6, 17, 19, 14, 18	
<i>Columba livia f. domestica</i>	B			4, 8, 0, 6, 2	everywhere in settlements
<i>Columba palumbus</i>	B	R3	TM050	17	very scarce
<i>Streptopelia turtur</i>	M		TM031	0	two single migrants
<i>Streptopelia decaocto</i>	B	S5	TM020, TM031, TM048, TM049, TM050	1, 14, 4, 7, 8, 3, 5, 0, 6, 17, 14, 18	widespread and numerous in settlements
<i>Spilopelia senegalensis</i>	B		TM031, TM048, TM050	14, 4, 7, 5, 0, 6, 17, 14, 18	widespread and numerous in settlements
<i>Pterocles orientalis</i>	B				single record
<i>Caprimulgus europaeus</i>	M		TM025	8	single record

<i>Caprimulgus aegyptius</i>	B			8, 2	
<i>Tachymarpis melba</i>	M	R2	TM021, TM025, TM026, TM038, TM049	1, 14, 4, 8, 0, 17, 15	
<i>Apus affinis</i>	B?	S2	TM038	14	
<i>Apus apus</i>	B	R4, R3	TM020, TM021, TM025, TM026, TM031, TM034, TM038, TM042, TM050	1, 14, 8, 0, 6, 17, 14, 17, 9	
<i>Cuculus canorus</i>	M		TM020, TM031, TM049	14, 0, 2	
<i>Gallinula chloropus</i>	B	S5	TM031, TM048	5, 0	very rare
<i>Fulica atra</i>	B		TM025, TM031	8, 0	
<i>Grus grus</i>	M			0	
<i>Otis tarda</i>	M			8	single record - fresh footprint
<i>Chlamydotis macqueenii</i>	B	R1	TM034	6	R1-pers.comm. of the Reserve staff
<i>Plegadis falcinellus</i>	B?		TM025, TM032	8, 0, 2	
<i>Nycticorax nycticorax</i>	B?		TM031	0	very rare
<i>Ardeola ralloides</i>	B?			0	
<i>Ardea cinerea</i>	B?		TM025, TM031, TM032, TM048	8, 0, 14, 18	
<i>Ardea purpurea</i>	B?		TM025, TM031, TM048	8, 5, 0, 2	
<i>Ardea alba</i>	B?		TM031, TM032	14, 0, 14, 18	
<i>Egretta garzetta</i>	B?		TM025	8, 0	
<i>Microcarbo pygmaeus</i>	B?		TM025, TM031	8, 0	
<i>Phalacrocorax carbo</i>	B?	S1	TM022, TM032	8, 0, 2	
<i>Himantopus himantopus</i>	B	S1	TM019, TM022, TM025, TM026, TM032, TM049	8, 3, 0, 6, 2	
<i>Charadrius dubius</i>	B		TM025, TM032, TM048	14, 8, 5, 0, 14, 18	
<i>Charadrius alexandrinus</i>	B	S1	TM022, TM025, TM032, TM048	8, 0, 2	
<i>Charadrius leschenaultii</i>	B		TM034	6	
<i>Vanellus gregarius</i>	M			0	one seen on 11.05.2018 NW of Akdepe
<i>Vanellus leucurus</i>	B		TM025, TM032	8, 0, 2	
<i>Calidris pugnax</i>	M		TM032	2	
<i>Calidris temminckii</i>	M			0	single migrant
<i>Calidris alpina</i>	M		TM032	2	
<i>Calidris minuta</i>	M		TM032	14, 2	
<i>Phalaropus lobatus</i>	M	S1	TM022, TM032	14, 8, 0, 2	
<i>Actitis hypoleucos</i>	M			8, 0, 2	
<i>Tringa ochropus</i>	M		TM025	14, 8, 0, 2	
<i>Tringa erythropus</i>	M		TM032	2	few on migration
<i>Tringa glareola</i>	M		TM025, TM026, TM032	1, 14, 7, 8, 0, 2	
<i>Tringa stagnatilis</i>	M				

<i>Glareola pratincola</i>	B		TM019, TM032	8, 0, 2	
<i>Glareola nordmanni</i>	B			8	single record of 5
<i>Larus genei</i>	B	S1	TM022, TM032	8, 2	
<i>Larus ridibundus</i>	B?		TM025	8, 0, 2	
<i>Larus ichthyaetus</i>	B				
<i>Larus michahellis</i>	B		TM025	8	
<i>Larus cachinnans</i>	B	S1	TM022, TM025	8, 0	
<i>Sternula albifrons</i>	B		TM025, TM031, TM032, TM048	8, 0, 2	
<i>Gelochelidon nilotica</i>	B	S1	TM022	8, 0	
<i>Chlidonias hybrida</i>	M	S5	TM025, TM031, TM048	7, 8, 5, 0	
<i>Chlidonias leucopterus</i>	M		TM025	8	
<i>Chlidonias niger</i>	M		TM031, TM032	8, 0, 2	
<i>Sterna hirundo</i>	M	S5	TM025, TM048	8, 5, 0, 2	
<i>Athene noctua</i>	B	R4, S1	TM020, TM021, TM038, TM049	14, 4, 7, 8, 3, 5, 0, 6, 14, 17, 9	widespread and numerous
<i>Otus scops</i>	B			8	
<i>Asio otus</i>	M				single record
<i>Pernis apivorus</i>	M			0	
<i>Gypaetus barbatus</i>	B	R4, R3	TM038, TM050	14, 17, 18	
<i>Neophron percnopterus</i>	B	R4, R2, S6	TM020, TM021, TM025, TM038, TM041, TM049, TM050	14, 4, 7, 8, 0, 6, 17, 17, 9	
<i>Circaetus gallicus</i>	B	R4, R2, B1	TM038, TM050	14, 17, 18	
<i>Gyps fulvus</i>	B	R4, R2, B1, S6	TM021, TM038, TM049, TM050	14, 4, 17, 17, 9	
<i>Aegypius monachus</i>	B	R4, R2, B1	TM021, TM038, TM050	14, 3, 0, 17, 19, 17, 9	
<i>Aquila nipalensis</i>	M	R2	TM021, TM038	1, 7, 8	
<i>Aquila heliaca</i>	M?	R2	TM038	14, 18	single immature birds
<i>Aquila chrysaetos</i>	B	R4, R3	TM021, TM025, TM026, TM038, TM050	1, 14, 8, 0, 17, 17, 9	
<i>Hieraaetus pennatus</i>	B	R3	TM050	0, 17, 18	
<i>Circus aeruginosus</i>	B, M	S1, S5	TM022, TM025, TM031, TM032, TM042, TM048, TM049	1, 7, 8, 3, 5, 0, 2	
<i>Circus cyaneus</i>	M	S1, S6	TM022, TM050	8, 17, 2	
<i>Circus macrourus</i>	M			0	
<i>Accipiter badius</i>	B		TM048	14, 5, 0, 6, 14, 18	
<i>Accipiter nisus</i>	M				
<i>Milvus migrans</i>	M	S1	TM021, TM022	14, 8, 17, 9	
<i>Buteo buteo</i>	M		TM021	14, 9	
<i>Buteo rufinus</i>	B	R4, R2, B1, S3, S6	TM020, TM021, TM025, TM038, TM049, TM050	1, 14, 4, 8, 3, 5, 0, 6, 17, 19, 14, 17, 9	the most numerous bird of prey
<i>Upupa epops</i>	B, M		TM049, TM050	14, 8, 3, 0, 17, 14, 14	

<i>Merops persicus</i>	B, M	S5	TM019, TM031, TM034, TM042, TM048	14, 4, 7, 8, 3, 5, 0, 6, 19, 14, 18	
<i>Merops apiaster</i>	B, M	R4, B1, S3, S6	TM020, TM031, TM034, TM038, TM042, TM048, TM050	14, 8, 3, 5, 0, 6, 17, 19, 14, 18	
<i>Coracias garrulus</i>	B, M	R4, S5	TM019, TM025, TM029, TM032, TM034, TM038, TM041, TM042, TM048, TM049, TM050	14, 4, 8, 3, 0, 6, 17, 19, 14, 18	widespread
<i>Alcedo atthis</i>	B	S5	TM031, TM048	5, 0, 2	
<i>Falco naumanni</i>	B, M	R4, R3	TM038, TM050	4, 0, 17, 18	
<i>Falco tinnunculus</i>	B	R4, S1	TM021, TM025, TM026, TM038, TM049, TM050	1, 14, 4, 7, 8, 0, 17, 14, 17, 9	
<i>Falco subbuteo</i>	M	R3	TM050	8, 0, 17	single migrants, breeding on buildings in Ashgabat
<i>Falco cherrug</i>	B	R2	TM021, TM025, TM038	14, 4, 8, 17, 17, 9	
<i>Falco pelegrinoides</i>	B	R2	TM038, TM050	0, 17, 18	
<i>Psittacula krameri</i>	V? E?			0	single flying bird in Ashgabat
<i>Oriolus kundoo</i>	B, M		TM020, TM041, TM050	14, 0, 17, 14, 18	
<i>Lanius collurio</i>	B, M		TM019	14, 7, 0, 2	scarce
<i>Lanius phoenicuroides</i>	B	R2, S6	TM050	0, 17, 19, 2	
<i>Lanius isabellinus</i>	B	R2, S6	TM050	17	
<i>Lanius schach</i>	B		TM049, TM050	0, 17, 2	
<i>Lanius minor</i>	B, M	R3	TM020, TM050	14, 7, 17	
<i>Lanius excubitor</i>	M	R4, S1	TM025, TM038	8, 3, 0, 14, 18	
<i>Podoces panderi</i>	B		TM026	1, 8, 2	
<i>Pica pica</i>	B	R2, S5, B1	TM030, TM034, TM038, TM048, TM050	14, 3, 5, 0, 6, 17, 14, 18	relatively scarce
<i>Corvus monedula</i>	B			14, 0, 14, 18	locally only
<i>Corvus frugilegus</i>	M			0	
<i>Corvus corax</i>	B	R2	TM019, TM029, TM038, TM049, TM050	14, 4, 0, 6, 18	
<i>Corvus ruficollis</i>	B	S1	TM021, TM022, TM025	1, 8, 19, 14, 9	nests on electricity pylons
<i>Corvus corone</i>	B		TM025, TM048	8, 5	scarce
<i>Corvus cornix</i>	B		TM048	14, 5, 0	scarce
<i>Periparus rufonuchalis</i>	B	R3	TM050	17	
<i>Parus bokharensis</i>	B			0	
<i>Ammomanes deserti</i>	B			14, 17	
<i>Melanocorypha bimaculata</i>	B	S1	TM021, TM022, TM025, TM026	1, 14, 8, 14, 9	
<i>Melanocorypha calandra</i>	B?			14	
<i>Calandrella brachydactyla</i>	B	S1	TM021	14, 4, 8, 9	
<i>Calandrella cheleensis</i>	B		TM026	1, 14, 8	

<i>Eremophila alpestris</i>	M			14	
<i>Alauda arvensis</i>	B, M		TM020	14	
<i>Alauda gulgula</i>	B	R3	TM050	1, 14, 0, 17	
<i>Galerida cristata</i>	B	all	all	all	abundant everywhere, including desert areas
<i>Panurus biarmicus</i>	B		TM032, TM048	8, 5, 2	
<i>Iduna rama</i>	B, M		TM025	8, 0	
<i>Iduna pallida</i>	B, M		TM025, TM048	1, 14, 7, 8, 5, 0, 2	
<i>Hippolais languida</i>	B, M		TM025	8, 0	
<i>Acrocephalus scirpaceus</i>	B, M		TM032	8, 0, 2	
<i>Acrocephalus stentoreus</i>	B	S5	TM025, TM031, TM032, TM048, TM050	8, 5, 0, 17, 2	
<i>Delichon urbicum</i>	B	R3	TM050	17	single migrant
<i>Hirundo rustica</i>	B, M	R4, S1, S5	TM020, TM021, TM025, TM026, TM030, TM031, TM032, TM038, TM048, TM049, TM050	1, 14, 4, 8, 5, 0, 6, 17, 14, 17, 9	
<i>Hirundo rupestris</i>	B			14	
<i>Riparia riparia</i>	B	R2, S5	TM025, TM032, TM048, TM049, TM050	1, 14, 7, 8, 3, 5, 0, 17, 14, 18	
<i>Phylloscopus trochilus</i>	M			0	
<i>Phylloscopus collybita</i>	M			1, 14, 0, 2	
<i>Scotocerca inquieta</i>	B	R4, S6	TM038, TM050	17, 18	
<i>Sylvia atricapilla</i>	M		TM031	0	
<i>Sylvia nana</i>	B	S1	TM032	8, 3, 2	
<i>Sylvia crassirostris</i>	B	R3	TM050	17	
<i>Sylvia curruca</i>	M	R3	TM050	14, 17, 2	
<i>Sylvia communis</i>	B, M			0	
<i>Sylvia althaea</i>	B	R3	TM050	17	
<i>Sitta tephronota</i>	B	R4, R3	TM038, TM050	14, 17, 18	
<i>Sturnus vulgaris</i>	B	S5	TM031, TM034, TM048, TM049	14, 8, 5, 0, 6, 2	scarce
<i>Pastor roseus</i>	B, M		TM021	14, 7, 8, 3, 0, 14, 9	
<i>Acridotheres tristis</i>	B	S5	TM034, TM048	all	everywhere in settlements
<i>Turdus viscivorus</i>	M	R3	TM050	17	
<i>Turdus merula</i>	B			0	rare, local
<i>Cercotrichas galactotes</i>	B, M	R4, S5	TM038, TM048	14, 7, 5, 0, 14, 18	
<i>Muscicapa striata</i>	M			2	single migrants
<i>Cyanecula svecica</i>	M		TM025	8	
<i>Luscinia luscinia</i>	M		TM025	8	
<i>Luscinia megarhynchos</i>	M		TM031	0	rare, local
<i>Ficedula parva</i>	M			0	

