Chapter 7

Status and Action Plan for the Przewalski's Horse (*Equus ferus przewalskii*)

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7.1 Nomenclature and conservation status

Scientific name:
Equus ferus przewalskii (Groves 1986)

Important synonyms:
Equus przewalskii, *Equus caballus przewalskii*

Common names:
Przewalski's horse, Przewalski's wild horse, Asiatic wild horse, Mongolian wild horse, Takhi

Indigenous names:
Takh or Takhb (Mongolia)

IUCN Red List Category (version 2.3):
Equus ferus przewalskii **EW** Extinct in the Wild

CITES Listing:
Equus ferus przewalskii Appendix I

7.2 Biological data

7.2.1 Introduction

Although Przewalski's horse can hybridise with domestic horses to produce fertile offspring (Ryder *et al.* 1978; Trommerhausen-Smith *et al.* 1979), the existence of 2n=66 chromosomes in Przewalski's horse identifies it as being more different from its domestic relatives (2n=64) than are any two breeds of domestic horse (Ryder 1994). They also show a number of other consistent differences in their appearance: the manes of Przewalski's horses are erect with no forelock, and the upper part of the tail has short guard hairs, unlike domestic horses, which have long, falling manes and long guard hairs all over the tail; a dark dorsal stripe runs from the mane down the back and dorsal side of the tail to the tail tuft; three to ten dark stripes can be present on the carpus and, generally, the tarsus (Groves 1994). Przewalski horses, contrary to domestic horses, shed their tail and mane hair once per year.

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Przewalski's horse (*Equus ferus przewalskii*).

Other studies of the genetic differences between Przewalski's and domestic horses have indicated very little genetic distinction between them. Only four alleles at four separate serological marker loci have been identified as specific to Przewalski's horse (Bowling and Ryder 1987), the vast majority of blood protein variants are present in both Przewalski's and domestic horses and even the fastest evolving DNA region known in mammals (the mitochondrial DNA control region), does not show significant differences between the two types of horse (Ishida *et al.* 1995; Oakenfull and Ryder 1998). Thus it is clear that Przewalski's and domestic horses are very closely related and have in the past interbred, but the fixed chromosomal number difference between them indicates that they are distinct populations (Oakenfull *et al.* 2000).

7.2.2 Historic distribution

The first visual account of Przewalski's-type wild horses date from more than 20,000 years ago. Rock engravings, paintings, and decorated tools dating from the late Gravetian to the late Magdalenian (20,000–9,000 BC), consisting of 2,188 animal pictures were discovered in caves in Italy, western France, and northern Spain; 610 of these were horse figures (Leroi-Gourhan 1971). Cave drawings in France, at Lascaux and Niaux, show horses that look like Przewalski's horse (Mohr 1971). In prehistoric times, the species probably roamed widely over the steppes of central Asia, China, and western Europe (Ryder 1990).

The first written accounts originate from Tibet. The monk Bodowa, who lived around 900 AD, recorded them. In the "Secret History of the Mongolians", there is also a reference to wild horses that crossed the path of Genghis Khan during his campaign against Tangut in 1226, causing his horse to rear and throw him to the ground (Bokonyi 1974). That the wild horse was a prestigious gift, perhaps denoting its rarity or that it was difficult to catch, is shown by the presentation of a Przewalski's horse to the emperor of Manchuria by Chechen-Khansoloj-Chalkaskyden, an important Mongolian, circa 1630 (Zevegmid and Dawaa 1973). In a Manchurian dictionary of 1771, Przewalski's horse is mentioned as "a wild horse from the steppe" (Dovchin 1961).

Przewalski's horse was not described in Linnaeus's "Systema Naturae" (1758) and remained largely unknown in the West until first mentioned by John Bell, a Scottish doctor who travelled in the service of Tsar Peter the Great in 1719–1722 (Mohr 1971). His account of the expedition, "A Journey from St Petersburg to Peking", was published in 1763. Bell and subsequent observers all located horses known at that time within the area of 85–97° E and 43–50° N.

Wild horses were reported again from what is now China by Colonel Nikolai Michailovich Przewalski, an eminent explorer, at the end of the nineteenth century. He made several expeditions by order of Tsar Alexander the Second to central Asia, aiming to reach Tibet. While returning from his second expedition in central Asia, he was presented with a horse's skull and hide at Zaisan on the Chinese-Russian border. The horse had been shot about 80km north of Gutschen. The remains were examined at the Zoological Museum of the Academy of Science in St Petersburg by I.S. Poliakov, who concluded that they were a wild horse, which he gave the official name *Equus przewalskii* (Poliakov 1881). However, current scientific review of the taxonomy wild equids (Groves 1986) describes Przewalski's horse as *Equus ferus przewalskii*.

