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## Water use of Asiatic wild asses in the Mongolian Gobi

P. Kaczensky, V. Dresley, D. Vetter, H. Otgonbayar & C. Walzer

### Abstract

Water is a key resource for most large bodied mammals in the world's arid areas. With the growing human population, access to water for wildlife often becomes compromised. Equids are typical inhabitants of semi-arid to arid rangelands and need regular access to fresh water. However, their water needs are difficult to study under free-ranging conditions. In this study we investigated Asiatic wild ass (*Equus hemionus*) use of permanent water points in the Great Gobi B Strictly Protected Area (SPA) in south-western Mongolia. We combined observational data from one specific water point with high frequency GPS location data from one radio-collared Asiatic wild ass mare. Observations and GPS data revealed that wild asses come to drink during all 24-hours of the day without an apparent diurnal pattern. The majority of wild asses came to the water point alone or in small groups. Other ungulates were largely ignored by wild asses, but the arrival of humans and their transportation devices almost always resulted in flight behaviour. The monthly drinking frequency varied from every 1.5 to 2.2 days during the hot and dry season in June and August to every 2.3 to 3.8 days in April, May and September. Longer intervals between successive visits to permanent water points may explain why Asiatic wild asses can make use of pastures further away from water than sympatric Przewalski's horses (*Equus ferus przewalskii*). The lack of a clear diurnal pattern suggests that there is no specific time window in which wild ass are particularly vulnerable to disturbances at water points. However the high disturbance potential of humans and their transportation devices makes it desirable to restrict human impact at water points by re-routing transportation routes, or requiring a minimum distance from water for herder camps and wildlife viewing facilities.

**Keywords:** Asiatic wild ass, diurnal pattern, *Equus hemionus*, Gobi, Mongolia, water use

### 1. Introduction

Water is a key resource for most large bodied mammals in the world's dry lands. Although some bovids like the Arabian oryx (*Oryx leucoryx*; OSTROWSKI et al. 2003) or Addax antelopes (*Addax nasomaculatus*, HUMMEL et al. 2007) can survive without access to open water, most other large ungulates need to drink regularly (GAYLARD et al. 2003). Many water sources in arid landscapes used by wildlife are necessarily shared with humans and their livestock. With a growing human population, access to water for wildlife often becomes compromised (ANDREW et al. 1997, KACZENSKY et al. 2006). Thus understanding the requirements and constraints of water intake in wild ungulates is of high conservation interest in order to mitigate competition for this scarce resource.

Wild and domestic equids are typical inhabitants of semi-arid to arid rangelands. Whereas wild- and domestic horses (*Equus ferus przewalskii* & *E. caballus*) and Plains- and Mountain zebras (*E. burchelli* & *E. zebra*) seem adapted to mesic savanna and steppe habitats, donkeys (*Equus asinus*), asses (*Equus hemionus* & *Equus kiang*) and Grévy's zebras (*Equus grevyi*) can make a living in arid semi-deserts and deserts (BAUER et al. 1994, MOEHLMAN 1998, KACZENSKY et al. 2008). Unfortunately, water needs of free-ranging equids in arid ecosystems are difficult to study. Animals range over large areas and tend to quickly quench their thirst without lingering around water points due to a high disturbance or predation risk and the presence of blood sucking insects (GAYLARD et al. 2003, KACZENSKY et al. 2006).

Reliable data on how often wild asses have to drink are lacking, but it is often assumed that they can "regularly do without water" (e.g. BAHLOUL et al. 2001: Page 320). However, range con-

traction around water sources (KACZENSKY et al. 2007) and shortest distance to the nearest water source during the summer months show that availability of water is an important factor determining space and habitat use in asses (KACZENSKY et al. 2008).

According to MALOIJ (1970) a domestic Somali donkey “can survive a loss of water corresponding to 30% of its original body weight even at an ambient temperature of 40°C, and can drink in 2-5 min enough water (24-30 liters) to restore its deficit”. In his experiments MALOIJ (1970) and MALOIJ & BOARER (1971) deprived donkeys of water at 22°C for up to 20 days. However, in a captive environment natural conditions are difficult to simulate. Depriving an animal of important resources in a metabolic chamber simultaneously deprives it of its choices, while confining it to a very limited space. If on the other hand resources are readily available, they will likely be used opportunistically, revealing little about how long an animal can or is willing to go without these resources in the wild (e.g. SCHEIBE et al. 1998).