<i>Phoenicurus phoenicurus</i>	M	S1	TM022	8	
<i>Monticola saxatilis</i>	V				single record
<i>Saxicola caprata</i>	B, M	S5	TM019, TM031, TM032, TM042, TM048, TM049, TM050	4, 3, 5, 0, 6, 14, 18	
<i>Oenanthe oenanthe</i>	B, M			14, 4, 8, 0, 19, 14, 18	scarce
<i>Oenanthe isabellina</i>	B	R4, B1, S1	TM020, TM021, TM025, TM029, TM038, TM041, TM049, TM050	1, 14, 4, 7, 8, 3, 5, 0, 19, 14, 17, 9	abundant in most of the habitats
<i>Oenanthe deserti</i>	B	R4, S1	TM021, TM038	8, 19, 17, 9	
<i>Oenanthe pleschanka</i>	B	R3	TM021, TM050	14, 17, 9	
<i>Oenanthe picata</i>	B	S2	TM038	0, 18	
<i>Oenanthe finschii</i>	B	R4, R2, S6	TM021, TM026, TM038, TM050	1, 14, 4, 8, 17, 14, 17, 9	
<i>Passer domesticus</i>	B	R4, R2, S5	TM020, TM021, TM025, TM029, TM034, TM038, TM041, TM048, TM049, TM050	1, 14, 4, 7, 8, 3, 5, 0, 6, 17, 19, 14, 17, 9	<i>P. d. Indicus</i> - everywhere in settlements
<i>Passer hispaniolensis</i>	B	S1	TM022, TM025, TM032	8, 0, 2	
<i>Passer montanus</i>	B	S5	TM048, TM049, TM050	14, 4, 7, 5, 0, 17, 14, 18	
<i>Petronia petronia</i>	B	R2	TM020, TM038	14, 18	
<i>Anthus trivialis</i>	B	R3	TM050	17	single record
<i>Anthus richardi</i>	M		TM021	9	single record
<i>Anthus campestris</i>	B, M	R3	TM050	1, 14, 17, 2	
<i>Motacilla flava</i>	M, B	S1	TM019, TM022, TM025, TM026, TM032, TM050	1, 8, 0, 17, 2	1 <i>M. f. feldegg</i> in IBA TM025
<i>Motacilla citreola</i>	M, B		TM048	5	locally numerous
<i>Motacilla alba</i>	B, M		TM025, TM026	1, 8, 0	
<i>Motacilla personata</i>	B		TM029, TM049, TM050	14, 7, 3, 0, 6, 18	
<i>Carpodacus erythrurus</i>	B, M	R3	TM050	17	
<i>Bucanetes githagineus</i>	B			14	
<i>Rhodospiza obsoleta</i>	B	R2	TM021, TM025, TM029, TM031, TM038, TM049	14, 4, 8, 0, 14, 17, 9	
<i>Linaria cannabina</i>	B			14	
<i>Carduelis caniceps</i>	B	R3	TM050	14, 17	
<i>Emberiza bruniceps</i>	B	R3	TM020, TM050	14, 7, 0, 6, 17, 2	
<i>Miliaria calandra</i>	B	R2	TM019, TM020, TM038	14, 7, 3, 19, 18	
<i>Emberiza stewarti</i>	B	R3	TM050	17	

***Nature Reserves (see Fig. X – Chapter X Area):** R1: Gaplanyr, R2: Badhyz, R4: Sunt Hasardag, R3: Koytendag, B1: Badhyz Buffer Zone, B2: Koytendag Buffer Zone

Wildlife Sanctuaries: S1: Shasenem, S2: Sarykamysh, S3: Gyzylyar, S4: Chemenabat, S5: Kelif, S6: Hodjaburjibelent

****Geographical regions (also see Fig. x – Chapter X Area):** 0: Oasis, rivers, irrigated areas, 1: Zaunguz Karakum, 2: Central Karakum, 3: South East Karakum, 4: Tallymerjen, 5: Obruchev steppe, 6: Meana-Chacha steppe, 7: South West Turkmenistan, 8: Southern Ustyurt, 9: Trans-Uzboy North-west region, 14: Western Kopetdag Mountain, 16: Eastern Kopetdag Mountain, 17: Koytendag Mountain, 18: Badhyz Foothills, 19: Garabil Foothills

5.5 Globally threatened species

- **Marbled Duck *Marmaronetta angustirostris*.** Single individual recorded 6.05.2018 at a marsh in TM032 IBA Ayrauly-Garajavak.
- **European Turtle-dove *Streptopelia turtur*.** Two records only: singing bird on 6.05.2018 at TM030 IBA Mergen and one flying bird on 8.06.2018 at border checkpoint Tejen.
- **Great Bustard *Otis tarda*.** Fresh footprints of one bird, 22.05.2018 at the chink Tarymgya.
- **Asian Houbara *Chlamydotis macqueenii*.** We recorded the species once: 1 individual in an area suitable as breeding habitat on 30.04.2018 to the south of Sarygamysh Depression. According to the rangers, the species breeds on the territory of Kaplankyr Nature Reserve. According to Gurban Geidyew 180 ind. have been observed on 13.08.2013 and 5 ind. on 28.05.2018 at TM034 IBA Tedjen.
- **Sociable Lapwing *Vanellus gregarius*.** One bird, probable a migrant, was seen on 11.05.2018 between Akdepe and Garagan.
- **Egyptian Vulture *Neophron percnopterus*.** Presented with visibly healthy population in all of the visited parts of Turkmenistan, where number of occupied nests and pairs were seen. Particularly numerous in the Western Kopetdag mountains, the areas between Koytendag and Tallymerjen and at Badhyz and Garachop, where 8 immature individuals were seen during the period 8-10.06.2018.
- **Steppe Eagle *Aquila nipalensis*.** Observed in both western (15 ind.) and eastern (3 ind.) parts of the country. In western Turkmenistan mostly adult birds (most probably migrants) were seen between 30.04. and 09.05.2018 in the regions between Sarygamysh Depression and the south-eastern edge of the Caspian Sea. In eastern Turkmenistan 3 immature birds were seen on 8-9.06.2018 in the Badhyz Nature Reserve. Our previous research in eastern Turkmenistan (Iankov 2017) showed intensive migration of this species over other areas of the eastern part of the country (especially Tallymerjen and Koytendag). This suggests the existence of two migration flyways: In the west from the Sarygamysh Depression to the southeastern edge of the Caspian Sea and in the east along from Tallymerjen to Badhyz. Further investigations should reveal the obviously important role of Turkmenistan for the conservation of this globally threatened species.
- **Eastern Imperial Eagle *Aquila heliaca*.** One immature eagle was seen on 8.05.2018 at Western Kopetdag and one juvenile bird was recorded on 8.06.2018 in the Badhyz Nature Reserve.
- **Saker Falcon *Falco cherrug*.** In total 24 records, out of them 13 individual birds, 9 nests, 1 pair and 1 family group of a pair with 3 fledglings. The species was observed in Western Kopetdag, Northern, Southern and Eastern Turkmenistan.

5.6 General conclusions

The general impression is of a quite healthy bird fauna and a very low level of impact of agriculture chemicals or other pesticides on the wildlife in general. Most of the habitats appear to be in good condition. Although the avifauna seems to be in a good situation there appears to be very little investment in monitoring or protection of birds. This avian diversity makes Turkmenistan a potentially attractive birdwatching destination. Trip reports of birdwatchers can fill out the very significant gaps of bird information for most of the territory of the country and can contribute to better preservation of the bird fauna. Even more valuable can be some research projects between Turkmenistan experts and research institutes from Europe, targeting specific areas or scientific questions.

6 Rapid assessment of the reptile fauna in April-June 2018

6.1 Introduction

The reptile fauna in Turkmenistan is very diverse and includes numerous endemic species and subspecies (details can be found in: Ananjeva et al. 2006, Ataev 1985, Bannikov et al. 1977, Bogdanov and Sudarev 1988, Chkhikvadze et al. 1990, 2009, 2010, Nazarov and Poyarkov 2013, Rustamov et al. 2013, Shammakov 1981, Sindaco and Jeremcenko 2008, Solovyeva et al. 2012, Suniyev et al. 2009, Tuniev et al. 2009).

However, recent surveys are lacking from most parts of the country. To start closing this knowledge gap, we opportunistically recorded the reptile fauna during two expeditions between April and June 2018, visiting 12 regions throughout Turkmenistan. The work encompassed searching for reptiles during stops and describing numbers and species encountered, and counting individuals along transects for rough density approximations. The main aim of this survey was to update and verify the existing reptile database of the regions.

The outcome of these two trips were summarized in Russian language in Shestopal and Rustamov (2018). In summary, the two expeditions:

- (1) Added records to clarify the distribution area of a number of reptiles in Turkmenistan.
- (2) Document for the first time the presence of the Afghan Awl-header *Lythorhynchus ridgewayi* in the Southern Ustyurt.
- (3) Documented for the first time the presence of the nominate form of the Sunwatcher Toadhead Agama (*Phrynocephalus helioscopus helioscopus*) in northern Turkmenistan.
- (4) Obtained density indices of the more common species. It documents how changes in the ecosystem (e.g. irrigation and collection channels, increase in water levels) seem to have resulted in a 2-fold increase of certain desert species in the Sarygamysh depression, namely the Steppe Agama *Trapelus sanguinolentus aralensis* and the Aralo-Caspian Racerunner - *Eremias intermedia*, as well as a 20-fold increase in the Striped Racerunner - *Eremias lineolata*.

6.2 Methods

The areas visited during the first expedition were: Trans-Unguz Karakum (26-27 April), Sarygamysh depression (27-29 April), Southern Ustyurt (Gaplanyr plateau; 30 April, 1-2 May), Central Karakum (26 April; 3, 5-6 May), Western Kopetdag (7-11 May), and South-western deserts (incl. the Messerian plain; May 9). The areas visited during the second expedition were: Eastern Kopetdag (6 June), Tedjen-Murgab river valley (6-7 June), Badhyz foothills (8-9 June), Garabil foothills (11 June), South-eastern Karakum & Obruchev steppe (11-12 June), and Koytendag-Gaurdak mountains (13-16 June).

For descriptions of the main landscape units see chapter 3. Information on the species composition and their distribution are provided in table format (see Table 10). The data on biotope (see Fig. 6 for example) and density estimates are provided in the species description. We chose to use the Russian terms for biotopes for which no single term exists in the English language. Illustrations of most species are given in Fig. 47, referenced in the text by their photo number.

The expedition was not primarily focussed on recording reptiles and hence reptiles were recorded opportunistically during stops, largely aimed at recording birds, ungulates or to cook,

eat, and camp overnight. When recording reptiles, the route and area method was used for which the time of the beginning and the end of the route, all encounters with the species, and changes in habitat were noted. In addition, most species were photographed and measured. On average (including the time it takes to detect, observe, and write down species), 1 hour of walking corresponds to roughly 2 km of transect route.

For the more common species, minimum density indices were calculated based on transect length and two times the distance (transect width) at which an observer can be expected to reliably detect a reptile. Based on previous experience, the transect width is estimated to be 20 meters for large reptiles (e.g. turtles and lizards), 6 meters for medium sized reptiles (e.g. for agama, skinks, racerunners, and venomous snakes), and 2-3 meters for smaller species (e.g. night geckos and small species of night snakes). However, if the specimen was seen while driving or the stop was too short, only time and place were recorded. No density indices were calculated when less than 3 individuals were encountered.