Further reports came from the brothers Grigory and Michael Grum-Grzhimailo, who travelled through western China from 1889–1890. In 1889, they discovered a group in the Gashun area and shot four horses, three stallions, and a mare. The four hides and the skulls of the three stallions, together with an incomplete skeleton, were sent back to the Zoological Museum in St Petersburg. They were able to observe the horses from a short distance and gave the following account: 'Wild horses keep in bands of no more than ten, each herd having a dominant stallion. There are other males, too, but they are young and, judging by the hide of the two-year old colt that we killed, the dominant male treats them very cruelly. In fact, the hide showed traces of numerous bites' (Grum-Grzhimailo 1892).

7.2.3 Historical population estimates and trends

Since the 'rediscovery' of the Przewalski's horse for western science, western zoos and wild animal parks became interested in this species for their collections. Several long expeditions were mounted to catch animals. Some expeditions came back empty handed and some had only seen a glimpse of Przewalski's wild horse. It proved difficult to catch adult horses, because they were too shy and fast. Capture of foals, with possible killing of the adult harem members, was considered the only option (Bouman and Bouman 1994). Four capture expeditions that managed to catch live foals took place between 1897 and 1902. Fifty-three of these foals reached the west alive. Between the 1930s and the 1940s only a few Przewalski's horses were caught and most died. At least one mare was crossbred with domestic horses by the Mongolian War Ministry. One mare (Orliza III), particularly through her son Bars, was of great importance to breeding in the west (Bouman and Bouman 1994).

Small groups of horses were reported through the 1940s and 1950s in an area between the Baitak-Bogdo ridge and the ridge of the Takhin-Shara-Nuru (which, translated from Mongolian, means "the Yellow Mountain of the Wild Horse", Figure 7.1), but numbers appeared to decline dramatically after World War II. A number of causes have been cited for the final extinction of Przewalski's horses. Among these are significant cultural and political changes

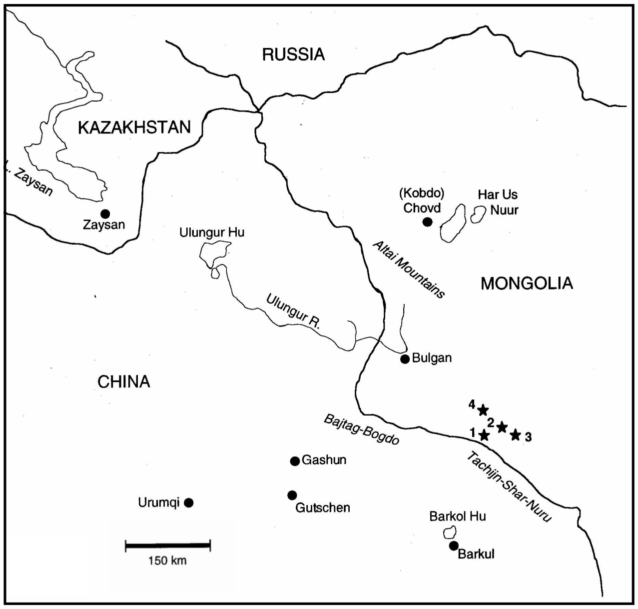

Figure 7.1. Area of the known geographical range and last sightings for Przewalski's horse (*Equus ferus przewalskii*) prior to extinction. Starred locales are natural wells or springs where wild horses were sighted: 1. Jargat-us 2. Todgijn-us 3. gun-Tamga 4. Tachijn-us.

(Bouman and Bouman 1994), hunting (Zhao and Liang 1992; Bouman and Bouman 1994), military activities (Ryder 1993), climatic change (Sokolov *et al.* 1992), and competition with livestock and increasing land use pressure (Sokolov *et al.* 1992; Ryder 1993; Bouman and Bouman 1994). Capture expeditions probably diminished the remaining Przewalski's horse populations by killing and dispersing the adults (S. Dulamtseren in Van Dierendonck and de Vries 1996). The harsh winters in 1945, 1948, and 1956 probably had an additional impact on the small population (Bouman and Bouman 1994). Increased pressure on, and rarity of waterholes in their last refuge should also be considered as a significant factor contributing to their extinction (Van Dierendonck and de Vries 1996).

The last confirmed sighting in the wild was made in 1969 by the Mongolian scientist N. Dovchin. He saw a stallion near a spring called Gun Tamga, north of the Tachin-Shara-Nuru, in the Dzungarian Gobi (Paklina and Pozdnyakova 1989). Annual investigations by the Joint Mongolian-Soviet Expedition have since failed to find conclusive evidence for their survival in the wild (Ryder 1990). Chinese biologists conducted a survey in north-eastern Xinjiang from 1980 to 1982 (covering the area of 88–90° E and 41°31'–47°10' N) without finding any horses (Gao and Gu 1989). The last wild populations have almost certainly disappeared.

7.2.4 Present distribution

The only free-ranging populations are those associated with the recent reintroduction projects in Mongolia.