In this study we investigated the use of permanent water points by Asiatic wild ass in the Great Gobi B Strictly Protected Area (SPA) in south-western Mongolia. We combined observational data from one specific water point with high frequency GPS location data from one radio-collared animal followed over one year. With our data we addressed the following questions:

- How is the diurnal pattern of drinking events in Asiatic wild asses ?
- How do Asiatic wild asses react to other species and humans at water points ?
- How often does an Asiatic wild ass drink and how long can it go without water ?
- How is the seasonal pattern of drinking events in the Asiatic wild ass ?

## 2. Study area

The Great Gobi B Strictly Protected Area was established in 1975 and encompasses some 9,000 km<sup>2</sup> of desert steppes and semi-deserts (ZHIRNOV & ILYINSKY 1986; fig. 1). The climate of the Great Gobi B Strictly Protected Area is continental with long cold winters and short, hot summers. Average annual temperature is 1°C and average annual rainfall is 96 mm with a peak during summer. Average snow cover lasts 97 days. Rain and snowfall can be highly variable from year-to-year in space and time (ZHIRNOV & ILYINSKY 1986, KACZENSKY unpubl. data).

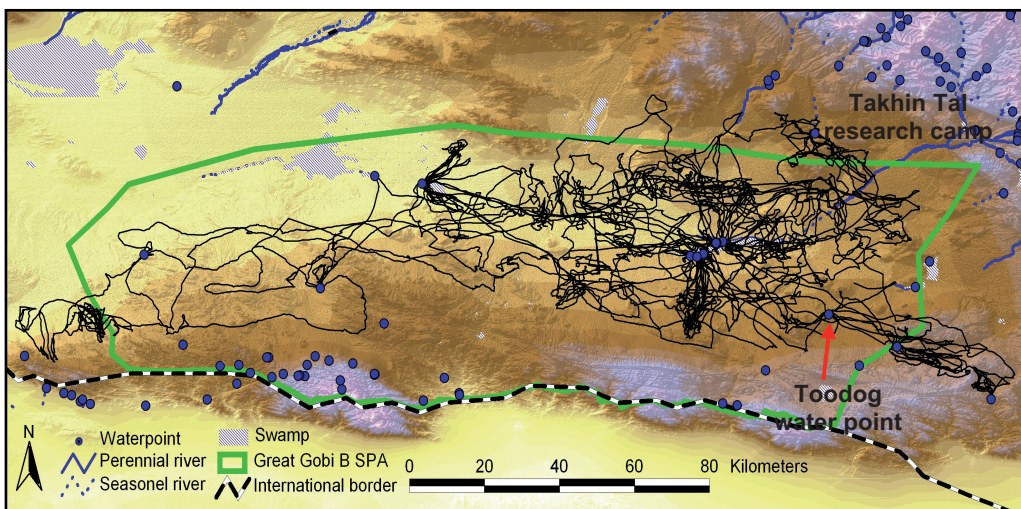


Fig. 1: Study area showing the distribution of permanent water and the movement path of a collared wild ass mare from July 2007-June 2008.

The landscape of the Great Gobi B Strictly Protected Area is dominated by plains in the east and rolling hills in the west. The Altai Mountains flank the park to the north, and the Takhin Shar Naruu Mountains form the southern border with China. Elevations range from 1,000 to 2,840 m. Open water (rivers & springs) is unevenly distributed with almost no water in the central or western part of the park (fig. 1). In locations where several springs occur, they are surrounded by intermittent swamps and form oases. Desert areas are widely dominated by Chenopodiaceae, such as saxaul *Haloxylon ammodendron* and *Anabasis brevifolia*. The steppe areas are dominated by Asteraceae, such as *Artemisia* and *Ajanía*, and Poaceae like *Stipa* and *Ptilagrostis* (VON WEHRDEN et al. 2006).

