

## Proceedings of the Mongolian Biodiversity Databank Workshop: Assessing the Conservation Status of Mongolian Mammals and Fishes: III – Fishes: Assessment Results and Threats

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### Abstract

The Mongolian Biodiversity Databank Workshop was held at the National University of Mongolia and Hustai National Park from 31<sup>st</sup> October to 4<sup>th</sup> November, 2005. As part of the workshop, a working group of fish experts assessed the conservation status of all Mongolian fishes using the IUCN Categories and Criteria. Of the 64 fish species found in Mongolia, 48 were assessed, with 16 considered Not Applicable (NA) by the working group. Only one species, the Siberian sturgeon (*Acipenser baerii*) was assessed as Critically Endangered (CR) in Mongolia, however six species were assigned Endangered (EN) status. Four were found to be Vulnerable (VU) and three were assessed to be Near Threatened (NT). Forty-eight percent of Mongolian fishes were Data Deficient (DD) and 25% were Least Concern (LC). The north-east of Mongolia was most species rich, particularly the Onon River basin and Buir Lake. There was no trend for where the most threatened species occurred as they were found throughout the north of Mongolia. Hunting/fishing was the greatest threat to Mongolian fishes, followed by resource extraction and pollution.

Keywords: biodiversity, extinction risk, fish, Mongolia, taimen, threat

### Introduction

Fish have not traditionally been a part of the Mongolian diet or economy, so historically species were relatively unaffected by human presence. However, by the close of the 20<sup>th</sup> century, new pressures were coming to bear on Mongolian society, driving a new – mainly commercial – interest in the inhabitants of Mongolia's many water-bodies. Experts on Mongolian fish were brought together for the Mongolian Biodiversity Databank workshop (held at the National University of Mongolia and Hustai National Park from 31<sup>st</sup> October to 4<sup>th</sup> November, 2005) to assess the status of Mongolian fishes using the IUCN Categories and Criteria, and to discuss threats affecting the species and what conservation measures were needed to address them.

Despite its many large lakes and rivers, Mongolia's fishes have received relatively little scientific attention. Results from this workshop hope to rectify this both for the charismatic species such as the taimen (*Hucho taimen*), and for less well-known fish. The working group on fishes were able to create distribution maps for species, so the most species rich zones could be identified, and those

regions with the highest number of threatened species. These sites will therefore be those most needing protection. As well as assessing the threatened status of fish, direct threats affecting their persistence were discussed. The increase of mining in Mongolia, especially along waterways in the north, is putting Mongolia's fishes at risk due to inorganic pollution and localised habitat loss and degradation. However, it is the substantial increase in fishing of all fishes at all times of the year that poses the biggest and most immediate threat. Without baseline information about species it is hard to conserve them. The information amassed at this workshop should help policy makers address how the law can be used to help fish under threat, and will also alert NGOs and scientists about species and regions most in need of research and protection.

### Results and Discussion

#### *The distribution of Mongolian fishes*

Fish richness in Mongolia appears to be roughly demarcated into four regions (Figure 1). The north-eastern region had the highest species rich-

ness, particularly around the Onon River basin and Buir Lake, within the Amur River basin, where it reached a maximum of 31 described species. The north-central region was the next highest in species richness. The rivers and lakes in this region drain toward the Arctic Ocean and include the Selenge, Orkhon and Shishged rivers and Khövsgöl Lake. The north-western and southern regions are part of the Central Asian Inland drainage basin. This basin is an endorehic watershed, i.e. none of these rivers and lakes has an outflow outside the basin. The north-western region and the area known as the Valley of the Lakes (south-central) had the lowest richness of fishes, but included a number of Mongolia's most threatened species, for example the Mongolian grayling (*Thymallus brevirostris*), the lake osman (*Oreoleuciscus angusticephalus*), Dzungarian dace (*Leuciscus dzungaricus*) and Gobi loach (*Barbatula dgebuadzei*). The region consisting almost entirely of the Gobi desert had no known fish species. There did not appear to be any clear geographical trend in the distribution of threatened fish species in Mongolia (Figure 2). They were spread throughout the northern half of Mongolia, with the highest richness of threatened species in the south of Khövsgöl province. The distribution of Data Deficient (DD) species appeared to mirror the distribution of all fish species: the area around the Onon River had the highest richness of DD species (Figure 3). Areas of high species richness were more likely to have a high number of DD

species. Therefore, it was not surprising that the north-eastern region also had the highest concentration of DD species.