The short species description section gives the range of species / subspecies across Turkmenistan, a brief description of the main habitats they inhabit, and the general abundance (rare, sporadic, common, numerous). Subsequently, the date, number, and where possible status (e.g. sex, age group) of specimens encountered is given, followed by a site specific description where the species was encountered during the trip: landscape, habitat, substrate. Times in round parentheses provide the encounter time and time in square parentheses the duration and time span in which a transect was walked, which was subsequently used to calculate densities per hectare. Transects with longer photograph breaks were marked with * and the time for photographing was deducted from the overall transect time; in this case the transect period is longer than the recorded transect time (e.g. 1:00 transect from 11:00-12:20; 20 min were spent for photography). English species names were taken from Ananjeva et al. (2006) and <http://reptile-database.reptarium.cz/>.

6.3 Summary results

We encountered a total of 578 reptiles belonging to 38 species or subspecies from 3 orders and 11 families throughout the five regions (Table 10, Fig. 47).

Table 10: Reptile species and subspecies encountered by region. For photos see Fig. 47. [Numbering corresponds with numbers before the species name in the species description section]

[illegible]

17	<i>Paralaudakia caucasia caucasia</i> (Photo 19)					5								5
18	<i>Paralaudakia erythrogastra erythrogastra</i>									1				1
19	<i>Paralaudakia lehmanni</i>												1	1
20	<i>Pseudopus apodus apodus</i> (Photo 20)					1								1
21	<i>Ablepharus pannonicus</i>												3	3
22	<i>Eumeces schneideri princeps</i> (Photo 21)					1				1				2
23	<i>Eurylepis taeniolatus pathiranicus</i> (Photo 22-23)					1								1
24	<i>Eremias grammica</i> (Photo 24)	2		6									4	12
25	<i>Eremias intermedia</i> (Photo 25)	5	15	2									5	27
26	<i>Eremias lineolate</i> (Photo 26)		111	1					2				27	141
27	<i>Eremias persica</i> (Photo 27)									1				1
28	<i>Eremias scripta scripta</i> (Photo 28)			2										2
29	<i>Eremias velox velox</i> (Photo 29-30)		7		15	8	1			3			19	53
30	<i>Mesalina watsonana</i>									2				2
31	<i>Varanus griseus caspius</i> (Photo 31)			2					4	4			1	11
32	<i>Typhlops vermicularis</i> (Photo 32)					2				1				3
33	<i>Eryx miliaris miliaris</i> (Photo 33)					2								2
34	<i>Platycephalus karelinii karelinii</i> (Photo 34)		2											2
35	<i>Lythorhynchus ridgewayi</i> (Photo 35)				3									3
36	<i>Psammophis lineolatus</i> (Photo 36)		1			1				1				3
37	<i>Spalerosophis diadema schiraziana</i> (Photo 37)	2												2
38	<i>Echis carinatus</i> (Photo 38)					2								2
Total reptile individuals (all species)		25	185	38	69	56	3	3	15	35	19	14	116	578

Fig 47: Reptile species and subspecies encountered in different parts of Turkmenistan from 26 March to 11 May 2018. Photos: A. Shestopal



Photo 1: *Agrionemys horsfieldii horsfieldii*.



Photo 2: *Agrionemys horsfieldii kazachstanica/kuznetzovi*.



Photo 3: *Agrionemys horsfieldii rustamovi*, ♂+♀.



Photo 4: *Agrionemys horsfieldii rustamovi*.



Photo 5: *Mediodactylus russowii russowii*.



Photo 6: *Mediodactylus spinicaudus*.



Photo 7: *Tenuidactylus caspius caspius*.



Photo 8: *Teratoscincus scincus scincus*.



Photo 9: *Trapelus sanguinolentus aralensis*, ♂.



Photo 10: *Trapelus sanguinolentus aralensis*, juv.



Photo 11: *Trapelus sanguinolentus aralensis*, ♀.



Photo 12: *Phrynocephalus helioscopus helioscopus*.



Photo 13: *Phrynocephalus helioscopus turcomanus*.



Photo 14: *Phrynocephalus raddei raddei*.



Photo 15: *Phrynocephalus interscapularis*.



Photo 16: *Phrynocephalus mystaceus galli*, ♂.



Photo 17: *Phrynocephalus mystaceus galli*, ♀.



Photo 18: *Phrynocephalus mystaceus galli*, juv.



Photo 19: *Paralaudakia caucasia caucasia*.



Photo 20: *Pseudopus apodus apodus*.



Photo 21: *Eumeces schneideri princeps*.



Photo 22: *Eurylepis taeniolatus pathiranicus*, ventral view.



Photo 23: *Eurylepis taeniolatus pathiranicus*.



Photo 24: *Eremias grammica*.



Photo 25: *Eremias intermedia*.



Photo 26: *Eremias lineolata*.



Photo 27: *Eremias persica*.



Photo 28: *Eremias scripta scripta*.



Photo 29: *Eremias velox velox*, ♂.



Photo 30: *Eremias velox velox*, ♀.



Photo 31: *Varanus griseus caspius*.



Photo 32: *Typhlops vermicularis*.



Photo 33: *Eryx miliaris miliaris*.



Photo 34: *Platycephalus karelinii karelinii*.



Photo 35: *Lythorhynchus ridgewayi*.

Photo 36: *Spalerosophis diadema schiraziana*.Photo 37: *Psammophis lineolatum*.Photo 38: *Echis carinatus*.

6.4 Species descriptions

6.4.1 Order Testudines

6.4.1.1 Family Tortoises – Testudinidae

Central Asian tortoise (also known as Russian tortoise, Afghan tortoise, Horsfield's tortoise, and Steppe tortoise). There is disagreement on the taxonomic status of the *Agrionemys horsfieldii* taxon regarding species and subspecies status. Opinions range from accepting only one species with no subspecies to three species (e.g. Chkhikvadze et al. 2010). Until more information is forthcoming, we list the different morphological types as subspecies.

1. Central Asian Tortoise - *Agrionemys horsfieldii horsfieldii* (Photo 1). Widely distributed, found in deserts, mostly in overgrown sand and clay sites. Found throughout the sandy Karakum, common in Badkhyz and numerous in Garabil. We encountered the 4 specimens in the Trans-Unguz Karakum:

- TUK: 27 April, 1 specimen (10:10) 1.5 km north of Tyumkdag village [during a 0:45 transect from 9:35-10:10].
- TUK: 30 April, 1 specimen (17:30) on the slope of a sand ridge at Atabai shor; 1 [during a 01:16 transect from 16:46-18:02].
- TUK: 3 May, 1 specimen ca. 4 km east of the village of Islam on a sand dune on semi-fixed sands.

2. Kazakhstan Tortoise - *Agrionemys horsfieldii kazachstanica* / *kuznetzovi* (Photo 2). Found in the northern regions of Turkmenistan and probably the Southern Ustyurt. Encountered on the plateau of Southern Ustyurt (including Gaplanyr) and the Sarygamysh basin. Common, in places numerous, occurs on sandy, clay and clay-gravelly plains. We encountered a total of 21 individuals.

- SD: 28 April, 1 specimen (9:13) at the foot of the Tyrimgaya chink, ca. 1 km south of height 102.7, on the clay plain with low black saxaul [during 0:26 transect from 9:05-9:31]; 1 specimen (10:21) ca. 1 km east of Yurshlydza village on a sandy kyr [during a 0:15 transect from 10:10-10:25]; 2 specimens (13:19, 13:30) on the remnant of mount Kaykrylan [during a 0:30 transect from 13:00-13:30], 3 specimens while driving 22 km along the foot of the Tyarkimkaya Chink.
- SD: 29 April, 4 specimens (8:36, 8:57-9:18) in the Cukurlyk tract, ca. 1 km north of the height 10.7, on fixed slightly wavy sands [during a 0:46 transect from 8:36-9:22; suggesting a density of 1.3 individuals/ha].
- SD: 30 April, 1 specimen (14:00) ca. 18 km south-west of Cape Burchlyburun on the loess low-hilly plain [during a 0:19 transect from 13:54-14:13].
- SU: 1 May, 1 specimen (8:13) in the Karra-Mazarchalyk tract, ca. 1.5 km east of height 61.0, on the loess plain [during 0:21 transect from 8:28-8:49]; 1 specimen near the Gussas tract, ca. 1.5 km south of elevation 116.0, on a slightly hilly loess plain [during 0:20 transect from 11:50-10:10]; 3 specimens, one of which was a juvenile, (11:14, 16:47, 17:45) along the Gaplanyr chink [during a series of short surveys totalling 2:00 which were distributed over a distance of 42 km at heights of 218-247m between 11:00-12:44 and 16:40-18:32, suggesting a density of 0.4 individuals/ha].
- SU: 2 May, 1 specimen near the West Uzboy riverbed, ca. 1 km north of altitude 59.4, on takyr-like soil; 2 specimens on Gaplanyr at height 185.5, on a slightly hilly loess plain [during 0:20 transect from 9:20-9:40]; 1 specimen near the West Uzboy riverbed, ca. 1 km north of height 72.4, on takyr-like soil.

3. Rustamov Tortoise - *Agrionemys horsfieldii rustamovi* (Photo 3-4). Mountain species which reaches from the base to the upper altitudes, but avoids rocky areas and cliffs. Found in the Kopetdag range and the sand massif of Mashat on its western foothill plains. Common, in places numerous. We recorded a total of 20 individuals in Western Kopetdag.

- WK: 7 May, 2 specimens (17:47) at the Eysham spring, on loess hills with rocky outcrops [during a 0:40 transect from 17:47-18:27].
- WK: 8 May, 1 specimen (08:29) on the dry mudflats, ca. 1.5 km north of Amannazar [during a 01:16 transect from 8:29-9:45].
- WK: 9 May, 1 specimen (18:45) at the north-eastern side of the Maly Kulmach Ridge [during a 0:25 transect from 18:45-19:10].
- WK: 10 May, 3 specimens (10:41) south of the Kulmach Range, ca. 2 km west of the Keshan well at the foot of high loess hills.
- WK: 11 May, 3 specimens at the foot of the hills in the Tersakan Valley, ca. 1.5 km south-east of the Doyran spring [during a 0:16 transect from 8:30-8:46; suggesting a possible density of 3 individuals/ha]; 10 specimens on a hilly plain at the Kurbanniyaz well [during a 0:34 transect from 9:46-10:20; suggesting a density of 5.0 individuals/ha]

6.4.2 Order Squamata Suborder Lacertilia (Lizards)

6.4.2.1 Family Geckos – Gekkonidae

4. Transcaspian bent-toed or Grey thin-toed gecko - *Mediodactylus russowii russowii* (Photo 5). The species is widespread in the plains of Turkmenistan. It can be found in habitats with semi-fixed sands and takyr-like soils, where it lives on tree-shaped shrubs. Common, sometimes numerous. We recorded 4 individual.

- TUK: On 26 April, 1 specimen (22:30) in the Trans-Unguz Karakum near the Egriptakyr tract at altitude marker 128.1m, on a sand dune.
- SKO: On 11 June, 3 specimens at the Arapkui well on the branches of the desert acacia (*Ammodendron* sp.) and wooden construction, on dense small-hilly sands [during 1:00 transect from 22:00-23:00; suggesting a possible density of 5 individuals/ha].

5. Kopet Dagh bent-toed gecko or Spiny-tailed thin-toed Gecko - *Mediodactylus spinicaudus* (Photo 6). In Turkmenistan distributed in the Kopetdag range, Badkhyz and the valley of the Murgab river. The species inhabits stony slopes and hills, mudflow gullies, and riverbeds. Sporadic occurrence. We recorded 1 individual in the Western Kopetdag.

- WK: 1 May, 1 specimen (22:00) near the Annapolat well on the clay slope of a hill [during a 01:35 transect from 22:00 to 23:35].

6. Caspian thin-toed gecko - *Tenuidactylus caspius caspius* (Photo 7). It is distributed throughout Turkmenistan, except for the upper altitudes of the mountains. It inhabits mountains, plains, and will also willingly settle in human habitations. Numerous, can form large clusters. We encountered a total of 17 individuals.