7.3 Ecology and habitat

The historic range is not known and there has been much debate about the areas in which Przewalski's horses were last seen: was it merely a last refuge or was it representative of the typical/preferred habitat? The Mongolia Takhi Strategy and Plan Work Group (MTSPWG 1993) concluded that the historic range may have been wider but that the Dzungarian Gobi, where they were last seen, was not a marginal site to which the species retreated. Although grass and water is more available in other parts of Mongolia, these areas often have much harsher winters. Of all the wild horse species, the Tahki was the one with the most eastern distribution and was most likely well adapted to the arid steppe of the Dzungarian Gobi (Zimmermann 1999)

An alternative viewpoint of the desert-steppe controversy is that the Eurasian steppe should be considered the Takhi's optimal habitat (Van Dierendonck and de Vries 1996). This would suggest that Przewalski's horses were forced into sub-optimal ranges such as the arid Gobi, as the more favourable steppe region was colonised by nomadic pastoralist people over several millennia. Studies of feral horses have shown that they are able to live and reproduce in semi-desert habitats but their survival and reproductive success is clearly sub-optimal compared to feral horses on more mesic grassland (Berger 1986). Van Dierendonck and de Vries (1996) suggest that the Tahki is primarily a steppe herbivore that can survive under arid conditions when there is access to waterholes.

Lomolino and Channell (1995) examined the patterns of range collapse in 31 species of endangered terrestrial mammals. Extant populations of 23 out of the 31 cases were located along the periphery, not the centre, of their historic range. They attributed this to two characteristics of peripheral populations: (i) isolation from (mainly anthropogenic) disturbances; and (ii) because they tend to be ecologically and genetically dissimilar from each other and from populations at the centre of the species range – one of the many and diverse peripheral populations may, therefore, be pre-adapted to the disturbances that drove the more central populations to extinction. Lomolino and Channell (1995) concluded that sites along the periphery of a species' historic range (including islands) may actually represent critical refugia for many endangered species.

7.4 Captive populations

7.4.1 Captive breeding

The Przewalski's horse is extinct in its natural habitat and survives due to captive breeding (Ryder 1994). The total number of living specimens recorded in the studbook as of

31/12/1999 is 1590 (Kus pers. comm.). These individuals are mainly descended from Przewalski's horses, but have a significant and incompletely documented contribution from domestic stock (Seal *et al.* 1990).

Of the 53 animals recorded in the studbook as having been brought into zoological collections in the west, only 12 contribute any genes to the current living population. Of these, 11 were brought into captivity in 1899–1902 and the last of them died in 1939. The one wild horse that has been bred into the population since then is the mare 231 Orlitza III, captured as a foal in 1947. A thirteenth founder is stallion 56 Halle 1, born in 1906 in Halle (Germany) to a wild caught stallion and a domestic Mongolian mare, which was one of the foster mothers used to nurse the Przewalski's foals during their journey to European collectors. Although the 12 founders taken from the wild are officially recorded as being of truly wild origin, one of them, a mare (18 Bijsk 8) is suspected, on the basis of phenotypic evidence, as having domestic horse ancestry (Dolan 1982). Because of this suspicion 18 Bijsk 8 is usually assumed to be an F1-hybrid (Przewalski's × domestic horse) in genetic analyses (Geyer and Thompson 1988; Geyer, Thompson, and Ryder 1989). Accounts of travellers in Mongolia and of those associated with the transfer of Przewalski's horses to European and American buyers at the turn of the century have also questioned their purity (Mohr 1971). In addition, recent research has identified at least one other domestic founder, 175 Domina, from the Askania Nova line, who was most likely a tarpan-like domestic horse (Bowling, in press).

Genetic drift and bottlenecks in the history of the captive population have resulted in the loss of some of the genetic diversity represented by the original founders. In fact, taking into account the combined effects of skewed founder contribution and gene loss, the number of new founders that would be required to start a captive population with the level of genetic diversity currently retained in the existing populations (known as the Founder Genome Equivalent) is 3.31 (Ballou 1994). The genetic bottleneck that conclusively defined the extent of the surviving gene pool occurred as a result of the capture, transfer to captivity, and variable reproductive rates of the individuals removed from the wild, with these initial poor breeding successes resulting in a slow rate of population growth. In addition, there has been artificial selection, orientated largely towards the production of a phenotype that resembles the descriptions made of museum specimens of wild individuals (e.g. Salensky 1907), which biased the genetic contribution of each founder.

Inbreeding depression also played a role in the population genetic history of Przewalski's horse. Studies have indicated that inbreeding was associated with increased juvenile mortality and shorter lifespan (Bouman and Bos 1979; Bouman-Heinsdijk 1982). Additional studies by Ballou (1994) have shown that there is a decrease in survival of about 2–3% for each 10% increase in inbreeding in the Przewalski's horse – this is substantially less than for many other mammalian species (Ralls *et al.* 1988). Inbreeding depression only becomes a significant mortality factor in extremely inbred ($F>0.4$) Przewalski's horses; at this level of inbreeding, infertile stallions were also produced. It is believed that Przewalski's horse did not have a system of close inbreeding in the wild, so it is surprising that they do not show higher levels of depression when inbred (Buisman and van Weeren 1982). However, the level of their susceptibility also reflects stochastic sampling of founders; by chance alone the founders may have been free of the deleterious alleles that cause inbreeding depression.