#### Status of Mongolian fishes

Forty-eight of the 64 native fish species were assessed by the Red List Categories and Criteria; the other 16 were Not Applicable (NA). A quarter (25%) of the assessed species were not threatened with extinction in Mongolia (Figure 4). However, 23% of the assessed species were facing a high risk of extinction and thus considered threatened, and a further 6% were viewed as being close to qualifying in the future for a threatened or Near Threatened (NT) category. Nearly half of the evaluated species were found to have insufficient data regarding their population size, trends, and the impact of threats, and were therefore assessed as DD.

For well-known species, such as commercial and sport-fishing species, population trends could be inferred from declining catches. For other little known species declines could be inferred where threat processes were clearly documented and understood. However, nearly half the fish species in Mongolia were lacking sufficient data to determine their conservation status. Data was lacking not only in population trend information, but also on basic biology and the effect of threats. Sixty-four percent of the DD species were Cypriniformes, (loaches and minnows). All four sculpin (Scorpaeniformes) species, such as the Siberian sculpin (*Cottus sibiricus*)

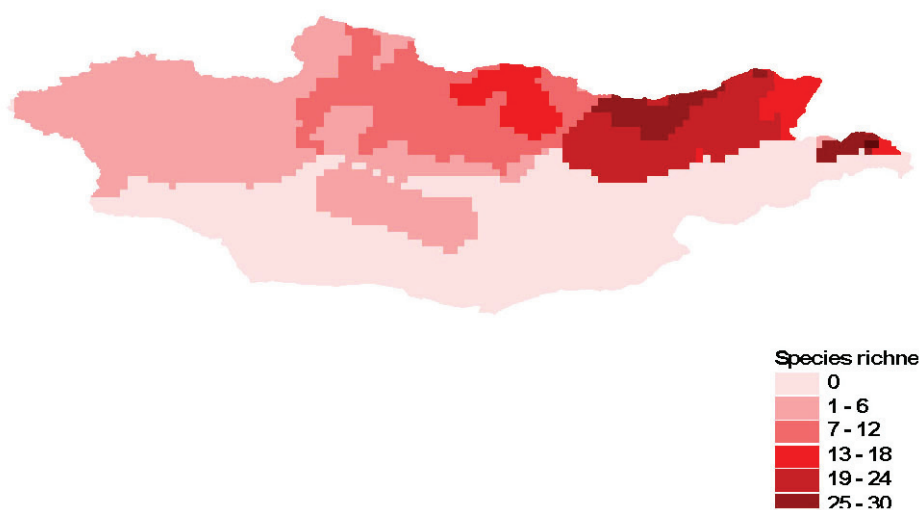


Figure 1. Species richness of Mongolian fishes. The darker shades represent areas with the highest number of threatened species.