- TUK: 3 May, 1 specimen, ca. 2 km to the south of the village Balaish, on ridge-hummocked, semi-fixed sands with small takyr.
- SD: 29 April, 1 specimen (18:40) in the Sarygamysh depression in the area of the Duschekidash tract, on the adobe wall of a building (47.8 m) located on a rubble-bearing plain with shell rock.
- SU: 1 May, 1 specimen (12:26) along the Gaplangyr chink near the Goklenkui solonchak (Karashor at 229 m), under a tile among the plate material, during a series of short surveys which were distributed over a distance of 42 km at altitudes of 218-247 m over several short transects totalling 01:11 (between 11:00 and 18:32).
- SU: 2 May, 1 specimen on the Gaplangyr loess plain, ca. 1 km to the south of the map height 80.7 m in a gerbil burrow [during a 0:30 transect from 10:30-11:00].
- SU: 2 May, 2 specimens in the Kaplanyk area, in the Atabay tract on a well located on a small hill on the loess plain.
- WK: 7 May, 1 specimen on the Annapolat well [during a 01:30 transect from 22:00 to 23:35].
- WK: 8 May, 2 specimens (8:35) ca. 1.5 km north of Amannazar in the mudflow in the Amannazar tract [during a 01:16 transect from 8:29-9:45]; 3 specimens (22:25, 23:54, 00:20), in a deep ravine southwest of Kemender at a colony of large gerbils, 0.5 km to the northwest of height 145.2 [during a 02:00 transect from 22:20-00:20].
- WK: 9 May, 3 specimens on the north-eastern side of Maly Kulmach ridge on a colony of large gerbils [during a 01:30 transect from 22:45-00:15].
- SKO: 11 June, 2 specimens at the Arapkui well on the walls of brick and wooden buildings on dense, fine-hilly sands [during 1:00 transect from 22:00-23:00].

7. Turkmen thin-toed gecko - *Tenuidactylus turcomenicus*. The species is found in southern Turkmenistan, namely in Eastern Badkhyz. It lives on slopes and rocky outcrops, and walls of buildings. Mostly rare, but sometimes locally common. We recorded a total of 7 individuals in Badkhyz.

- BF: 9 June, 7 specimens (22:24, 22:35, 22:39, 22:46, 22:57) in the village of Serkhetchi (formerly Morgunovka) on the walls of the Badkhyz Nature Reserve administration on the Kushka river floodplain [during 0:42 transect from 22:17-22:59; suggesting a density of 17.5 individuals per hectare].

8. Turkestan thin-toed gecko - *Tenuidactylus fedtschenkoi*. The species is found in south-eastern Turkmenistan, namely in Koytendag and its foothills. It lives in rocky, dissected areas (precipices, caves, sheer cliffs), and walls of buildings. Common in many places. We recorded a total of 7 in Gaurdak-Koytendag.

- KY: 16 June, 2 specimens (16:16, 16:40) on the top of hills along the Sakyrta ridge, on the rocky outcrops of the southern exposure [during short transects totalling 0:38 from 15:57-16:16, 16:27-16:31, 16:36-16:50]; 5 specimens (16:59, 17:16) along the Aktau mountains, on the coarse material in the form of easterly exposure boulders [during short transects totalling 0:33 from 16:50-17:06, 17:10-17:16, 17:27-17:38; suggesting densities of 15.2 individuals/ha].

9. Common Wonder or the Frog-eyed Gecko - *Teratoscincus scincus scincus* (Photo 8). The species is widespread throughout sandy plains of Turkmenistan. It mainly lives on sand dunes and semi-hardened sands, and sometimes goes onto takyrs. Numerous. We recorded a total of 3 individuals.

- TUK: On 27 April, 1 specimen (6:52) near the Egriptakyr tract, on a sandy ridge of a dune field at height 128.1 [during a 00:42 transect from 6:30-7:12].
- CK: On 5 May, 2 specimens, one dead and one alive (22:30), at the Adzhikel well, in an area of dunes and takhyrs.

6.4.2.2 Family Agama – Agamidae

10. Steppe Agama - *Trapelus sanguinolentus aralensis* (Photo 9-11). In Turkmenistan, the steppe agama is found everywhere, excluding the upper altitudinal zones of the mountains. Common, in places numerous. We encountered the species throughout all visited regions and recorded a total of 157 individuals.

- TUK: 27 April, 1 specimen (7:00) near the Egriptakyr tract, on a sand dune (128.1m) [during a 0:42 transect from 6:30-7:12]; 1 specimen (9:40) at Tyumekdag on sandy hill.
- TUK: 30 April, 2 specimens (16:46, 17:41) at Atabay Shorra.
- TUK: 3 May, 1 specimen (17:41) ca. 2 km to the south of the Balaish village, on ridge-hummocked semi-fixed sands with small takyrs.
- SD: 27 April, 2 specimens (11:40, 12:45) along the bottom of the Achchagaya basin ca. 1.5 km north of height 44.0m, in an area of mudflow and sandy mounds [during a 0:24 transect from 11:36-13:00]; 1 specimen (19:22) at the foot of the Tyrimgaya chink, ca. 1 km west of a height of 60.5 [during 1:04 transect from 19:15-20:19].
- SD: 28 April, 1 specimen (9:13) at the foot of the Tyrimgaya chink, ca. 1 km south of height 102.7 [during 0:26 transect from 9:05-9:31]; 1 specimen (9:13) ca. 1 km east of the town of Yurshlydzha at the beginning of the Kangakyr hill chain, on sandy substrate [during 0:15 transect from 10:10-10:25]; 1 specimen (13:50) ca. 1 km north of Mount Kaykyrylan, in black saxaul on soft soil.
- SD: 29 April, 4 specimens (8:46, 8:52) in the tract Cukurlyk 1 km north of height 10.7, on fixed weakly wavy sands [during 0:46 transect from 8:36-9:22; suggesting a density of 4.4 individuals/ha]; 10 specimens (4 juveniles) on the shore of Sarygamysh lake, on fixed small-hilly sands near Gulanly Bay [during 0:50 transect from 9:58-10:48, suggesting a density of 6.7 individuals/ha]; 1 specimen (11:46) in the Dusheklidash tract, at height 29.6, on ridge-small-hilly fixed sands; 11 specimens (9 juveniles) ca. 3.5 km south-west of Dortkak at height of 10.3, on small-grained fixed sands [during 1:15 transect from 13:23-14:38, suggesting a density of 6.1 individuals/ha].
- SU: 30 April, 2 specimens (12:05, 12:08) ca. 8 km to the south-west of Burchlyburun, on a hilly loess plain [during a 01:15 transect from 11:21-12:36]; 1 specimen (13:54) ca. 18 km to the south-west of Cape Burchlyburun, on the loess slab-hilly plain [during a 0:19 transect from 13:54-14:13].
- SU: 1 May, 1 specimen on the Gaplangyr plateau near the Gusassu tract ca. 1.5 km to the south of height 116.0, on a loess plain [during a 0:20 transect from 11:50-10:10].
- SU: 1 May, 11 specimens (including 5 juveniles; 11:00, 11:02, 11:10, 11:25, 11:28, 11:53, 12:44, 16:40, 16:44, 16:47, 18:32) along a 42 km stretch of the Gaplangyr chink (228.4-296.5m) in the Goklenkui solonchak (Karashor) [recorded during a series of short transects over a total 2:00 between 11:00-12:44 and 16:40-18:32, suggesting a density of 4.6 individuals/ha]; 1 additional specimen (13:53) was found at height 231.7, where in an area of 80x600m the tile material was turned over (13:40-14:40) – the low encounter rate was due to the animals seeking natural shelters (rodent burrows) during this hottest part of the day.
- SU: 2 May, 1 specimen (10:35) on Gaplagyr near the Sardjakel ca. 1 km to the south of height of 80.7, on the loess plain [during a 0:30 transect from 10:30-11:00]; 12 specimen in the Atabay tract, ca. 2 km west of Atabay village on a well located on the slightly hilly loess plain; 1 more specimen near the western Uzboy river bed ca. 1 km north of height of 72.4, on takyr-like soil.
- CK: 5 May, 1 specimen (11:10) in the vicinity of the Bukreolen well.
- CK: 6 May, 1 specimen (8:15-8:48) ca. 3 km east of the Katya well.
- MP: 9 May, 1 ♀ specimen at the ruins of the Shirkebir mosque.

- WK: 11 May, 1 specimen (9:46) near the Kurbanias dam, on a hilly plain [during a 0:24 transect from 9:46-10:20].
- EK: 6 June, 1 specimen (9:40) ca. 3 km north of the village of Halaz, at a height of 367.0, in the hills; 1 specimen (11:25) ca. 1 km east, at a height of 262.2, on the foothill plain.
- EK: 7 June, 1 specimen (9:45) ca. 2 km north of Ptichy, on clay takyr plain.
- TMR: 7 June, 1 specimen (10:07) ca. 1 km east of altitude 240.7, on fine-grained, semi-fixed sand; 2 specimens ca. 1 km to the north of the town of Barkhan at height 249.2, on fine-grained, semi-fixed sand [during 0:10 transect from 10:14-10:24]; 2 specimens 1 km to the north of the village of Barkhan at height 249.9 [during 0:10 transect from 10:36-10:46]; 1 specimen (11:57) by the Durnali shore, ca. 1 km west of height 242.8, on fine-grained, semi-fixed sand [during 0:10 transect from 11:50-12:00].
- TMR: 8 June, 3 specimens (10:07, 10:08) ca. 40 km north of the cordon Akarcheshme on a large, hilly plain with dense sandy ground.
- BF: 8 June, 5 specimens (10:07, 10:08) ca. 1 km west of the Kyariz well, on a clay hilly plain, near the colonies of a large gerbil [during a 0:10 transect from 10:00-10:10; suggesting a density of 10 individuals/ha]; 2 specimens (10:42, 10:45) ca. 3.5 km northeast of the village of Jumaji, on a clay hilly plain, near the colonies of a large gerbil [during 0:18 transect from 10:38-10:56]; 8 specimens (14:43, 14:48, 15:10, 15:14, 15:43, 15:45) on a clay-gravelly slope on the border ridge, at a height of 843.4 [during a 1:02 transect from 14:43-15:45, suggesting a density of 6.7 individuals/ha].
- BF: 9 June, 1 specimen (11:50) at height 751.6 [during 1:15 transect from 10:35-11:50].
- GF: 11 June, 1 specimen (7:50) at the Saryyazy reservoir on the road to Gumly, on a large hilly plain of fixed sands; 1 specimen on the road to the Salamguy well, on a large hilly plain of fixed sands [during 0:05 transect from 8:21-8:26]; 14 specimens (10:14-2, 10:19, 10:21, 10:23, 10:31, 10:35, 10:44, 11:03, 11:07, 11:18, 11:20, 11:22, 11:32) at the Salamguy well, on fixed, dense and coarse sand [during 1:20 transect from 10:12-11:32, suggesting a density of 5.8 individuals/ha]; 1 specimen near the village of Aymak, on a large hilly plain of fixed sands; 1 specimen (12:07) at the Yakhbil well, on coarse hilly fixed sand; 1 specimen further along the way.
- SKO: 11 June, 1 specimen (14:17) at the Agayusup well, on coarse hilly fixed sands; 1 specimen at the Goshasyuyi well, on coarse hilly fixed sands; 1 specimen (17:34) at the Gayalbaba well, on large hilly fixed sands; 1 specimen (17:44) at the Kulach well, on the large hilly fixed sands; 1 specimen at the Eresh well, on large hilly fixed sands.
- SKO: 12 June, 1 specimen (7:00) at the Arapkui well, on dense, fine-hilly sands; 2 specimens (7:58, 8:05) at the Khtai well, on dense, fine grained sands; 1 specimen (9:55) at the Karametnityaz well, on dense, finely grained sands.
- KY: 13 June, 4 specimens (17: 52-2, 18:05, 18:54) ca. 10 km south-east of Amu Darya town in the foothills of a saline, sandy plain [during two transect totalling 0:39 from 17:51-19:15 & 18:26-18:41, suggesting a density of 1.6 individuals/ha].
- KY: 14 June, 3 specimens (11:10, 11:32-11: 39, 11:41) ca. 3 km north of Khodjaguluk village, near the Shuvakkum sands [during 0:14 transect from 10:46-11:56 & 11:16 -11:20].
- KY: 15 June, 2 specimens (8:12, 8:14) ca. 2 km south of the Khodjakaraul gorge, on a clay plain.
- KY: 16 June, 1 specimen (15:57) along the Sakyrtna mountains, on a hill slope in a large gerbil colony [during 0:19 transect from 15:57-16:16].
- KY: 17 June, 18 specimens (10:53, 11:05, 11:06, 11: 36-2, 11: 47-2, 12: 05-3, 12:06, 12 : 09-2, 12:17, 12:21, 12:40, 12:50, 12:54) ca. 3 km east of Khojaheiran village [during multiple transects totalling 1:09 from 10:53-11:08, 11:36-11:47, 12:03-12:09, 12:17-12:54, suggesting a density of 8.7 individuals/ ha]; 2 specimens (16:42, 17:39) ca. 5 km south-east of Amu Darya town [during a 0:58 transect from 16:41-17:39]; 3 specimens (17:57, 18:35, 18:36) ca. 7 km south-east of the Amu Darya town [during 1:12 transect from 17:57-19:26 & 19:06-19:23; suggesting a density of 1.4 individuals/ha].