A study of outbreeding depression (potential detrimental effects of breeding conspecifics too distantly related to each other, as when founders have been acquired from geographically different sources) looked at the potential for outbreeding depression from several sources (Ballou 1994): 1) the domestic mare founder, 2) founder #18 Bijsk 8 (if treated as an F1 domestic/ Przewalski's hybrid), and 3) founder #231 Orlitza III, who entered the population much later than the other founders. None of the outbreeding effects was negative; in fact, there was a significant positive effect of hybridisation on survival from founder #231, reflecting the beneficial effects of a new founder being brought into an inbred population.

At the end of World War II there were only 31 Przewalski's horses in captivity. Of these, only 12 were reproductive (Zimmermann 1997). A more organised captive breeding effort was needed to secure the future of the species. An important development came in the 1950s with the creation of the studbook, which first appeared as a supplement to the monograph "Das Urwildpferd" (Mohr 1959), and contained entries for the 228 animals in captivity between 1899 and 1958. Updated studbooks were published annually thereafter by Prague Zoo (Volf 1960–1990; Volf and Kus 1991; Kus 1995, 1997). The Przewalski's horse symposia on genetic management, inbreeding depression, and hereditary disease were further steps to a better understanding of the breeding history and its influence on population development and management (Bouman and Bos 1979). Prague Zoo organised the First International Symposium on the Preservation of the Przewalski's Horse in 1959, and four more symposia were held in 1965, 1976, 1980, and 1990. The Sixth International Symposium was held in Kiev and Askanya Nova, Ukraine, in October 1999.

By 1979, there were 385 Przewalski's horses in captivity, distributed over 75 institutions in Europe, North America, and Cuba. However, with the likelihood that the species was now extinct in the wild, the potential problems of long-term breeding of the captive population with no hope of additional founders became a reality. Therefore, in

1979, breeders of Przewalski's horse met to form a North American breeders group, which became the Species Survival Plan (SSP) for the Przewalski's horse. In 1986, the European Endangered Species Programmes (EEP, from the Europäisches Erhaltungszucht Programm) were accepted for several endangered species, including Przewalski's horse. This now includes the horses from the former Joint Management of Species Group Programme in the UK. There is an Australasian Species Management Programme (Wilkins 1995) and captive breeding efforts in the former Soviet Union are coordinated through the All-Union Federation of Zoological Parks. About half of the global captive population is now within these managed programmes and represents almost all of the surviving founder genes (Ryder *et al.* 1993). The main objective of these programmes is to retain 95% of the current average individual heterozygosity for at least 200 years. Husbandry guidelines have been produced (Zimmermann and Kolter 1992) and a comprehensive summary of the biology of the species has been published (Boyd and Houpt 1994).

An additional objective of the programmes is to produce animals for reintroduction into the wild. The captive space required by Przewalski's horse also has to be balanced against the requirements of programmes for other equid taxa. This is to be addressed through Regional Collection Plans drawn up by the regional Equid Taxon Advisory Groups, which have started in Europe, North America, and Australasia. A Captive Management Masterplan (Ryder *et al.* 1993) determined that the captive populations in Europe and North America could be reduced to make space available for other equids, without compromising the goals of the Global Masterplan. The growth rate of the population can be manipulated relatively easily through the use of single sex groups and immuno-contraceptive vaccine (Kirkpatrick *et al.* 1993).

7.4.2 Research activities

There is an active research programme involving horses in zoological collections, release, and reintroduction projects. The lack of the appropriate forms and quantities of vitamin E in the diet in captivity has led to locomotion problems (ataxia) and is being investigated. The social behaviour of Przewalski's horses may differ from that of other harem-forming equids and the correct development of social behaviour, particularly in stallions, is also a crucial aspect in the development of released groups. In addition, research projects are underway or have been carried out in semi-reserves, wild animal parks, zoos, museums, and research laboratories on a whole range of topics, including communication systems, drinking behaviour, helminthic infections, dunging behaviour, feeding ecology, time budgets, coat colour genetics, physiology, social structure, and mating strategies in relation to paternity.

Similar to the effect of other herbivores, a certain grazing pressure by Przewalski horses was shown to increase plant diversity (at Eelmoor Marsh, a semi-reserve in the UK, and at Le Villaret, France) and there is clear potential for using Przewalski's horses as a means of managing certain habitat types to achieve other nature conservation goals.