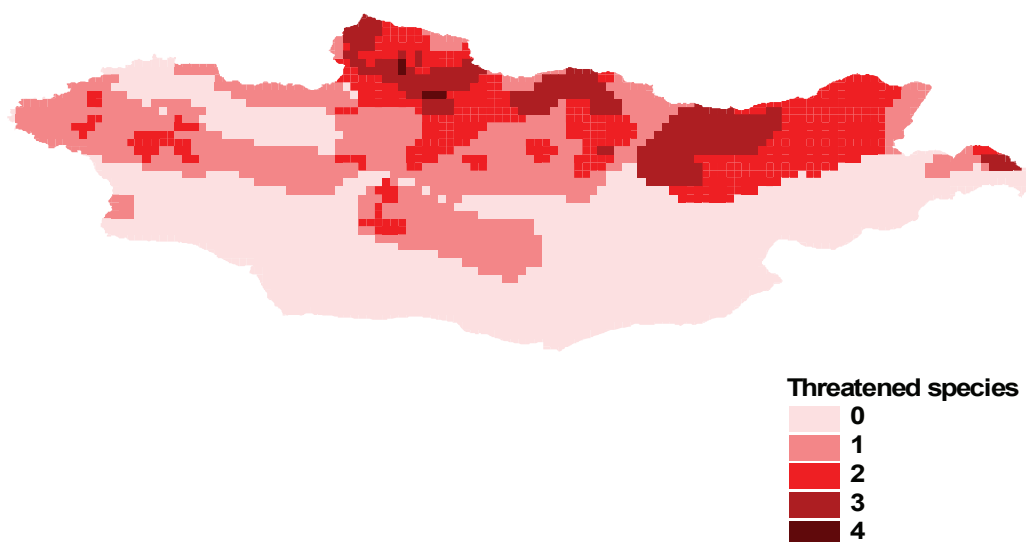


Figure 2. Species richness of threatened Mongolian fishes. The darker shades represent areas with the highest number of threatened species.

and Kessler's sculpin (*Leocottus kesslerii*) were assessed as DD. The majority of the DD fishes were small, had little economic importance and were not favoured by anglers.

#### Threatened species

Only one species was assessed as Critically Endangered (CR) in Mongolia, and six species were assigned Endangered (EN) status. Four species were found to be Vulnerable (VU) and three were assessed as NT (Table 1).

This DD assessment was due to uncertainty about whether the species still occurred in Mongolia. Participants felt it was likely that if the Amur sturgeon was still extant in Mongolia, it would also be CR.

The Salmoniforme order includes the whitefish (coregonids), graylings (thymallids), and the taimen and lenok (salmonids). Six out of the nine Salmoniforme species found in Mongolia were threatened, making them the most threatened order of fish in Mongolia. Four qualified as EN: the Amur

Table 1. Fish species categorised as regionally threatened (Critically Endangered, Endangered and Vulnerable) and Near Threatened in Mongolia.

<i>Critically Endangered</i>	<i>Endangered</i>	<i>Vulnerable</i>	<i>Near Threatened</i>
Siberian sturgeon <i>Acipenser baerii</i>	Gobi loach <i>Barbatula dgebuadzei</i>	Lake osman <i>Oreoleuciscus angusticephalus</i>	Amur spiny bitterling <i>Acheilognathus asmusi</i>
	Dzungarian dace <i>Leuciscus dzungaricus</i>	Small osman <i>Oreoleuciscus humilis</i>	Ide <i>Leuciscus idus</i>
	Pidschian <i>Coregonus pidschian</i>	Mongolian grayling <i>Thymallus brevirostris</i>	Arctic grayling <i>Thymallus arcticus</i>
	Amur grayling <i>Thymallus grubei</i>	Lenok <i>Brachymystax lenok</i>	
	Khövsgöl grayling <i>Thymallus nigrescens</i>		
	Taimen <i>Hucho taimen</i>		

There were two sturgeon species (Acipenseriformes) on the Mongolian Red List, one is assessed as CR: the Siberian sturgeon (*Acipenser baerii*) and the other is DD: the Amur sturgeon (*A. schrenkii*).

grayling (*T. grubei*), taimen, Khövsgöl grayling (*T. nigrescens*) and pidschian (*Coregonus pidschian*). Two are VU: the lenok (*Brachymystax lenok*) and the Mongolian grayling (*T. brevirostris*). One Salmoni-