11. Sunwatcher Toadhead Agama - *Phrynocephalus helioscopus helioscopus* (Photo 12).

It is widespread in northern Turkmenistan (Southern Ustyurt / Gaplangyr, Sarykamysch depression, Sarygamyschsky delta and Amu Darya delta). Found in deserts in areas with a dense substratum (hills, takyrs, clay plains, less often in solonchaks). Rare, but locally common. We recorded a total of 12 individuals.

- SD: 27 April, 1 specimen ca. 1.5 km east of the point 43.0 near the southwestern chink of the Achchagaya Depression, on the loess plain; 3 specimens (12:05♂, 12:13♀, 12:38♂) along the bottom of the

Achchagaya basin ca. 1.5 km north of height 44.0, at a takyr [during a 1:24 transect from 11:36-13:00, suggesting a density of 3.6 individuals/ha].

- SU: 30 April, 1 specimen (13:58) ca. 18 km to the south-west of Cape Burchlyburun, on the loess slab-hilly plain [during a 0:19 transect from 13:54-14:13].
- SU: 1 May, 2 specimens on Gaplangyr plateau in the Karry-Mazarchalik tract, ca. 1.5 km to the east of the height 61.0m, on the loess plain [during a 0:21 transect from 8:28-8:49]; 2 specimen on Gaplangyr plateau near the Gusassu tract, ca. 1.5 km south of height 116.0, on the loess plain [during a 0:20 transect from 11:50-10:10].
- SU: 2 May, 2 specimens (10:35) on Gaplangyr plateau, ca.1 km to the south of the height of 80.7, near the Sardjakel, on the weakly hilly loess plain [during a 0:30 transect from 10:30-11:00]; 1 specimen on Gaplangyr plateau, near the bed of the Western Uzba ca. 1 km to the north of height of 72.4, on takyr-like soil.

12. Turkmen Sunwatcher Toadhead Agama - *Phrynocephalus helioscopus turcomanus* (Photo 13). Western and southern (foothills and clay plains of Kopetdag) Turkmenistan. Desert species which can be found on areas with a dense substratum (takyr, clay plains, less often solonchaks), hilly foothills, through valleys which penetrate into the lower belt of mountains. Common, in places numerous. We recorded a total of 3 individuals in Western Kopetdag.

- WK: 8 May, 1 specimen ca. 1 km south-west of Beki-bent, on a clay plain; 1 specimen south-west of Kemender ca. 0.5 km to the west of height 145.2, on a loess plain near a deep ravine.
- MP: 9 May, 1 specimen on the Messerian plain near the Shirkebir mosque, on takyr.

13. Transcaspian Round Head Agama - *Phrynocephalus raddei raddei* (Photo 14). The species is found in the western and central regions of the Karakum desert of southern Turkmenistan. It lives on clayey parts of the desert, but occasionally ventures into sandy areas. Common, in places numerous. We recorded a total of 2 individuals in the Central Karakum.

- CK: 7 May, 2 specimens (8:25, 8:33) ca. 3 km to the east of the Katya well, on takyr in a complex with ridge-finely sands [during a 0:33 transect from 8:15-8:48].

14. South-eastern Transcaspian roundhead Agama - *Phrynocephalus raddei boettgeri*. Occurs in the South-Eastern Karakum desert, from the PriAmu Darya sands to Kelif Uzboy (settlement of Karametniyaz) and the foothills of Koytendag. It inhabits areas with compacted soil and is found on clay plains, saline deserts, and overgrown sands. Common. We recorded 4 individuals of this subspecies in the Gaurdak-Koytendag region.

- KY: 17 June, 4 specimens (18:32, 18:46, 18:50, 19:26) ca. 7 km south-east of the Amu Darya town, on a salt plain [during 1:12 transect from 17:57-19:26 & 19:06-19:23, suggesting a density of 3.7 individuals/ha].

15. Lichtenstein's Toadhead Agama - *Phrynocephalus interscapularis* (Photo 15). Sand dunes and sandy plains. Distributed widely. Numerous. We recorded 23 individuals.

- TUK: 3 May, 1 specimen west of the Kyzylja-Burun mountain, on a sand dune on semi-fixed sands.
- CK: 5 May, 1 specimen ca. 1 km south of the village of Adzhikel, on takyr with separate small sandy mounds among semi-fixed sands [during a 0:49 transect from 16:58-17:47].
- CK: 6 May, 4 specimens (8:25, 8:33) ca. 3 km east of the Katai well, on takyr in a complex with small ridged hilly sands [during 0:33 transect from 8:15-8:48, suggesting a density of 13.3 individuals/ha]; 5 specimens ca. 5.5 km east of the Karaaji well, on the dunes of semi-hilly, semi-fixed sands [during 1:11 transect from 10:24-11:35, suggesting a density of 8.3 individuals/ha].
- KY: 17 June, 12 specimens (17:51, 17:54, 18:02, 18:03, 18:04, 18:05), ca. 10 km south-east of Amu Darya town, on a foothill saline plain with silty sands [during 0:39 transect from 17:51-19:15 & 18:26-18:41; suggesting a density of 11.6 individuals/ha].

16. Secret Toadhead Agama - *Phrynocephalus mystaceus galli* (Photo 16-18). Half-overgrown sand dunes. Widely distributed and common. We recorded 13 individuals.

- TUK: 26 April, 1 specimen near the Egritakyrt tract near height 128.1, on a sand dune.
- TUK: 27 April, 1 specimen (10:17) ca. 1.5 km north of the Tyumkdag village on a sandy kyr [during 0:35 transect from 9:35-10:10]; 1 specimen (15:15) ca. 1 km south of height 100.1, at Garagash takyr.
- TUK: 3 May, 1 specimen ca. 1 km west of Kyzylca-Burun mountain, on a sand dune in the semi-fixed sands.
- CK: 3 May, 1 specimen (12:20) ca. 3 km north-west of the village of Atakui.
- CK: 5 May, 1 specimen (12:34) near the village of Kyrkkui, on a sand dune in the ridge-small-hilly semi-fixed sands; 2 specimens ca. 1 km south of the village of Adzhikel, on takyr with small mounds, sands among the ridge-hilly semi-fixed sands [during 0:49 transect from 16:58 to 17:47]; 1 specimen (juvenile) ca. 3 km east of the Kataoy well, on takyr in a complex with ridge-small-hilly sands [during 0:33 transect from 8:15-8:48].
- CK: 6 May, 3 specimens ca. 5.5 km east of the Karaaji well, on a sand dune in semi-hilly semi-fixed sands [during 1:11 transect from 10:24-11:35, suggesting a density of 2.5 individuals/ha]; 1 specimen ca. 4 km north of Bozkel village on a sand dune in the ridge-hilly semi-fixed sands.

17. Caucasian Agama - *Paralaukadia caucasia caucasia* (Photo 19). It is widespread in southern Turkmenistan, except for the extreme South-East. Found in the Garabil (Pelenhovali gorge), Kopetdag, Uly and Kichi Balkan mountains, and also introduced to Karadag, where it penetrates into Kubadag. It can be found in the mountains and foothills - rocky areas, rocky screes, clay-loess cliffs, ruins of buildings, valleys, and gullies. Common, in places it is numerous. We recorded a total of 5 individuals in the Western Kopetdag.

- WK: 7 May, 1 specimen (18:17) at the Eishem spring, on loess hills with rock outcrops [during a 0:40 transect from 17:47-18:27].
- WK: 8 May, 3 specimens (9:34, 9:45) in the mudflats of the Amannazar tract, 1.5 km north of Amannazar [during a 1:16 transect from 8:29-9:45 for a possible density of 2.0 individuals/ha].
- WK: 10 May, 1 specimen (10:45) ca. 2 km west of the Keshan well, in the mudslide at the foot of the high loess hills south of the Kulmach ridge.

18. Redbelly Rock Agama - *Paralaukadia erythrogastra erythrogastra*. Occurs in the Garabil and Badhyz foothills. It inhabits the foothills, rocky and stony slopes, old clay bricks. Common. We recorded 1 individual in the Badhyz foothills.

- BF: 8 June, 1 specimen (15:06) on the Pogranichny Range at height of 843.4, on a clay-gravelly slope [during 1:02 transect from 14:43-15:45].

19. Turkestan Rock Agama - *Paralaukadia lehmanni*. Occurs in Koytendag and its foothills. Found in rocky habitats, e.g. rocky plains, stony slopes, cliffs along dry river channels, and in the ruins of buildings. Common. We recorded 1 individual in Gaurdak-Koytendag.

- KY: 15 June, 1 specimen (8:26) ca. 2 km south of the Khodjakaraul gorge, on a foothill clay plain.

Family Glass- and Alligator lizards – Anguidae

20. European Glass Lizard (Scheltopusik) - *Pseudopus apodus apodus* (Photo 20). Inhabits southern Turkmenistan: Kopetdag, Badhyz, Garabil, Koytendag, and the valleys of the Kushka and Murgab rivers. Found in mountain gorges, hollows, foothills and also gardens and vineyards on river floodplains. Common. We recorded 1 individual in the Western Kopetdag.

- WK: 9 May, 1 specimen (19:48) in the mudflow channel of the intermontane depression, on the north-eastern side of the Maly Kulmach Ridge.

Family Skinks – Scincidae

21. Asian Snake-eyed Skink - *Ablepharus pannonicus*. Widespread in southern Turkmenistan, namely the Uly and Kichi Balkans, Kopetdag, Badhyz, Koytendag, and the the Murgab valley. Inhabits grassy and tree-shrub vegetation of the mountains and river valleys. Common. We recorded 3 individuals in Gaurdak-Koytendag.

- 15 June, 1 specimen (12:51) near the Maidan ranger station on a mountain plateau with small bushes [during 4:33 transect from 9:42-14:45/10:45-11:28]; 2 specimens (18:33, 18:37) [during 1:30 transect from 18:13-19:43].

22. Gold Skink - *Eumeces schneideri princeps* (Photo 21). Occurs in southern Turkmenistan: Kopetdag, Badhyz, Garabil, Koytendag, and the valleys of the rivers Murgab and Tedjen. Inhabits mountains areas with dense grassy vegetation, foothill plains and river valleys, including cultivated land and riverine forests. Numerous. We recorded a total of 2 individuals.

- WK: 11 May, 1 dead specimen (11:00) on the wormwood plain with ravines at the Kurbaniasz well.
- BF: 8 June, 1 specimen (15:02) on a clay-gravelly slope on the Pogranichny Range, at al altitude of 843.4 [during 1:02 transect from 14:43-15:45].

23. Ribbon-Sided Skink - *Eurylepis taeniolatus pathiranicus* (Photo 22-23). It is widespread in southern Turkmenistan: the Kopetdag, Badhyz, Garabil, and in places along the Murgab, Tedjen, and the upper reaches of the Amu Darya river. The species inhabits rocky mountain slopes, gorges with woody-shrub thickets, and river valleys. Numerous. We recorded 1 individual.

- WK: 11 May, 1 specimen (11:20) at the Kurbaniasz well, under a stone on a slope with rocky outcrops [during a 0:34 transect from 9:46-10:20].

Family lizards – Lacertidae

24. Reticulate Racerunner - *Eremias grammica* (Photo 24). Distributed widely throughout the plains of Turkmenistan. Inhabits mostly semi-overgrown areas and areas with loose sands and sparse vegetation. Numerous. We recorded 12 individuals.

- TUK: 27 April, 1 specimen (10:05) ca. 1.5 km north of the Tyumkdag village, on sand hill [during 0:35 transect from 9:35-10:10].
- TUK: 3 May, 1 specimen ca. 1 km east of the village Islam, on ridge-hilly semi-fixed sands
- CK: 5 May, 1 specimen [17:00] ca. 1 km south of the village Adzhikel, on takyr with small hillocks and sands among the ridge-hilly semi-fixed sands.
- CK: 6 May, 3 specimens ca. 3 km east of the Kataoy well, on takyrs in a complex with ridge-small-hilly sands [during 0:33 transect from 8:15-8:48].
- CK: 8 June, 2 specimens (10:42, 10:45) ca. 3.5 km northeast of the village Jumaji, on a clay hilly plain, near a colony of a large gerbils [during 0:18 transect from 10:38-10:56].
- KY: 13 June, 2 specimens (18:03, 19:11) ca. 10 km south-east of Amu Darya town, on the foothill saline plain with sandy sands [during 1:24 transect from 17:51-19:15 & 18:26-18:41].
- KY: 17 June, 2 specimens (19:02, 19:26) ca. 7 km south-east of Amu Darya town, on a salt plain [during 1:12 transect from 17:57-19:26*].