7.4.3 Release projects outside the historic range

Many semi-reserves are established worldwide to breed Przewalski horses in more natural environments, to keep bachelor herds, and to prepare some of the individuals for reintroduction. Four release projects occupying large areas have been conducted at Le Villaret (Massif Central, France), in Buchara (Uzbekistan), the Hortobágy-National Park, Hungary, and Chernobyl, Ukraine – with a view to establishing self-sustaining breeding populations that can demonstrate natural social processes. The largest of these, in a predator-free fenced area (5126ha) is in Uzbekistan (Pereladova *et al.* 1999). In Uzbekistan, four stallions and six mares were introduced in a 5,126ha fenced acclimatisation area at the Bukhara Breeding Centre in the Kyzylkum Desert between 1987 and 1990 (Pereladova *et al.* 1999; studbook data 1997). Since 1992, 17 foals have been born and the population numbered 16 in 1998. A monitoring study (Pereladova *et al.* 1999) concluded that zoo-bred horses were able to adapt to the desert conditions. Twenty-one individuals were released in the Chernobyl exclusion zone, Ukraine, in 1998; four foals were born in 1999 (Dvojnos *et al.* 1999). At Le Villaret, 11 horses (five stallions, six mares) were released in 1993/1994 to a 400ha secondary steppe area. In the absence of human intervention, the population increased to 40 animals by the end of 2000. The herd naturally organised itself into four family groups and one stallion group.

The reduction of genetic variation through past genetic bottlenecks and many generations in captivity raised concerns that today's horses have reduced abilities, behaviourally and genetically, to survive in the wild. However, release projects have shown that they can adjust successfully to free-ranging conditions and develop functional social structures. Furthermore, observations of the first free-ranging groups in Mongolia provide additional confirmation of their ability to survive (Van Dierendonck *et al.* 1996; Bouman 1998).

7.5 Current conservation measures

There is a strong will among those working with Przewalski's horses to conserve the species using modern techniques of gene pool management and by the reintroduction of the species to its historic range (Ryder 1990). In 1985, an expert consultation was organised by the Food and Agricultural Organisation of the United Nations and the United Nations Environment Programme in Moscow to draw up an action plan for the reintroduction of the Przewalski's horse into Mongolia (Food and Agricultural Organisation 1986). At the Fifth International Symposium on the Preservation of the Przewalski's Horse (Leipzig Zoo, 19–23 May 1990), breeders and delegates from Mongolia, China and the former Soviet Union reiterated their interest in the reintroduction of the species.

As with any reintroduction, genetic bottlenecks will occur unless every effort is made to ensure that the re-established populations have the gene pool resources available to the species (Ryder 1994). The Przewalski's Horse Draft Global Conservation Plan (Seal *et al.* 1990) called for Przewalski's horse to be re-established in free-ranging populations in wild habitat in sufficient numbers to allow continuing evolution by natural selection. Five to ten wild populations were recommended, each with an effective population size (N_e) of at least 50 (or 250 adult animals) in order to avoid extinction by predation or stochastic events (Seal *et al.* 1990). An essential aspect of these and future projects will be their integration, economically and culturally, into the local community's programme of development, particularly as suitable reintroduction sites are likely to also be utilised by domestic livestock. Where there is the possibility of contact with feral or domestic horses, additional measures will be necessary, which will also need to be acceptable to the local people. To achieve this, the semi-permanent presence of relevant experts – management, ecology, behaviour, and veterinary – is important.

7.5.1 Release projects inside the historic range

At present, three release projects are currently in different phases in China (Figure 7.2). All of them include an adaptation phase in a restricted area. The founder animals either come directly from zoos or have been kept for some generations in semi-reserves. However, the successful establishment of viable populations may vary considerably between projects, principally due to the availability of suitable resources and habitat at the release site: Jimsar (desert, China), Gansu (desert, China), and Anxi (desert, China). These programmes are each using different approaches and methods (Van Dierendonck and Wallis de Vries 1996).

In China, the Wild Horse Breeding Station in Jimsar County, Xinjiang began a breeding programme in 1985 with horses from several zoos; at the end of 1996, the centre had 20–41 animals but are unlikely to be able to release any due to the lack of water in the surrounding desert. Horses have also been brought to the Gansu National Breeding Centre in western Gansu Province in 1989. A release of 10–15 animals into an adjoining 67km^2 semi-reserve was proposed for 1996, with eventual release to the planned Gansu National Park (Wiesner pers. comm.), but again doubts have been expressed as to the availability of sufficient water and forage. Finally, the Howletts and Port Lympne Foundation have sent horses to the Biodiversity Centre in Beijing as part of a planned release in the Anxi Gobi Nature Reserve in Gansu province; however, there has been no update since the end of 1994, when there were 7–11 horses (Zimmermann pers. comm.). At the VIth International Symposium, plans were presented concerning reintroductions/releases in Kazachstan (Pereladova pers. comm.).

7.5.2 Reintroduction projects in Mongolia

Przewalski's horses have been present in two locations in Mongolia since 1992: Takhin Tal and Hustain Nuruu.