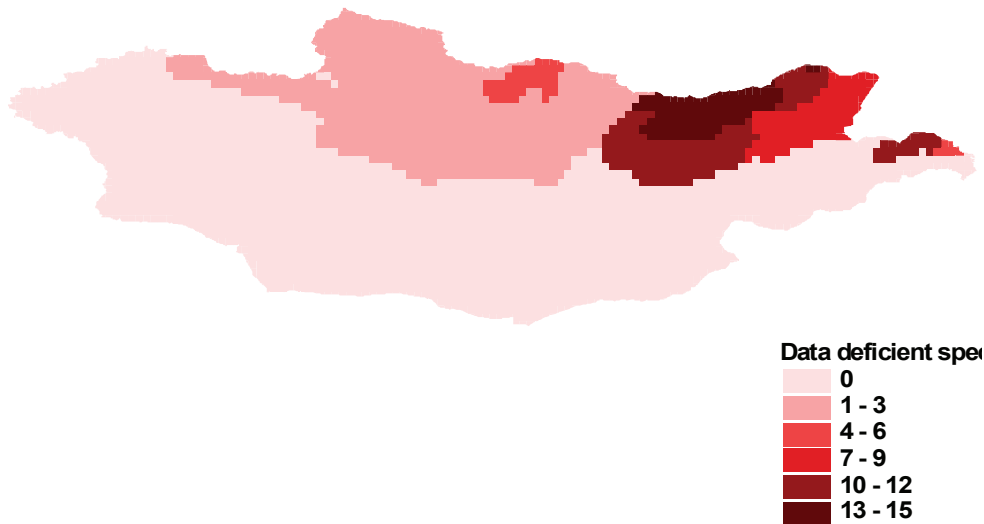


Figure 3. Species richness of the Data Deficient fishes of Mongolia..The darker shades represent areas with the highest number of threatened species.

forme is NT: the Arctic grayling (*T. arcticus*), and two are DD (Chadary, *C. chadry* and Baikal omul, *C. migratorius*). The threatened Salmoniforme species were commercially and recreationally favoured large fish; the two Cypriniforme species classified as VU, the two osman species (*Oreoleuciscus humilis* and *O. angusticephalus*), also shared these characteristics. Two Cypriniformes were listed as EN, Dzungarian dace, *L. dzungaricus* and Gobi loach, *B. dgebuadzei*, however these are recently described species. They are both only found in one location that is at risk from threatening activities, such as mining or illegal fishing, and little is known about their general ecology in Mongolia.

Comparison with other regions

The IUCN Freshwater Biodiversity Assessment Programme have conducted several regional assessments of the status and distribution of priority groups of freshwater taxa (see website [http://www.iucn.org/themes/ssc/programs/freshwater/regional\\_biodiv\\_assess.htm](http://www.iucn.org/themes/ssc/programs/freshwater/regional_biodiv_assess.htm)). However, comparisons between these regions and Mongolia are difficult, as their data are based on the threat status of endemic species and Mongolia only has four known endemic species, all of which were assessed as threatened: the Mongolian and Khövsgöl graylings, the lake osman, and the Gobi loach. However, if the overall percentage of Mongolian native species under threat