25. Aralo-Caspian Racerunner - *Eremias intermedia* (Photo 25). Widely distributed throughout the plains of Turkmenistan. Inhabits overgrown, compacted sands and clay-gravel sites in the desert. Common, in places numerous. We recorded 27 individuals.

- TUK: 27 April, 2 specimens (9:35, 9:45) ca. 1.5 km north of Tyumkdag village, on sandy hill [during 0:35 transect from 9:35-10:10].
- TUK: 30 April, 3 specimens (17:20, 17:24, 17:25) at Atabai shor [during 1:16 transect from 16:46-18:02, suggesting a density of 4.0 individuals/ha].

- SD: 27 April, 1 specimen (pregnant ♀; 12:46) along the bottom of the Achchagaya depression, ca. 1.5 km north of height 44.0, on sandy hillocks [during a 0:24 transect from 11:36-13:00].
- SD: 28 April, 2 specimens (10:10) ca. 1 km east of the town of Yurshlydzha, on the sandy substrate at the beginning of the Kangakyr hills [during 0:15 transect from 10:10-10:25].
- SD: 29 April, 1 specimen (9:18) in the Tukurlyk tract, ca. 1 km north of height 10.7, on takyr in fixed weakly wavy sands [during 0:46 transect from 8:36-9:22]; 10 specimens on the shore of Sarygamysh lake at a height of 10.3, on fixed small-hilly sands near Gulanly Bay [during a 0:50 transect from 09:58-10:48, suggesting a density of 13.3 individuals/ha]; 1 specimen (12:06) in the Dusheklidash tract at a height 29.6, on the ridge-covered fine sands.
- CK: 5 May, 1 specimen ca. 1 km south of the village of Adzhikel, on takyr with small hillocks [during 0:49 transect from 16:58-17:47].
- CK: 6 May, 1 specimen ca. 3 km east of the Kataoy well [during 0:33 transect from 8:15-8:48].
- KY: 13 June, 5 specimens (18:05, 18:42, 18:54, 19:03, 19:15) ca. 10 km south-east of the Amu Darya town, on a foothill saline plain with silty sands [during 1:09 transect from 17:51-19:15*, suggesting a density of 4.8 individuals/ha]

26. Striped Racerunner - *Eremias lineolata* (Photo 26). Distributed widely throughout the plains of Turkmenistan. Lives on overgrown ridge-hilly sands, and areas of dense, compacted sands, and in the clay desert. Common, in places it is numerous. We recorded a total of 141 individuals.

- SD: 27 April 4 specimens (12:37, 12:45) along the bottom of the Achchagaya basin on the loess slopes at the junction with the takyr at the bottom and on the sandy hillocks 1.5 km north of height 44.0m [during a 01:24 transect from 11:36-13:00; for a density of 4.8 individuals/ha].
- SD: 29 April, 9 specimens (8:41, 8:57-9:18) in the Tukurlyk tract near the Sarygamysh spill, 1 km north of the height of 10.7 on fixed weakly wavy sands [during 0:46 transect from 8:36-9:22, suggesting a density was 15.9 individuals/ha]; 76 specimens on the coast of Sarygamysh, on fixed small-hilly sands near Gulanly Bay, at a height of 10.3 [during 0:50 transect from 09:58-10:48, suggesting a density of 101.3 individuals/ha - The proximity to lake Sarygamysh resulted in increasing moisture levels, stimulating vegetation growth and in turn resulting in high numbers of insects which provide an excellent food base]; 1 specimen (12:06) in the Dusheklidash tract, at a height of 29.6 on the ridge-small-hilly fixed sands; 21 specimens ca. 3.5 km south-west of Dortkak at the Sarygamysh spills at a height of 10.3 on small-grained fixed sands [during 1:15 transect from 13:23-14:38, suggesting a density of 18.7 individuals/ha].
- CK: 5 May, 1 specimen ca. 1 km south of the village of Adzhikel on takyr with small hillocks, sands among the ridge-hilly semi-fixed sands [during 0:49 transect from 16:58-17:47].
- TMR: 7 June, 2 specimens [11:12] ca. 1 km north of height 249.9, in Barhan desert on a hill with small-grained fixed sands.
- KY: 13 June, 3 specimens (17:53) ca. 10 km south-east of Amu Darya town, on the foothill of a saline plain with fine sands [during 1:09 transect from 17:51-19:15*, suggesting a density of 2.9 individuals/ha].
- KY: 14 June, 20 specimens (10:48, 10:52, 10:58, 11:00, 11:02-2, 11:04, 11:07, 11:10, 11:11, 11:16-11:20, 11:24, 11:26, 11:30, 11:31, 11:46) ca. 3 km north of the village of Khodjagulluk, near the Shuvakkum sands in the foothill of a slightly hilly loess plain [during 0:59 transect between 10:46-11:56, suggesting a density of 22.2 individuals/ha]
- KY: 17 June, 4 specimens (17:57, 18:23, 18:40, 19:26) ca. 7 km south-east of Amu Darya town [during 1:12 transect between 17:57-19:26, suggesting a density of 3.7 individuals/ha]

27. Persian racerunner - *Eremias persica* (Photo 27). In Turkmenistan, it is found in Badkhyz, namely in the Yeroyulanduz depression and the Kuska floodplain. It occurs in sandy, compacted overgrown areas, on cliffs and ravines, and on similar areas on river floodplains – often in an admixture with pebbles. Common. We recorded 1 individual in Badkhyz.

- BF: 8 June, 1 specimen (15:34) on the Pogranichny Range at an altitude of 843.4, on a clay-gravelly slope [during 1:02 transect from 14:43-15:45].

28. Sand Racerunner - *Eremias scripta scripta* (Photo 28). Widely distributed in the sand deserts of Karakum and Sandykly, except for the foothills (Badhyz and Garabil) areas. The species inhabits weakly fixed sandy hillocks and sand dunes with sparse vegetation. Common, in places it is numerous. We recorded a total of 2 individuals in the Central Karakum.

- CK: 6 May, 2 specimens on the sand dunes ca. 5.5 km east of the Karaaji well [during a 01:11 transect from 10:24-11:35]. The anthropogenic changes due to waste waters collectors in the surrounding of the sand dunes has resulted in the emergence of unusual vegetation, which reduced the available habitat and likely resulted in a decrease in densities

29. Rapid Racerunner - *Eremias velox velox* (Photo 29-30). In Turkmenistan, it is widely distributed along coastal waters, river valleys and oases, and on gravelly deserts, hills and mountains. In places common and even numerous. We recorded a total of 53 individuals.

- SD: 27 April, 2 specimens (11:27, 11:37) at the foot of the Kangakyr highland ca. 1 km south-east of the height 103.0, on the powdery soil in a colony of a large gerbil [during 0:32 transect from 11:05-11:37]; 7 specimens (11:37, 11:41, 11:44, 11:48, 12:22, 12:26, 12:48) in two locations in the Achchagaya basin mudflow channels (one in a colonies of large gerbil) [during a 01:24 transect from 11:36-13:00, suggesting a density of 8.3 individuals/ha].
- SU: 30 April, 11 specimens (11:45-12:05) ca. 8 km south-west of Cape Burchlyburun, on the loess weak-hilly plain [during 1:15 transect from 11:21-12:36, suggesting a density of 18.3 individuals/ha]; 2 specimens (14:08, 14:13) ca. 18 km south-west of Cape Burchlyburun, on the loess low-hilly plain [during 0:19 transect from 13:54-14:13].
- SU: 1 May, 1 specimen at Gaplangyr near the Gusassu tract, ca. 1.5 km to the south of height 116.0, on the loess plain [during a 0:20 transect from 11:50-10:10]; 1 specimen (12:30) along the Gaplangyr mound near the Goklenkui solonchak (Karashora) over a stretch of 42 km (228.4- 296.5m) and a series of transects over 02:00 (11:00-12: 44, and 16:40-18:32).
- WK: 7 May, 1 specimen (17:47) at the Eishem spring, on loess hills with rocky outcrops [during 0:30 transect from 17:47-18:27].
- WK: 8 May, 2 specimens (8:29, 8:35) in the Amannazar tract ca. 1.5 km north of Amannazar, on the loess plain. [during a 01:16 transect from 8:29-9:45]; 1 specimen (10:57) ca. 1.5 km north of height 359.0, on loess hills [during 0:22 transect from 10:44-11:06]; 1 specimen ca. 1 km south-west of the Bekibent village, on a clay plain.
- WK: 10 May, 2 specimens ca. 1.5 km south-east of the Doyran spring, at the foot of the hills in the Tersakan Valley [during 0:16 transect from 8:30-8:46]; 1 specimen (10:45) ca. 2 km west of the Keshan Well at the foot of high loess hills south of the Kulmach Range
- WK: 11 May, 1 specimen (10:10) at the Kurbaniash well, on the hilly plain [during a 0:34 transect from 9:46-10:20].
- MP: 9 May, 1 specimen at the ruins of the Shirkebir mosque, on takyr near the dry bed of the artificial channel.
- BF: 8 June, 1 specimen (10:42) ca. 3.5 km northeast Dzhumadzhi village, in the foothills of Gyaz-Gyadyk on hilly plain clay in colony of the large gerbil [during 0:18 transect from 10:38-10:56].
- BF: 9 June, 2 specimens (7:42, 9:32) ca. 1 km north of the Western spring at the Kizyljar chink at height 797.6, on sandy soil [during 3:05 transect from 6:05-9:35].
- KY: 13 June, 1 specimen (18:42) ca. 10 km south-east of Amu Darya town, on the foothill saline plain with sandy sands [during 01:09 transect between 17:51-19:15].
- KY: 16 June, 5 specimens (15:04, 15:05, 15:10, 15:12, 15:20) along the Aktau ridge, on the slopes of the hills on the colony of the large gerbil [during 0:19 transect from 15:57-16:16, suggesting a density of 10.5 individuals/ha].
- KY: 17 June, 12 specimens (11:03, 11:04, 11:07, 11:08, 11:36, 12:03, 12:04, 12:06) ca. 3 km east of the village of Khojaheiran, along the slopes of hills [during a series of transects of a total of 1:09 from 10:53-11:08, 11:36-11:47, 12:03-12:09, 12:17-12:54, suggesting a density of 11.6 individuals/ha]; 1 specimen (17:17) ca. 5 km south-east of Amu Darya town, among the residual mountains [during 1:00 transect from 16:41-17:39].

30. Persian Long-Tailed Desert Lizard - *Mesalina watsonana*. Found in southern Turkmenistan, namely Kopetdag and its foothills, Badhyz, Tedjen and Murgab river valleys. A single find has been made in the Eastern Karakum (near the Uchadzhi railway station). It occurs on areas with clay and takyr-like soils, less often on semi-overgrown sands. It is also found in gorges, stony foothills, and on hills in the mountains. Common. We recorded 2 individuals in Badhyz.

- 9 June, 2 specimens (8:11, 8:35) ca. 1 km to the north of the Zapadny spring at the Kizyljar chink at an altitude of 797.6, on a dense sandy soil [during 3:30 transect from 6:05-9:35].

Family Monitor Lizards - Varanidae

31. Desert Monitor - *Varanus griseus caspius* (Photo 31). Widely distributed in Turkmenistan, but not recorded from Southern Ustyurt. In the mountains it is found as high 2000m. It prefers sandy-clay plains, overgrown sands, foothills, and steppe-like areas in the mountains. Common in places, rare on the plains, and very rare in the mountains. We recorded a total of 11 individuals.

- CK: 5 May, 1 specimens (12:00) ca. 1 km north of the Hoshan well.
- CK: 6 May, 1 specimen (9:50) ca. 5 km west of the Dawali reservoir.
- TMR: 7 June, 1 specimen (11:57) by the Durnali shore ca. 1 km west of height 242.8, in small-hilly dense fixed sands [during 0:10 transect from 11:50-12:00]; 1 individual on an asphalt road 2 km south of the village Gangala.
- TMR: 8 June, 1 specimen ca. 9 km south of the Khan-Yap village, on hilly dense-sandy gray soils; 1 specimen 23 km south of the village of Khan-Yap, on hilly dense-sandy grey soil.
- BF: 9 June, 2 specimens (10:35, 10:56) on Kizyldzhar chink at height 751.6 [during 1:25 transect from 10:35-11:50]; 1 specimen (12:41) on Kizyldzhar chink at height 746.1; 1 specimen (17:39) on country road from Kizyldzhara. 7 km north of Chemenabat village
- KY: 16 June, 1 specimen (17:38) along the Aktau ridge, on the top of the hills in the crevice of rocky outcrops [during 0:28 transect from 17:10-17:38].