The Takhin Tal Project was initiated through an agreement with the Mongolia Ministry of Nature and Environment and financed by an international sponsor group (Christian Oswald Stiftung of Germany, W. Trense of Austria, and D. Stamm of Switzerland) (MTSPWG 1993).

The Hustain Nuruu Project was initiated by the Foundation Reserves Przewalski Horse (FRPH) and the Mongolian Association for the Conservation of Nature and Environment (MACNE). On 2 March 1991, the Parliament of Mongolia ratified the project. The reintroduction programme is complementary to a project supported by the Directorate General for International Cooperation (DGIS) from the Dutch Ministry of Development Aid.

Another release site in Mongolia, in Khomii tal, is in the advanced stages of preparation. The Governmental Commission on Endangered Species, previously the Takhi Commission (founded in 1991), is involved in all projects in Mongolia.

The Takhin Tal Project is located in semidesert close to the boundary of the western section of the Gobi National Park and consists of an acclimatisation area where the horses are kept in enclosures until they are released. A small stream, the Bjiin Gol, runs through the enclosures and provides water. In June 1992, the first group of Przewalski's horses arrived which consisted of two adult males and three females from Askanya Nova. One of the females, 1831 Golovushka, gave birth in the autumn of 1992, the first recorded birth of a Przewalski's horse in Mongolia since their extinction in the wild (Oswald 1992). In June 1993, a second transport of six females and two males arrived from Askanya Nova; there have also been subsequent shipments of horses from Switzerland, Australia, Austria, and Germany. In total, 59 horses in ten transports were shipped to Takhin Tal between 1992 and 1999.

Soft releases have taken place directly from the acclimatisation area at Takhin Tal. The first group was soft released, but had to be herded back into the enclosure due to concerns with wolves. In 1997 and 1998, horses were successfully released. Three mares with foals were recaptured before the winter of 1998/99 because the foals were injured by wolves; they were released again in the following spring.

In 1997, the International Takhi Group (ITG) was formed to review the structure and running of the project. The ITG is constituted from the Mongolian Takhi Committee, representatives from private foundations and a few European zoos. It has reviewed the organisation of the project and developed an active research programme, which includes veterinary research that has provided very important information on the impact of tick-borne diseases on reintroduced Przewalski's horses (see Disease chapter, chapter 12).

By the end of 1999, 25 foals had been born of which 14 have survived. There were a total of 44 horses present, 2–11 in the enclosures and 13–18 free-ranging, in two harem groups and one bachelor group. Monitoring of reproductive hormones in the faeces showed that 14 of the mares were pregnant at that time. In June 2000, seven foals had been born in the free-ranging harem group.

The reintroduction of Przewalski's horse in Hustain Nuruu is set within the context of the broader goals of the restoration and protection of biodiversity within a reserve (Bouman 1998). The DGIS Project is focused at the ecosystem level, but the Przewalski's horse, as a top herbivore, represents an important part of the ecosystem. The Hustain Nuruu Reserve covers 50,200ha and is situated 100km west of Ulaanbaatar, the capital, in an area of upland steppe, mountain steppe, and some forested areas. The upgrading of the Hustain Nuruu Mountain Steppe Reserve (designated in 1993) to the Hustai National Park (HNP) in November 1998 (Parliament Decree No. 115) and the subsequent adoption of the zoning plan for the park have sensibly improved the nature conservation situation in the protected area (Bouman pers. comm.). Nature management of the HNP was officially delegated by the Mongolian Government to MACNE. There is a training programme for reserve and nature conservation management, warden and ranger tasks, and applied monitoring and research of all relevant biological aspects of the ecosystem.

The support and involvement of the local people has been secured from the beginning. Socioeconomic activities, such as an afforestation programme, establishment of a cheese factory, provision of a basic health service for local villages and herdsman, a training centre for women in the surrounding villages, a veterinary programme for livestock, and the renovation of water wells, have been started in the buffer zone of the reserve with the participation of local people (Bouman 1998). The Mongolian legislation has been revised almost completely after the transition to a democratic government in 1990 and, in accordance with the law on buffer zones, three Buffer Zone Committees have been established, one in each village, which are represented in a Buffer Zone Council for HNP. A decision from the Council of Ministers on the borders of the buffer zones was made in November 2000 concerning the area surrounding the park, allowing controlled development that should protect the park from negative impacts and