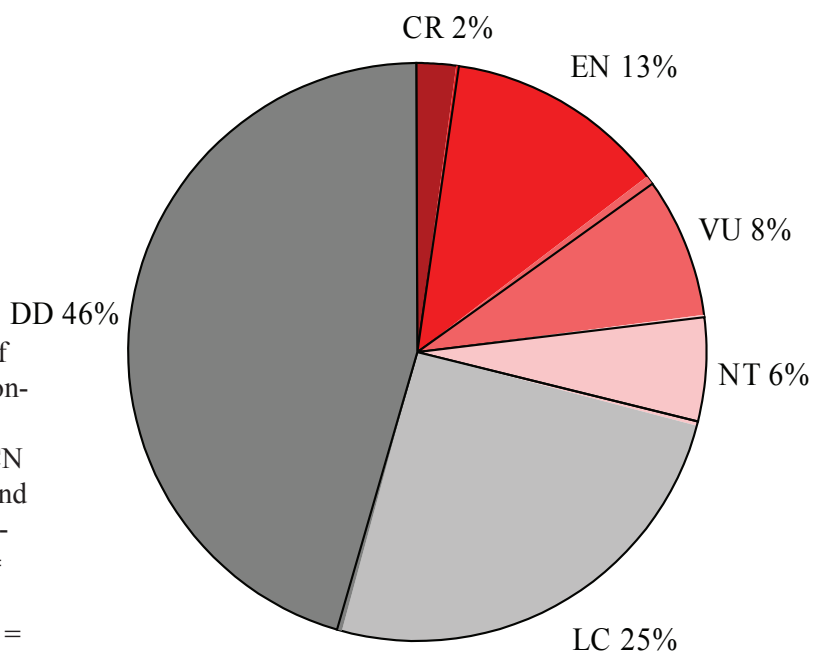


Figure 4. Conservation status of the 48 native fish species of Mongolia for which an assessment was made according to the IUCN Regional Red List Categories and Criteria. CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, DD = Data Deficient.

is compared with the other assessments, Mongolia has a low percentage of threatened species.

Table 2. Results of regional assessments showing the percentage of threatened endemic species, including Mongolia's percentage of threatened native species. The North American result was part of a different assessment and the result has been adjusted to fit with the IUCN categories (Kevin Smith pers. comm.).

<i>Region</i>	<i>Percentage</i>
Eastern Africa	28%
Mediterranean basin	56%
North America	34%
Madagascar	54%
Mongolia	23%

This conclusion should be treated with caution, because almost half of Mongolian native species were classified as DD. In comparison, the assessment of the 98 endemic fish of Madagascar found 28% are Data Deficient (IUCN Freshwater Biodiversity Assessment Programme, 2004) and the Eastern Africa assessment found only 8% (73) of 901 species to be DD (Darwall *et al.*, 2005). Further research into the DD species in Mongolia could result in an increase in the number of threatened species.

#### *Threats to Mongolian fishes*

Hunting/fishing was the most dominant cause of decline in Mongolian fishes (Figure 5). It was found to be the dominant threat to 23 species, more than twice the number affected by the next most dominant threat, resource extraction. Resource extraction, which includes activities like gold- or coal-mining, can be viewed as one of the underlying causes of habitat degradation, which ranked as a significant threat to many threatened fishes (Table 3). Following this was energy consumption, environmental change and agricultural development. The high percentage of DD species was also reflected here, as no information on threats or their causes was known for a large number of species.

The foremost threat to threatened species was intentional mortality, e.g. mortality from fishing (Table 3), caused by the current level of hunting/fishing (Figure 5). For two species the dominant threat was habitat degradation, and for a further two, climate change. Habitat degradation was identified as the second most dominant threat for the majority of threatened fishes. There was only one species for which intentional mortality and habitat degradation was not the dominant threat, the pidschian. Pollution was considered the third most dominant threat to these species.