6.4.3 Order Serpentes (Snakes)

Family Blind Snakes – Typhlopidae

32. Eurasian Blind Snake - *Typhlops vermicularis* (Photo 32). The species is widespread in the mountains and lower hills of Turkmenistan: Kopetdag, Badhyz, Garabil, Koytendag. It is found in stony areas with sparse vegetation in the foothills and slopes of mountains. Common, in numerous. We recorded a total of 3 individuals.

- WK: 9 May, 2 specimens (22:45, 22:55) on the spur on the north-eastern side of the Maly Kulmach Ridge, one on a clay slope, the other on a mudflow channel [during a 01:30 transect from 22:45-00:15].
- BF: 9 June, 1 specimen (22:30) in the village of Serkhetchi (formerly Morgunovka), on a concrete platform near the garden in the headquarters of the Badhyz Nature Reserve, on the Kushka river floodplain [during 0:42 transect from 22:17-22:59].

Family Boas – Boidae

33. Desert Sand Boa - *Eryx miliaris miliaris* (Photo 33). It inhabits practically the whole of Turkmenistan, excluding the upper belt of the mountains and foothills of Koytendag. It is found on various types of sandy ground in the foothills and mountains (in hilly areas and ravines) where it is found in close association with colonies of large gerbils, or other species of common rodents. Common. We recorded a total of 2 individuals in Western Kopetdag.

- WK: 8 May, 1 specimen (22:20) southwest of Kemender ca. 0.5 km northwest of height 145.2, in a colony of common voles in a deep ravine [during a 01:00 transect from 22:20-00:20].

- WK: 9 May, 1 specimen (23:28) on a spur from the north-eastern side of Maly Kulmach Ridge, in a large gerbil colony [during a 01:30 transect from 22:45-00:15].

Family Racers - Colubridae

34. Spotted Desert Rancer – *Platyceps karelinii karelinii* (Photo 34). The species is distributed throughout the plains of Turkmenistan, and lives in the lower belt of the mountains. It can be found on various types of sand, clay-rubble plains, foothills, hills and gorges, and along the high banks or cliffs along river floodplains. Common. We recorded a total of 2 individuals in the Sarygamys depression.

- SD: 28 April, 1 specimens (11:30) one at the foot of the Kangakyr among the coarse clastic material of the chink [during a 0:32 transect from 11:05-11:37]; 1 specimen (18:17) at the foot of Tjirimgaya chink, at an uninhabited large gerbil colony.

35. Afghan Awl-header - *Lythorhynchus ridgewayi* (Photo 35). The species is widely distributed in the southern and eastern plains of Turkmenistan, penetrating the lower belt of the mountains. It inhabits hilly terrain in the foothills, sites with clayey-gravel and compacted sands alternating with takyr on the plains and deeply gorges and high in the mountains. Rare. We recorded a total of 3 individuals in the Southern Ustyurt – which are the first records for this region!

- SU: 1 May, 3 specimens (13:52, 14:28, 17:52) along a 42 km stretch of the Gaplangyr chink (228.4-296.5m) in the Goklenkui solonchak (Karashor). The first specimen was recorded during a series of short transects over a total of 2 hours (between 11:00-12:44 and 16:40-18:32). The other two specimens were found at height 231.7, where in an area of 80x600m the tile material was turned over (from 13:40-14:40).

36. Steppe Ribbon Racer - *Psammodromus lineolatus* (Photo 37). The species is distributed throughout Turkmenistan, excluding the upper belt of the mountains. It can be found in a wide variety of habitats, including various types of sands: overgrown, half-fixed, loosely fastened. It is also found on takyr-like, clayey and solonchak areas of deserts and hilly foothills and intermontane plains, river valleys. Common, in places numerous. We recorded a total of 3 individuals.

- SD: 29 April, 1 specimen (11:46) on the sandy clay plain of the Duschekidash tract.
- WK: 8 May, 1 specimen (12:30) was seen by Hojamyrt Hojamyrdov in the mudflow channel ca. 1.5 km north of the height of 359.0.
- BF: 9 June, 1 specimen (18:36) on an asphalt road from Kizyldzhara to Chemenabat.

37. Diadem Snake - *Spalerosophis diadema schiraziana* (Photo 36). Distributed throughout the plains and the lower altitudinal zone of the mountains throughout Turkmenistan. It inhabits overgrown and semi-fixed sands, takyr, clay plains, hills. Common. We recorded a total of 2 individuals in the Trans-Unguz Karakum.

- TUK: 30 April, 2 specimens (18:02, 19:06) at the Atabai Shorra inter-ridge depression, on fine hilly sands [during a 02:24 transect from 16:46-19:10].

Family Vipers - Viperidae

38. Saw-scaled Viper - *Echis carinatus* (Photo 38). The species is distributed throughout the plains of Turkmenistan (except for the Northern Pri-Karabugazie) and the lower altitudinal zone of mountains. It inhabits habitats with semi-fixed sands, clay and solonchak areas, river valleys, hilly foothills, intermontane plains, ravines, mudflow channels. Common. We recorded a total of 2 individuals in Western Kopedag.

- WK: 8 May, 2 specimens (23:15, 23:43) southwest of Kemender, near our camp in a deep ravine at a large gerbil colony, 0.5 km northwest of height 145.2m [during a 2:00 transect from 22:20-0:20].

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8 Appendix: Summary of 2015 expeditions to Badhyz Nature Reserve, Gury Howdan Wildlife Sanctuary and Meana Chacha Wildlife Sanctuary

8.1 Introduction

We conducted two expeditions in Turkmenistan in 2015. The first in March-April to Badhyz Nature Reserve and the second in September to Gury Howdan Wildlife Sanctuary, Meana Chacha Wildlife Sanctuary and Badhyz Nature Reserve. The itineraries for both trips are below (Table A1). The main objective of these expeditions was to assess the status of kulan, and to opportunistically develop an overview of the status of other large mammals. These expeditions expand on the results from 2014, summarised in Kaczensky et al. (2015).

Table A1: Itinerary for field expedition to Badhyz, March –April 2015.

Date	Activity	Night	Distance driven	Distance walked
23.03.2015	Leaving Vienna / Trondheim	Airplane		
24.03.2015	Arrive Ashgabat. Meetings and planning.	Ashgabat hotel		
25.03.2015	Drive to Badhyz Nature Reserve headquarters in Serhetchi via Mary	Reserve HQ in Serhetchi		
26.03.2015	Meetings at reserve HQ with Islam Ishanov, Kadyr Anngulyev and Nury Khudaykulyev. Shopping and registration.	Reserve HQ in Serhetchi		
27.03.2015	Leave for Badhyz along eastern ecological corridors to Yeroylanduz	Yeroylanduz ranger post	89	4
28.03.2015	Hiking around Yeroylanduz	Yeroylanduz ranger post		15
29.03.2015	Drive to east side of Gyzylyar canyon, hike across canyon and along escarpment rim back to Yeroylanduz campsite	Yeroylanduz ranger post	36	21
30.03.2015	Drive to Agarcheshme ranger post	Agarcheshme ranger post	58	4
31.03.2015	Drive through pistachio savannah, hike around station	Agarcheshme ranger post	65	12
01.04.2015	Drive to Kepele and Dashgui, hike around station	Agarcheshme ranger post	67	11
02.04.2015	Drive to escarpment rim via Dashgui and hike rim	Agarcheshme ranger post	99	19
03.04.2015	Morning hike, drive back to Ashgabat	Ashgabat hotel	25	5
04.04.2015	Meetings in Ashgabat with Valery Kuznetsov.	Ashgabat hotel		
05.04.2015	Return to Vienna / Trondheim			
Sum		7 field days	439	82

Table A2. Itinerary for field expeditions to Gury Howdan, Meana Chacha and Badhyz, September 2015.

Date	Activity	Night	Distance driven	Distance walked
02.09.2015	Leave Trondheim	Airplane		
03.09.2015	Arrive Ashgabat	Ashgabat-Hotel		
04.09.2015	Travel from Ashgabat to Gury Howdan Wildlife Sanctuary and then onwards to Meana Chacha Wildlife Sanctuary	Gannaly		
05.09.2015	Driving around Meana Chacha	Gannaly	161 km	
06.09.2015	Driving around Meana Chacha	Gannaly	140 km	
07.09.2015	Driving around Meana Chacha	Gannaly	159 km	
08.09.2015	Driving around Meana Chacha	Gannaly	107 km	
09.09.2015	Travelling towards former river bed of the Tejen river, east of the Tejen-Sarakhs road	Gannaly	140 km	
10.09.2015	Drive from Gannaly to Badhyz	Agarcheshme ranger post	10.5 km	2.5 km
11.09.2015	Drive from Agarcheshme to escarpment rim, descent to Namakser water point, drive to Gyzylyar ranger post via Kepele ranger post	Gyzylyar ranger post	86 km	5.5 km
12.09.2015	Hiking Gyzylyar canyon, drive to Yeroylanduz ranger post	Yeroylanduz ranger post	36 km	9 km
13.09.2015	Hiking Yeroylanduz and checking waterpoints at base of escarpment	Yeroylanduz ranger post		24 km
14.09.2015	Drive to livestock camps to south of protected area, then to Gyzylyar via Caynury	Camping on escarpment overlooking Yeroylanduz	88 km	
15.09.2015	Hiking along rim of Yeroylanduz and Gyzylyar canyon escarpments	Camping on escarpment overlooking Yeroylanduz	24 km	7.7 km
16.09.2015	Driving to livestock camps north of Badhyz and return to Kepele	Kepele ranger post	89 km	
17.09.2015	Drive to Agarcheshme, Pynham and Kerlek rangers posts and surrounding landscapes.	Agarcheshme ranger post	28 km	4 km
18.09.2015	Return to Ashgabat	Ashgabat - Hotel		
19.09.2015	Return to Trondheim			
Sum		13 field days	1,069 km	53 km

8.2 Badhyz field investigations - March 2015

The trip to Badhyz was scheduled from 25th March until 3rd April, plus two days of debriefing in Ashgabat both prior to, and following, the expedition. In total we spent 7 days in the field, covering 439 km by car and 82 km on foot (Table 1). Upon arrival at Badhyz Nature Reserve headquarters in Serhetchi we learnt that the Badhyz plateau, Gyzylyar canyon and the Gyzylyar wildlife sanctuary had been closed to visitors due to increased security concerns along the Turkmen – Afghan border. Consequently, all field activities were concentrated around the Yeroylanduz depressions, the escarpment, and the Pistachio savannah in the west around Agarcheshme and Kepele ranger stations.

The field team consisted of Shirin Karryeva, Atamyrat Veyisov (RSPB / IBA team), Islam Ishanov, Nurmuhamet (Nury) Hudaykuliev (Reserve Director and Head of Science Department, Badhyz Nature Reserve, respectively), Kadyr Annagulyev (Head of the Flora and Fauna Protection Division, the Ministry of Nature Protection of Turkmenistan), Petra Kaczensky (Research Institute of Wildlife Ecology, University of Veterinary Medicine, Vienna, Austria), John Linnell (Norwegian Institute for Nature Research, Trondheim, Norway) and photographer Jeremy Holden.

Observations of kulan and other key wildlife

During the 7 days in Badhyz Nature Reserve, we had 206 observations of urial, 205 observations of goitered gazelles, 20 of red foxes, 4 of wild cats, and saw very fresh leopard tracks on at least 3 occasions (numbers do not exclude double counts!). We additionally saw fresh wolf and hyena tracks at several locations (Table A3).

We also encountered domestic horses on multiple occasions (253 sightings – but including many re-sightings of the same individuals), a group of 17 cattle and 1 camel (and tracks of several more camels). We failed to see any kulan and only came across a few fresh tracks; all of single animals, pairs or triplets.

Table A3: Observations of large mammals and livestock by P. Kaczensky and J. Linnell during the 7 day field expedition in Badhyz Nature Reserve in March 2015.

Date	Wildlife and livestock observed							
	Urial	Gazelle	Fox	Wild cat	Fresh leopard tracks	Horse	Cattle	Camel
27.03.2015			1					
28.03.2015	42	73			1			
29.03.2015	50	36	2	2	1			
30.03.2015	12	2	1			64		
31.03.2015	13		1			61		
01.04.2015	33	5	8	1	1	64		1
02.04.2015	48	89	7	1		64	17	
03.04.2015	8							
Total	206	205	20	4	3	253	17	1

8.3 Badhyz field investigations - September 2015

We spent 5 days, from 5th to 9th September 2015 in Meana Chacha wildlife sanctuary, and 7 days, from 11th to 17th September 2015, in Badhyz Nature Reserve. The team consisted of Petra Kaczensky, John Linnell, Jumamyrat Saparmyradov, Nurmuhamet (Nury) Hudaykuliev, and Aman Gurbanov.