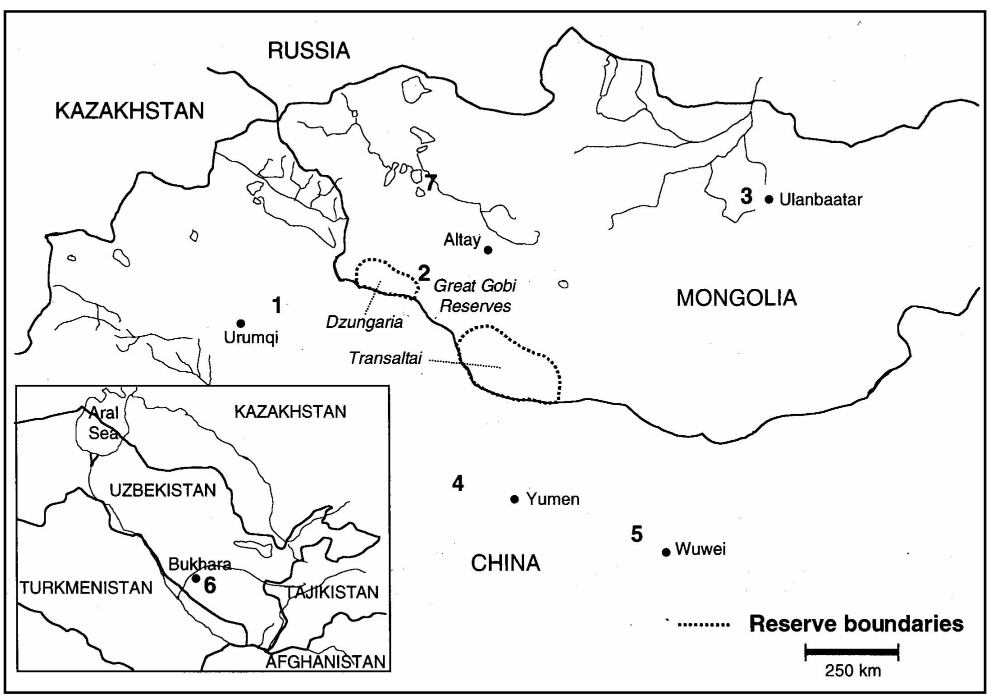

Figure 7.2. Current and proposed Przewalski's horse release and reintroduction areas. 1. The Wild Horse Breeding Station, Jimsar release project. 2. Takhin Tal reintroduction project. 3. Hustain Nuruu reintroduction project. 4. Anxi Gobi Nature Reserve release project. 5. Gansu National Breeding Centre release project. 6. Bukhara Breeding Centre release project. 7. Khomintal future reintroduction project.

allow the local population to draw benefits from having the park nearby.

The goal of the project is a free-ranging, self-sustaining population of 300–500 Przewalski's horses (Bouman 1996). The first group of 16 Przewalski's horses (of different bloodlines and low inbreeding coefficients) arrived in June 1992 and the first foal was born in June 1993, which was also the first foal to be conceived in Mongolia in recent times. A second group of 16 was sent in July 1994. In total, five visually and acoustically separated acclimatisation areas of 50ha each have been established, where the groups spend at least a year after their arrival to allow the harems to fully-integrate before release. All enclosures have year-round access to fresh running water from nearby natural springs (Bouman 1998). In total, 84 horses in five transports (1992, 1994, 1996, and 1998) have been shipped to Hustain Nuruu; the last transport took place in 2000. The horses have come mainly from the FRPH semi-reserves in the Netherlands and Germany, and also from Askania Nova (Ukraine), a semi-reserve of the Cologne Zoo, and Port Lympne (UK) (Bouman 1996). In 1998, the first surviving (at least one year) second generation foals were born in HNP. As per 1/12/2000, Hustai National Park had 122 Przewalski horses, with nine groups roaming freely in the park. 114 foals were born in the period between 1993 and 1/12/2000, of which 42 foals died.

Each released group is monitored daily. It has been noted that the overall body condition of the horses is better in the second year after their arrival than the first year; the free-ranging horses showed generally better condition than those in the enclosures. This suggests that the adaptation process may take some years. The free-ranging Przewalski horses, however, seem to defend their foals much better than the domestic horses monitored in the buffer zone. Up until the beginning of 1997, only two foals were lost to wolves and these belonged to released groups that were experiencing their first winter, when wolves predate in packs. This compares very favourably with a survey made of domestic horses from 1 October 1994 until the end of August 1995, where 11.3% of all domestic horses in the monitored area were killed by wolves, especially foals (Hovens 1997). In 1997 and 1998, the predation pressure on foals increased. Three foals were attacked by wolves in 1997 and died from the inflicted wounds, five in 1998, two in 1999, but only one in 2000.

There are large differences between the home ranges of the released groups; in 1995, they varied between 200–1,100ha and were almost non-overlapping, whilst between 1995 and 1997, the average home-range size of three harems was 995.4ha. With an average of 11.6 horses per harem, this gave an estimated population of 590 horses for the reserve – a clear indication that the numbers were not limited by food availability, but by social considerations (Bouman 1998).

Recently, initiatives have been taken to investigate the goals and possibilities for cooperation and exchange of information between all current and future Mongolian projects. A workshop took place in June 2000 that brought together representatives from the following institutions:

- Mongolian National Commission for Conservation of Endangered Species, Mongolia;
- MACNE, Mongolian Association for Conservation of Nature and the Environment, Mongolia;
- FRPH, Foundation Reserves Przewalski Horse, Netherlands;
- ITG, International Takhi Group, Switzerland and Germany;
- IUCN/SSC, Equid Specialist Group;
- WWF office Mongolia, Mongolia;
- Association pour le cheval de Przewalski/TAKH, France.