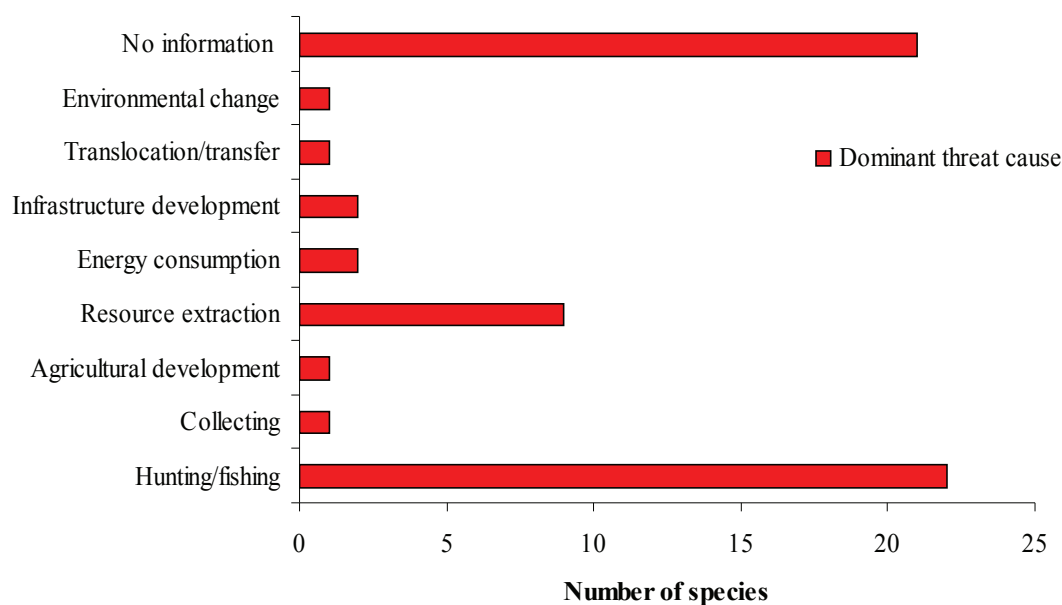


Figure 5. The dominant causes and activities leading to the decline of Mongolian fishes as identified by participants of the workshop.



Table 3. Summary of the direct threats facing threatened Mongolian fishes, as identified by the workshop participants. The primary threat is represented by a black square, the secondary threat is mid grey and the tertiary threat is light grey.

Category of threat	Species	Habitat degradation	Habitat loss	Pollution	Hybridisation	Competitors	Intentional mortality	Climate change
CR	<i>Acipenser baerii</i>							
EN	<i>Barbatula dgebuadzei</i>							
	<i>Leuciscus dzungaricus</i>							
	<i>Coregonus pidschian</i>							
	<i>Thymallus grubei</i>							
	<i>Thymallus nigrescens</i>							
	<i>Hucho taimen</i>							
VU	<i>Oreoleuciscus angusticephalus</i>							
	<i>Oreoleuciscus humilis</i>							
	<i>Thymallus brevirostris</i>							
	<i>Brachymystax lenok</i>							

#### Expert Working Group conclusions

During the three days of assessments, the participants of the expert working group on Mongolian fishes brought together information from a number of different sources. This information formed a baseline of knowledge on Mongolian fishes upon which future research and other activities can be founded. These data can be found in the Biodiversity Databank, this article, the Red List on Mongolian Fishes and the Summary Conservation Action Plans (the latter two to be published later this year). The workshop assessments also involved details of threats to Mongolian fishes, and the conservation measures required to conserve species under threat and prevent further species becoming threatened. These are discussed below.

Participants identified hunting/fishing as the dominant threat to fishes due to the amount of unregulated, illegal fishing being undertaken. This fishing is believed to be for commercial purposes, being driven by the growing international trade of fishes. This is occurring despite the Mongolian Parliament legislating fishing seasons for all fishes, outlining when it is illegal to catch them (Mongolian Law on Hunting, section 13; Wingard & Odgerel, 2001). Participants agreed that regulations are being ignored and there are not enough resources to

enforce them. Also noted was the non-species specific nature of the illegal fishing. The market for fishes appears to be indiscriminate, the only requirement being that they are large enough to consume. However, taimen are specifically targeted by illegal fishers due to the growing national and international market for taimen-meat (Parkinson pers. comm.; Erdenebat, pers. comm.), and by recreational anglers using catch-and-kill methods. Participants also stated that local demand plays only a small part in the commercial nature of the threat. Most of the fishes are sold for foreign markets, predominantly China but also Russia.