The SPA is used by ~100 families with ~60,000 head of livestock (sheep and goats, horses, cattle and camels), predominantly in winter and during the spring and autumn migration (KACZENSKY et al. 2007). In summer, human presence in the park is almost negligible. Poaching occurs but, based on the small number of wild ass carcasses found during this study, seems to be of minor importance compared to other Gobi areas (KACZENSKY et al. 2006). Other wild ungulates of the steppe areas are goitered gazelle *Gazella subgutturosa* and Przewalski's horse. The only large mammalian predator is the grey wolf *Canis lupus* (KACZENSKY et al. 2008).

### 3. Methods

Timing of wild ass drinking at the Toodog water point (fig. 1) was monitored for 190 hours on 42 days between 20 June and 31 July in 2004 and for 282 hours on 18 days between 27 July and 16 August in 2006. We defined wild ass groups as drinking, when the majority of animals reached the water's edge. Animals were observed with binoculars from a hill about 300m from the water. Night time observations were restricted to nights around full moon. Besides group size and date & time of arrival, we also recorded all interactions with other ungulates, carnivores or humans. We classified the behaviour of the wild asses towards the "intruder" as: indifferent (no apparent reaction), alert (looking towards with ears pricked), approaching (moving towards) or flight behaviour (trotting or galloping away).

In July 2007 we collared 10 wild ass with GPS store-on-board collars (GPS SOB Gen1, built by our own institute) that recorded a GPS position every 15 min (for details on capture and chemical restraint see WALZER et al. 2007). All collars were equipped with pre-programmed drop-off devices that released the collar on 10 July 2008. A VHF unit allowed for collar retrieval using standard ground telemetry. Although we were able to retrieve all collars only the collar on a 6-7 year old pregnant mare, captured on 5 July 2007, performed as expected (KACZENSKY & WALZER *in prep.*). From 5 July 2007 until 16 June 2008 the collar recorded 33,027 GPS locations. We calculated the total range covered during the monitoring period as minimum convex polygon of all GPS locations (100 % MCP).

Permanent water points and rivers had been digitized from Russian topographic maps and were confirmed by GPS readings of hand held units in the field. We discovered only few additional water points during field work since 2001; all new water points were subsequently added to the known water points. We defined a drinking event to occur when a GPS location was within 500 m of a permanent water point. For the timing of a drinking event we used the time of an animal arriving within 500 m of a water point. To calculate the frequency of drinking events per month we only used the first drinking event per day. Because in July 2007 5 days and in June 2008 14 days of GPS locations were missing we added additional drinking events by extrapolating from the number and frequency of drinking events for the days monitored in the respective month. All analysis was done in ArcView 9.2. (ESRI, Environmental Systems Research Institute, Inc., Redlands, California, USA) with the Hawth's tools extension (<http://www.spatial ecology.com/services.php>).

We monitored daily temperatures and precipitation using a Hobo H8 datalogger (Hoskin Scientific Limited, Vancouver, Canada) at the Takhin Tal research camp. We defined seasons based on average ambient temperatures and precipitation (fig. 4). Winter: December to February has



cold temperatures (mean per month: -14 to -21°C) and a high probability of snow cover. Spring: March to May has moderate temperatures (mean per month: -11 to 13°C) and snow melt provides small puddles and creeks as alternative water sources. Summer: June to August has hot temperatures (mean per month: 15 and 20°C) and the highest probability of rain resulting in ephemeral puddles and rivers. Fall: September to November has moderate temperatures (mean per month: -12 to 12°C) and a low probability of rain or snow.

#### 4. Results

##### *Observations at Toodog waterpoint*

During the 472 observation hours at Toodog water point we observed 685 groups of wild ass (455 in 2004 and 230 in 2006) totalling 4,115 animals (2,271 in 2004 and 1,844 in 2006). The majority of wild asses came alone or in small groups (fig. 2). Only 9-times did we observe groups > 50 animals arriving simultaneously; the largest counted 515 members. Wild ass groups arrived during all hours, day and night, without any apparent diurnal pattern (fig. 3a). Whereas the arrival of other ungulates was largely ignored, arrival of humans and their transportation devices almost always resulted in flight behaviour (table 1).