8.3.1 Observations of kulan

During our 7-day visit the only evidence of kulan presence came from:

- Two kulan spotted in the distance at Yeroyulanduz on 13.09.2015 at ~9:00 (by Jumamyrad Saparmyradov)
- A set of fresh tracks from one kulan on the mudflats at Yeroyulanduz on 13.09.2015 (Fig. A1)
- A set of somewhat older tracks from two khulan in the surroundings of Yeroyulanduz on 13.09.2015
- A set of fresh tracks from one kulan in Gyzylyar canyon on 15.09.2015.

We did not find any recent kulan scats or tracks at the 3 artificial water points near Gyzyljär, or at the 5 natural water points along the base of the escarpment (Namaksar, Gunbatar, Merkezi, Gundogar, Baskinkar), Kepele, and Kerlek.

Interviews with shepherds at several wells (Chai Nuri, Eschred, Jagimemet, "Well #3") in the buffer zone of Badhyz Nature Reserve did not reveal any kulan sightings during 2015. One shepherd reported that a few sightings had been made in 2014 (e.g. 19 kulan at "Well #3").

Other observers have also failed to record many kulan observations during 2015:

- No kulan had been seen by Nury Hudaykuliev, head scientist of Badhyz Nature Reserve, since December 2014 (when the last observation of 16 kulan was made on the plateau).
- No kulan were recorded on any of the ca. 20 camera traps that have been deployed during 2015, including at several key water points.
- The only kulan observation by park rangers in 2015 was a single observation of 4 animals in April 2015 at a water point in Gyzyljär canyon.
- No kulan had been observed coming to drink at the Kuska river during 2015.

8.3.2 Evidence of poaching of wild ungulates

During our 7 day visit, we found signs of poaching at the following locations:

- Many motorbike tracks criss-crossing the entire area of the Badhyz Nature Reserve [although some may have come from rangers].
- On 12.09.2015 near Yeroyulanduz: the remains of an urial ram (head, 4 cut off lower legs, gut pile, motorbike tracks).
- On 13.09.2015 at Bashinkar waterpoint: a hunting blind overlooking the spring (Fig. A2), 2 shotgun cartridges, water bottles, motorbike tracks, and a pile of dried stomach contents.
- On 14.09.2015 at Merkezi waterpoint: three hunting blinds overlooking the spring, one place with blood on the branches, 3 piles of dried stomach contents, many water bottles, a large plastic tarp, a used motorbike battery, multiple fire places.
- On 14.09.2015 at Gunbatar waterpoint: one hunting blind overlooking the spring.
- Spikes (nails) set by poachers to destroy the tires of the rangers' vehicles set on the way to reach the Merkezi waterpoint.
- Another shotgun cartridge found on the escarpment rim, overlooking Yeroyulanduz.
- Dried gut pile from one ungulate along the Yeroyulanduz escarpment rim and another along the Gyzyljär canyon rim.
- All animals were extremely shy (running at up to 1 km) of both people on foot and vehicles, indicating negative experience of human disturbance.



Fig. A1: Set of fresh tracks of 1 kulan on the salt pan at Yeroyulanduz.



Fig. A2: a) Dried gut pile from slaughtered ungulates, b): Nury Hudaykuliev standing next to hunting blind at Bashinkar waterpoint.

8.3.3 Evidence of kulan presence elsewhere

In May 2015, Nury Hudaykuliev was allowed to visit the area west of the border fence for a day trip. He saw large groups of urial and gazelles and also believes to have spotted a group of kulan in the far distance.

There are some unconfirmed rumours of kulan presence at wells to the NE and S of Badhyz Nature Reserve. Nury Hudaykuliev is very sceptical about these reports, but wants to check with the herders directly.

8.3.4 Other large mammalian wildlife

Although kulan have almost disappeared from Badhyz Nature Reserve, we saw urial primarily (at least 103 individual observations) in Gyzylyar Canyon, the pistachio forest and Yeroyulanduz, and we frequently encountered urial tracks at many locations, especially around waterpoints. We saw relatively few gazelles (19 observations), but encountered their tracks and droppings throughout the reserve and at all water points. Wild boar tracks were observed in the pistachio forest. Hyaenas were observed twice in Gyzylyar canyon, and tracks were seen in many locations. Wolf tracks were commonly observed. We also found tracks from leopards and porcupines in Yeroyulanduz (Table A4). Camera trap photographs from 2015 confirm the continued presence of urial, gazelles, wolves, leopards, hyenas, and wild cats, along with wild boar, foxes, porcupines, and a variety of smaller mammals.

Table A4: Observations of large mammals and livestock by P. Kaczensky and J. Linnell during the 7 day field expedition in Badhyz Nature Reserve in September 2015.

Date	Wildlife and livestock observed						
	Urial	Gazelle	Fox	Hyaena	Leopard tracks	Wolf tracks	Wild boar tracks
10.09.2015	6	3					
11.09.2015	0	1				1	
12.09.2015	>64	2	1	1		1	
13.09.2015	8	5			1	1	
14.09.2015						1	
15.09.2015	35	7	2				
16.09.2015		1	2				
17.09.2015							1
Total	103	19	4	1	1	4	1

8.3.5 Summary of kulan situation in Badhyz 2015

Based on our own observations during 14 days in Badhyz and discussions with Islam Ishanov and Nury Hudaykuliev it became clear that very few kulan remained in Badhyz. No kulan groups had assembled in the reserve during winter-spring 2015 which had been their previous habit and that the spring counts had therefore been cancelled. In fact, that had been very few observations of kulan at all. It was clear that there were far fewer kulan using the reserve than had been estimated in previous years (last official estimate was 420 in 2013). The methodology used in previous years remains unclear, so it is not clear to what extent the current situation is due to a dramatic decrease in the last two years or due to methodological issues that led to overestimation in previous years, or both. Although we were not able to apply any formal survey methodology on our two visits in 2015 to the reserve, the very few observations of animals and signs in October 2014 (Kaczensky et al. 2015) and the total absence of observations in March / April 2015 would indicate that a few tens of animals at most are currently using the reserve on an occasional basis.

Discussions with Valery Kuznetsov (former director of Badhyz Nature Reserve in the mid-1970s) in Asgabat upon our return confirmed these concerns. Based on his own estimations (200-250 kulan in April / May 2013) and our failure to see any kulans he estimated that the population may be as low as 100 animals and not more than 300 animals.

Based on what we saw in 2014 and I 2015, we feel that the staff of the Badhyz Nature reserve are genuinely concerned about wildlife and kulan in particular. Within the boundaries of the reserve they are doing whatever is possible to combat poaching, providing additional water and even provide emergency feed for kulan in winter. They are, however, fully aware that Badhyz Nature Reserve has become an “island” of safety. Kulan leaving the reserve are subject to harassment and poaching outside their area of influence. The poor status of kulan is experienced as very frustrating by the reserve staff, as they feel they are made responsible for a conservation failure which is caused by circumstances (outside the reserve) that are outside their control. Seeing that they are about to lose an important icon of the Badhyz Nature Reserve, the reserve staff is even considering a captive breeding facility to increase kulan numbers in Badhyz in the hope of breeding a population that would stay inside the reserve.

The question remains open concerning what has happened to the kulan population. It is widely perceived that they have been subject to frequent poaching outside the reserve that could explain their decline. However, given what we know about the extreme mobility of kulan it is also possible that some portion of the population is using areas beyond the reserve that have not yet been identified.

Finally, many different views have been expressed concerning the potential presence of kulan in the border security zone to the west of border fence (in Pulhatyn Wildlife Sanctuary and the western part of Badhyz Nature Reserve). There is currently no recent information on the status of kulan in this area.

In conclusion, the kulan population in Badhyz Nature Reserve appears to be at an all-time low, bordering on extinction. Urgent action is needed to upgrade and integrate conservation actions within the reserve with those in the surrounding landscape. If issues such as poaching and over-grazing by livestock outside the reserve can be dealt with, it should be possible for the population to recover by itself given sufficient time. The World Heritage site nomination of Badhyz could be a key process to motivate these necessary actions.

8.4 Meana Chacha field investigation - September 2015

We spent 5 days, from 5th - 9th September 2015, in Meana Chacha Wildlife Sanctuary. The team consisted of Petra Kaczensky, John Linnell, Eldar Rustanov, Shirin Karryeva, Charymyrat Durdyev and Aman Gurbanov.

During our visit, no natural water sources were available for kulan or other wildlife within the sanctuary. No water was left in the Tedjen riverbed, Reservoir #2 was dry, and even the Durnali salt lake had dried up. The dried lake surface had conserved animal tracks since spring (e.g. multiple tracks of cranes), but lacked any tracks from kulan or gazelles; only domestic cows and camels had crossed the surface during recent months.

Access to water also seems to restrict livestock presence. The pasture around the well near the main ranger station of the wildlife sanctuary is totally consumed for several kilometers because of the heavy use by livestock (grazing & trampling; Fig. A4 left). Herders in a nearby camp are forced to only water their sheep every other day as the trip between the pasture and the well takes over 4 hours. Our impression was that the only intact pastures (Fig. A4 right) were left in areas too far from water to be useable. Consequently, where grazing was good for wild ungulates (good pasture, low disturbance by livestock & herding dogs) there was no access to water. The only reliable water sources are in irrigation canals to the north of the wildlife sanctuary, or in natural wells in the area of the sanctuary behind the border fence in the border security zone.

8.4.1 Kulan and gazelle observations

- The last observations of kulan were from spring 2015 when a group of 7 kulan and a group of 15 kulan were seen and photographed along the border fence.
- Interviews with herders suggested that no kulan had been seen in the area during the summer anywhere near wells or along the irrigation channels in Meana Chacha and the surrounding buffer zone.
- Several observations by herders, rangers and border guards (e.g. in 2011 a group of 45 kulan) suggest there may be kulan on the other side of the border fence in the border security zone. Although the fence constitutes an absolute barrier for kulan and gazelles, floods of the local rivers (e.g. in 2002 and 2009 along the Meana and Chacha rivers and in 1976, 1991 and 1998 on the Tedjen river) temporarily open holes in the border fence and may have allowed wildlife movements across the border fence.
- We failed to see any gazelles or find their tracks in Meana Chacha and the buffer zone. According to Charymurat, poaching remains a huge problem, and even if poachers are caught, the case is not followed up by the local police.

A 1-day trip to the former (ancient) Tedjen river course east of the buffer zone confirmed the lack of surface water (Fig. A5, A6). Along an old irrigation channel we saw a few gazelle and wolf tracks. Currently there were almost no herders with livestock in the area and the only herder we met was new to the area and did not know about kulan presence.



Fig. A4: Left photo: The pasture around the main well near the main ranger station of the wildlife sanctuary. Right photo: Largely ungrazed pasture far from water.



Fig A5. Overgrown shrubland behind Tedjen dam which does not often receive water, 3.09.2015. Photo: P. Kaczensky.



Fig A6. Dry bed of the Meana river, 6.09.2015. Photo: P. Kaczensky

8.5 Gury Howdan field investigation 2015

We spent half a day, on 4th September 2015, in Gury Howdan Wildlife Sanctuary. The team consisted of Petra Kaczensky, Shirin Karryeva and Aman Kurbanov.

According to Pranov Azat (head of Gury Howdan Wildlife Sanctuary) the population numbered 13 adult individuals of which 11 roam as a group which includes 2 foals, and 2 additional stallions roam separately.

During our half-day visit we saw the group of 11 animals and were able to collect scat samples from a place nearby, where they had obviously spent some time (tracks and scat piles). The group was wary, but not overly shy, and it was possible to approach within 100m on foot (Fig. A7). Poaching does not seem to be a problem in Gury Howdan.



Fig. A7: Kulan at Gury Howdan on a wheat stubble field. Only part of the group is seen in this image.

According to Pranov Azat, there are many complaints by local people about kulan damaging crops and consequently chasing kulan out of wheat fields and tree plantations has become a major part of the rangers' work. According to Pranov Azat, there are no natural water sources for kulan on this side of the border fence and thus kulan have to drink from livestock wells or from irrigation canals. The area south of the first mountain ridge of the Kopetdag range until the fence (ca. 8 km) seems to constitute poor kulan range due to its hilly terrain and the lack of water.

There seems to be very little potential to increase the size of this kulan population and it will not be viable in the long term. Genetic analysis of the scat samples showed low variability and high inbreeding, but also show that this group has some rare alleles which could contribute towards the overall variability of the subspecies (Kaczensky et al. 2018).

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