The second dominant threat process discussed by participants was habitat degradation and loss due to resource extraction, principally mining for gold. Mining is viewed as a threat process on the increase. It causes habitat loss, as rivers and gravel are dredged, and also habitat degradation with increased sedimentation and inorganic pollutants. There are mining regulations and controls, such as a ban on operating within a two kilometre buffer zone around protected areas. However, it appears companies are either not aware of these zones (Mendsaikhan, pers. comm.) or are ignoring them (Farrington, 2005). The danger the mining industry poses to Mongolia's biodiversity, not only

fishes, is its economic attractiveness. The government is actively encouraging foreign investment and the mining sector is expected to be one of the nation's most important sources of revenue in the future (Anon, 2005; Pui-Kwan, 2004; Farrington, 2005).

Habitat degradation and loss to Buir Lake, Khövsgöl Lake and the Valley of the Lakes waterways also concerned participants. A decline in the water level at Buir Lake has been noted. It is believed this may have been caused by people removing vegetation from near the lake while fishing during winter (Baasanjav, pers. comm). Previously, Khövsgöl Lake had 96 rivers flowing into it, now only 20 rivers have water in them. While they all used to be permanent, a majority now dry up over summer (Mendsaikhan, pers comm), preventing fishes from migrating up them to spawn. Participants also expressed concern about changes in land use and climate change reducing water levels of the rivers and lakes in the Gobi.

Mongolian Parliament has enacted two laws which concern the conservation of fishes. The Mongolian Law on Hunting regulates the fishing season, as it contains a general ban on the hunting of all species between 1<sup>st</sup> April and 16<sup>th</sup> June. There are also longer ban periods in place for particular species (Wingard & Odgerel, 2001) (Table 4).

Table 4. The season during which particular fish cannot be hunted

<i>Species</i>	<i>Hunting ban period</i>
Pidschian ( <i>Coregonus pidschian</i> )	1 <sup>st</sup> August – 20 <sup>th</sup> October
Baikal omul ( <i>Coregonus migratorius</i> )	1 <sup>st</sup> December – 15 <sup>th</sup> September
<i>Coregonus peled</i>	1 <sup>st</sup> August – 15 <sup>th</sup> November
Osmans ( <i>Oreoleuciscus</i> spp)	15 <sup>th</sup> April – 1 <sup>st</sup> August
Any fish occurring in Buir Lake	15 <sup>th</sup> May – 1 <sup>st</sup> June

The Mongolian Law on Fauna lists four species as 'Very Rare' (Table 5). The Law on Hunting prohibits the harvesting of these species for personal or commercial purposes. Taimen is listed as "Rare", though sport-fishing is permitted pursuant to licenses granted by the Ministry of Nature and Environment (Wingard & Odgerel, 2001). While these are mainly catch-and-release licenses, it is also possible to purchase a catch-and-kill license from the Ministry (Parkinson, pers. comm.).

Table 5. Species listed as 'Very Rare' or 'Rare' in the Mongolian Law on Fauna

<i>Very Rare</i>	<i>Rare</i>
Siberian sturgeon ( <i>A baeri</i> )	Taimen ( <i>Hucho taimen</i> )
Amur sturgeon ( <i>A schrenkii</i> )	Silver carp ( <i>Hypophthalmichthys molitrix</i> )
Tench ( <i>Tinca tinca</i> )	Grass carp ( <i>Ctenopharyngodon idella</i> )
Amur sculpin ( <i>Mesocottus haitej</i> )	

The Mongolian Law on Hunting and the Law on Fauna work in tandem to protect Mongolian fishes. It was recommended at the conclusion of the working group session that these laws be updated to incorporate the reviewed status of the fishes, particularly the species assessed as threatened. However, these regulations will continue to be ineffective if improved enforcement regimes are not implemented. Threatened species are facing imminent extinction due to illegal fishing. Rangers are in place in some areas, but it was suggested they would benefit from an increase in personnel, improved transport (motorcycles instead of horses), cameras for collecting evidence, and communication methods that allow them to keep track of poachers and to alert rangers in other areas of poachers' movements. Mongolia has an extensive network of protected areas. None have been created specifically for the protection of fishes; although several include sites important to fish diversity – notably Khövsgöl Lake. Khövsgöl Lake is a Mongolian National Park and a World Heritage Site, as well as the only location for the endangered Khövsgöl grayling.