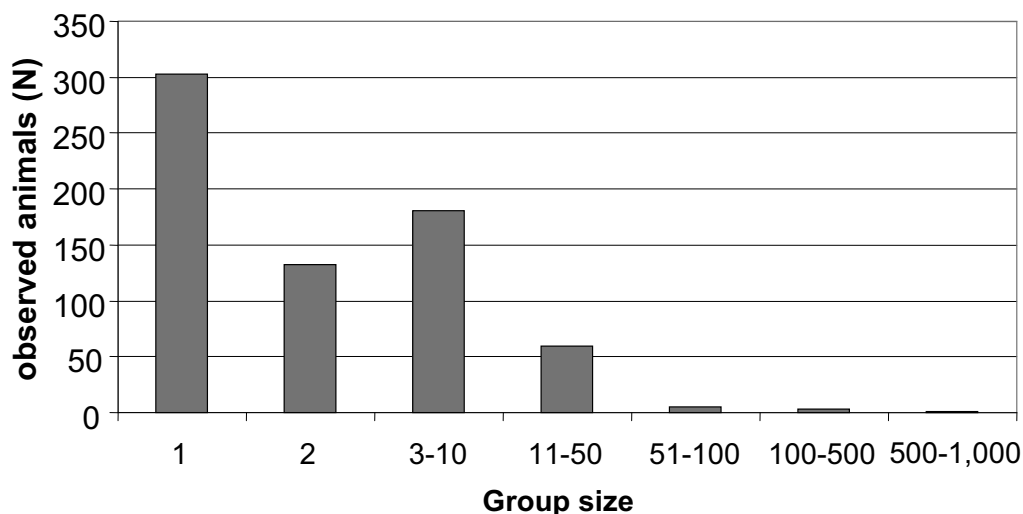


Fig. 2: Group size distribution of wild ass coming to drink at Toodog waterpoint.

Table 1: Interactions of wild ass with other species at Toodog water point

Species	Behaviour of wild ass towards other species			
	indifferent	alert	approaching	flight behaviour
Przewalski's horse	1			
Gazelle	39	15	1	1
Camel		2		
Wolf	1			1
Pedestrian				2
Motorbike				1
Jeep		1		6
Truck				2

*Data from radio-collared Asiatic wild ass mare*

The radio-collared Asiatic wild ass mare roamed over a total area of 9,122 km<sup>2</sup> and visited seven permanent water points, three permanent rivers/small streams and one large oasis complex with multiple springs during all 24-hours of the day (fig. 3b). The frequency of drinking events showed a seasonal pattern with 48 drinking events in summer, only 3 events in winter and intermediate values in spring (27) and fall (13; fig. 4). The monthly drinking frequency at permanent water points varied from an average of every 1.5 days in June to not at all in January. The longest periods without visiting a permanent water point were recorded from mid-December to end of February (max: 69.5 days), the shortest in June (max: 2.6 days) and August (max: 2.9 days; fig. 4).