Among many other subjects, the possibility of a third reintroduction project in Mongolia was discussed and met with general approval. The Khomiin tal region is a buffer-zone (2,500km^2) to the Khar Us Nuur National Park in western Mongolia. It is surrounded by lakes in the west, a river in the east, and sand dunes to the south. The site qualifies as an "Important Bird Area". Vegetation types include riverbeds, reed marshes, desert, and mountain steppes. Only a few wolves are present. The project was approved by the local and district governments. In collaboration with local people, alternative activities to herding will be developed.

7.6 Current legal protection

The statute of the Great Gobi Reserve (or "The Gobi National Park", in English) was ratified by the Great People's Khoural of the Mongolian People's Republic on 31 December 1976. Recently, the Mongolian Parliament has passed a series of environmental laws and greatly extended the protected area system (Bouman 1998). In 1993, the Reserve Status category III was declared for the Hustain Nuruu area; conservation measures were approved and have been implemented since April 1994. At the end of 1998, the 60,000ha area received final approval for the status of a national park.

7.7 Actual and potential threats

The long-term threat to the retention of heritable variation in the captive population is loss of founder genes. Sixty percent of the unique genes of the studbook population have been lost (Ryder 1994). Losses of founder genes are irretrievable and further losses must be minimised through close genetic management. Furthermore, inbreeding depression could become a population-wide concern as the population inevitably becomes increasingly inbred (Ballou 1994). However, correct management of the population can slow these losses significantly, as has been achieved since the organisation of the regional captive breeding programmes.

There are potential threats to the reintroduced populations. Wherever Przewalski horses come into contact with domestic horses, there is a strong risk of hybridisation and transmission of diseases. In Hustain Nuruu, it has been noted that overgrazing of the buffer-zone and continued pressure on the reserve are possible consequences of the enhanced economic activity in this area (Bouman 1998); however, the second phase of the project (1998–2003) will pay much more attention to sustainable development of the buffer-zone. In the western section of the Gobi National Park (Gobi B), habitat degradation by nomads and military personnel and their livestock continues; there is no core zone here that is free from human influence all year round.

7.8 Recommended actions

7.8.1 Maintain the captive population and its genetic diversity

The primary objective of the management of the captive population is to maintain a population of sufficient size and character to protect the species from extinction, and produce animals for release programmes. Specifically, consideration must be given to the demographic stability and retention of genetic variation.

New information from on-going pedigree analysis, such as the recent identification of additional domestic founders, should be assessed for its implications for management of the population. The significance of a restricted number of patrilines should be addressed. At the present time, only two lines are still represented, and not equally. The possible implications should be assessed.

Integration of the regional breeding programmes into a global programme, with breeding recommendations in each region reflecting global goals should be a priority.

Re-analysis of past, current, and future genetic and demographic trends of the population is needed.

Calculation of gene survival in population sub-groups to identify genetically important individuals in order to manage their reproductive contributions should also be carried out.

Additional data should be collected on breeding opportunities v. breeding successes in order to examine the effects of both inbreeding and outbreeding on reproductive components of fitness. Such records should be routinely maintained by the institutions holding the animals and regularly compiled by the studbook keeper for such analyses.

7.8.2 Reintroduction to the wild

1. Continue the search for appropriate release/reintroduction sites. The important role of the IUCN/SSC Reintroduction Specialist Group in this process should be recognised. Research that has been done at the Takin Tal reintroduction site clearly indicates the need for specialised veterinary research and care. The expertise of the IUCN/SSC Veterinary Specialist Group should be incorporated whenever possible.
2. Careful monitoring of Przewalski's horse population dynamics and ecology in all current and future projects should be carried out. Standardisation of methods across projects and exchange of information would greatly assist understanding of the criteria for success. Monitoring efforts should include:
   - health, including possible vitamin E/selenium deficiencies;
   - fecundity, including influence of female age;
   - mortality, sources of mortality and survivorship;
   - habitat utilisation and feeding ecology;
   - behavioural ecology and mating systems related to reproductive success;
   - social organisation and its development.
3. In light of new information from release and reintroduction projects, and other advances in minimum viable population (MVP) studies, determine, in the next five years, the conditions that should be satisfied to secure free-ranging populations of Przewalski's horses in the wild. An important aspect of this will be the development of strategies to address potential hybridisation with domestic horses and thus introgression of domestic genes into the reintroduced population.
4. Only molecular pedigree analyses of all horses will allow to control for hybridisation. These can easily be made from dung samples. The data for all horses in Mongolia should be analysed and coordinated by the Genetic Department of the Mongolian Academy of Sciences.

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