The Taimen Conservation Fund (TCF) is a Mongolian-based non-governmental organisation promoting taimen conservation in the community and developing a collaborative management plan for the Eg-Uur watershed near Khövsgöl Lake. TCF is

unique for its watershed-based approach, although in 2004 the Mongolian Parliament legislated in the Mongolian Law on Water to encourage the use of watershed-wide management plans (Batsuren, pers. comm.). Using a combination of education and community initiatives, and recommendations based on the most recent scientific data from their scientific team, TCF provide initiatives and management important to the conservation of the taimen. These

types of initiatives were recommended as a conservation measure as it was believed Mongolia's fishes would benefit from increased public awareness of them and their threatened status.

The changes in 2004 to the Mongolian Law on Water provide a framework for whole watershed management (Batsuren, pers. comm.). Article 19 addresses watershed management committees. This encourages provinces to work together to create a watershed management plan that crosses territorial boundaries. This will provide a platform for better cooperation between provinces on the issue of freshwater protection and management. Participants believed management would be further enhanced by collaboration with research groups and angling tourist companies. It would encourage better cross-organisation communication not only between the local governments, but also between research groups and protected-area managers. Mongolia's fishes would therefore benefit from the interested and involved parties communicating more with each other, which will in turn prevent information from becoming isolated.

Above all, more research is required. The high percentage of species assessed as DD by the working group session shows a dearth of knowledge about the species known to be in Mongolia – their population numbers and trends, and what threatening processes they face. It may also be concealing a number of threatened species. A further issue, beyond the scope of the working group session is the number of species unknown to science. Precious little research has been done in the Central Asian Inland Basin, which includes the Gobi desert. Study in this endorehic drainage basin is likely to reveal a number of rare, endemic species. Research in these areas is a priority to fully understand the status of Mongolian fishes.

A baseline has been established for the native fishes of Mongolia, of their conservation status and on the level of knowledge pertaining to them. The goal for the future is to build upon this baseline, and ensure the best conservation for Mongolia's unique mixture of freshwater fishes.

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### References

- Anon. 2005. Inside Mongolia. *Metal Bulletin Monthly*. 416: 11.
- Darwall, W., Smith, K., Lowe, T., & Vie, J-C. 2005. *The Status and Distribution of Freshwater Biodiversity in Eastern Africa*. IUCN Species Survival Commission, Cambridge.
- Farrington, J.D. 2005. The Impact of Mining Activities on Mongolia's Protected Areas: a Status Report with Policy Recommendations. *Integrated Environmental Assessment and Management*. 1(3): 282–289.
- IUCN. 2003. *Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0*. IUCN Species Survival Commission, IUCN, Gland, Switzerland and Cambridge, UK.
- IUCN World Conservation Union. 2004. *IUCN Red List of threatened species*. Available at <http://www.iucnredlist.org/>. Accessed 7<sup>th</sup> January 2006.
- IUCN Freshwater Biodiversity Assessment Programme. 2004. *Red List Assessment of Madagascar's Freshwater Fish*. IUCN Species Survival Commission, Cambridge, UK.
- Pui-Kwn Tse,. 2004. *The Mineral Industry of Mongolia*. US Geological Survey Minerals Yearbook. <http://minerals.usgs.gov/minerals/pubs/country/2004/mgmyb04.pdf> . Accessed 12th December 2005.
- Wingard, J.R., & Odgerel, P. 2001. *Compendium of Environmental Law and Practice in Mongolia*. GTZ Nature Conservation and Buffer Zone Development Project and GTZ Commercial Civil Law Reform Project. Published report. (in English and Mongolian).