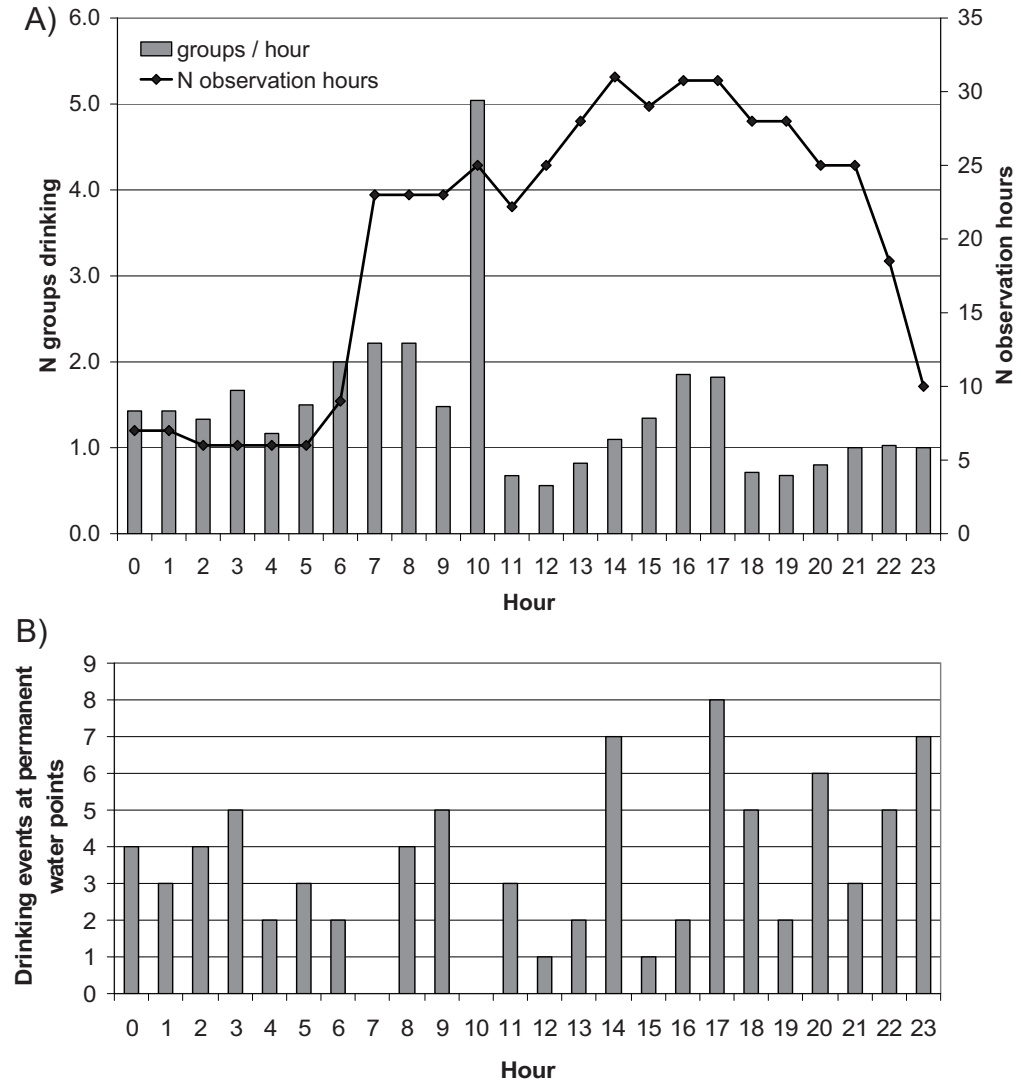


Fig. 3: Diurnal pattern of drinking events in Asiatic wild ass. A) Observations of groups of wild ass at Toodog waterpoint in June/July 2004 and July/August 2006. B) Drinking events at permanent water points by a radiocollared wild ass mare between July 2007 and June 2008.

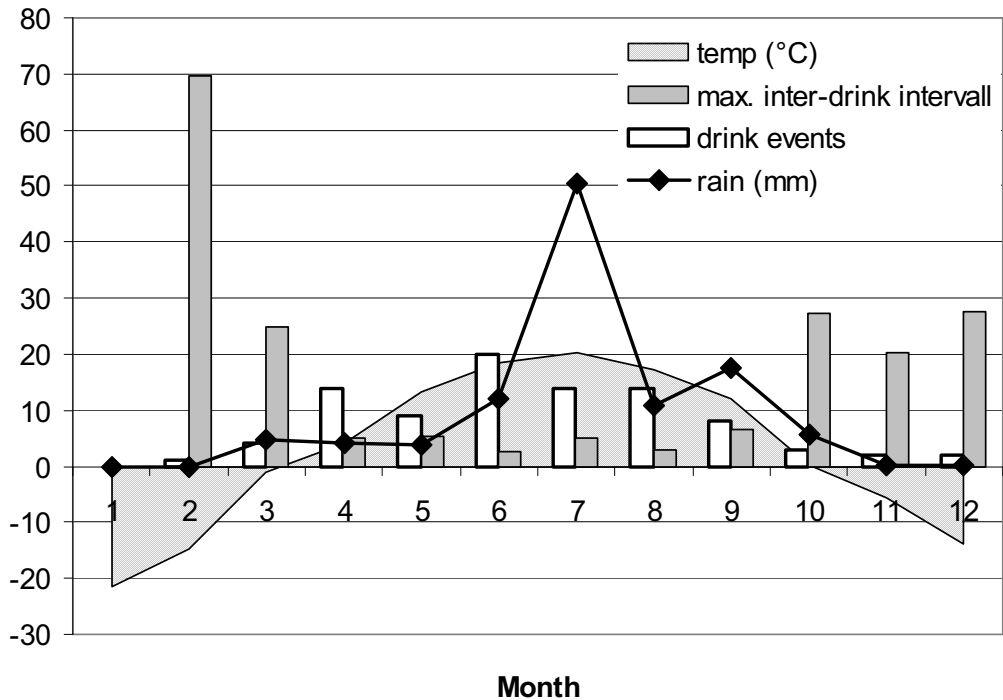


Fig. 4: Number of drink events, maximal length of intervals between successive drinking events (inter-drink interval) by a radiocollared wild ass mare relative to average ambient temperature and rainfall between July 2007 and June 2008.

## 5. Discussion

### *Frequency of drinking events*

The biggest constraint in our individual data is that we were unable to temporally and spatially map ephemeral water sources like seasonal rivers, rainfall puddles, local snow accumulations and their melt-off creeks. Thus our data can only provide minimum estimates of drinking events during periods when water availability is most constrained.

Our data strongly suggests that the Asiatic wild ass mare did not need to drink daily, but rather every 1.5 to 2.2 days during the hot and dry season in June and August and on average every 2.3 to 3.8 days in April, May and September. The fact that the intervals between successive drinking events in June and August were at most 2.9 days apart, suggests that the animal needed or wanted to drink at least every 3<sup>rd</sup> day during the hot season (see fig. 4). During the cooler, but also rather dry months April, May and September the animal had maximal intervals of 5-6 days between drinking events. In winter snow seems to constitute the main source of water as the collared mare did not visit any water points from mid December until the end of February.

Preliminary results suggest that sympatric Przewalski's horses visit permanent water points almost daily from spring to fall (Kaczensky et al. 2008, O. Ganbaatar and P. Kaczensky unpubl. data). The fact that Asiatic wild asses may only have to drink every other day during the hot season and less frequently in spring and fall explains why Asiatic wild asses can travel larger distances and can make use of pastures farther away from water than Przewalski's horses (KACZENSKY et al. 2008). The radio-collared mare was pregnant when captured in July 2007, but we do not know if or for how long a suckling foal accompanied her. If she was indeed lactating, our estimates represent the requirements of the most vulnerable portion of the population.

This would result in stallions and solitary mares being able to make use of pastures even further away from water, as has been shown for Gevy's zebras in Kenya (RUBENSTEIN 1989).

#### *Diurnal pattern of drinking events*

The individual data and the observations at Toodog water point showed no diurnal pattern in wild ass visits to water sources. Thus wild ass can be expected to drink at any time during day and night. Lacking a clear diurnal pattern entails that wild ass will eventually meet herders and their livestock at water points and be disturbed or displaced. The good news is that there is no specific time window in which wild ass are particularly vulnerable to disturbances at any one water point. Furthermore wild asses seem to come to drink preferably alone or in small groups. Thus a car passing by a water point will only displace a small subset of the wild ass population.

However the high disturbance potential of humans and their transportation devices gives raise to concern. Over the wild ass range new transportation routes should be planned well away from permanent water points. In protected areas existing dirt tracks (often army or border post routes) passing by permanent water points should be re-routed away from water points. In addition, herders should not be allowed to camp next to a permanent water point, but remain at least 500-1000m away or out of the direct line of sight. Wildlife viewing opportunities also have to be carefully designed in order to allow access of people to and from the observation posts while minimizing disturbance to wildlife at water points.

When water is sufficiently abundant, unguarded large livestock like camels, horses or cattle seem to constitute little disturbance potential. However, observations in other areas where water availability is restricted to few small water holes, large livestock has been observed to block water access for wild asses and other wildlife (DENZAU & DENZAU 1999, KACZENSKY et al. 2006). In protected areas permanent water points should be managed to minimize the impact of humans and their livestock and thus allowing unrestricted access for wildlife.

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