Mongolian Journal of Biological Sciences 2008 Vol. 6(1-2): 21-30

Fish Community Composition and Habitat Use in the Eg-Uur River System, Mongolia

Norman Mercado-Silva[1+], David J. Gilroy[1], Manchin Erdenebat[2], Zeb Hogan[3], Sudeep Chandra[3] and M. Jake Vander Zanden[1]

[1]*Center for Limnology, University of Wisconsin – Madison, 680 N. Park St., Madison, WI 53706 USA*
[2]*Institute of Geoecology, Mongolian Academy of Sciences, Baruun Selbe 15, Ulaanbaatar 211238, Mongolia.*
[3]*Department of Natural Resources and Environmental Science, University of Nevada - Reno, Nevada 89557 USA*
[+]*Corresponding address: Arizona Cooperative Fish and Wildlife Research Unit, School of Natural Resources, University of Arizona, 325 Biosciences East, Tucson, AZ 87521, USA. E-mail: nmercado@u.arizona.edu*

Abstract

Mongolian rivers and their fish communities have suffered severe impacts from anthropogenic activities. However, the remoteness of some systems has allowed for the conservation of unique fish faunas, including robust populations of *Hucho taimen*. Conservation of *H. taimen* requires understanding the composition and ecology of other fishes in the community. Using multiple sampling techniques, direct observation, and existing literature, we assessed the composition, relative abundance, and ecological attributes of fishes in the Eg-Uur watershed (Selenge basin). We collected 6 of 12 species known in the watershed. *Phoxinus* cf. *phoxinus* and *Lota lota* were the most and least abundant species, respectively. We failed to detect *H. taimen*, indicating low abundance or unknown habitat requirements for juveniles. We compared the effectiveness of different sampling techniques (with electrofishing producing the highest species richness), constructed length-weight relationships for four species, and identified ecological attributes (i.e., trophic guild, preferred habitat) for resident fishes.

Key words: *Barbatula* sp., *Brachymystax lenok*, *Cobitis* sp., habitat use, *Phoxinus* sp., Selenge river

Introduction

Northern Mongolia's rivers are among the most unimpacted river systems in the world. The country's largest system, the Selenge River, flows north into Lake Baikal and includes a fish fauna consisting of at least 22 species (Matveyev *et al*., 1998), including *Hucho taimen*, which is one of the world's largest salmonid species (Holcik *et al*., 1988, Baasanjav & Tsend-Ayush, 2001). *H. taimen* populations have declined across their range due to anthropogenic impacts - primarily dam-building, pollution, deforestation, mining, and overharvest (Bazuin *et al*., 2000). However, some parts of the Selenge River basin are extremely remote, and have not been subject to anthropogenic impacts. As such, they retain intact aquatic communities, including robust populations of *H. taimen.* The Eg-Uur is one such system.

The Taimen Conservation Fund has spearheaded a conservation program in the Eg-Uur aimed at conserving the river ecosystem while promoting a sustainable catch-and-release fishery for *H. taimen* that would raise revenue for local communities and conservation initiatives through licensing fishing concessions. Research efforts have focused primarily on the ecology of *H. taimen*, and include assessments of critical habitat, population sizes, and movement and migration, all with an emphasis on sustainable fishery management (e.g., Vander Zanden *et al*., 2007). While focus has been on the ecology of *H. taimen*, it is critical to recognize that they are just a part of the river ecosystem. *H. taimen* interact with other fishes in the ecosystem, and these species may also benefit from conservation efforts as *H. taimen* are considered an 'umbrella species' in rivers of this region (Frankel & Soulé, 1981, Roberge & Angelstam, 2004). With this in mind, we present a description of the fish communities of the upper Eg-Uur river basin focusing on species composition, ecological attributes, relative abundance, and habitat use. As large central Asian rivers and *H. taimen* in particular are increasingly threatened by anthropogenic pressures (Allen & Flecker, 1993; Dudgeon *et al*., 2006), our study describes the fish community of an unimpacted river system, thus providing a baseline for interpreting longer term anthropogenic changes in this ecosystem (Ocock *et al*., 2006, Stubblefield *et al*., 2005, Matveyev *et al*., 1998).

Materials and Methods

Study area. The Eg-Uur watershed area (3.48 million ha) is located in a remote region of northern Mongolia covering territories of 6 soums (administrative units like districts) in Hövsgöl Aimag and 2 soums in Bulgan Aimag (administrative units like provinces). The Eg and Uur rivers are relatively pristine, naturally meandering, and oligotrophic steppe river systems. The Eg river (length = 277 km) originates from Lake Hövsgöl and flows south where it meets with the Uur river (length = 152 km), a river fed by groundwater and precipitation run-off from the eastern Sayan Mountains. The combined Eg-Uur, known as the Eg river after the confluence (length = 281 km), feeds into the Selenge River, the largest tributary of Lake Baikal. The Eg-Uur rivers have an annual period of ice cover that usually spans from late November until early May and often reach peak flows in July and August during monsoonal rains. At the time of sampling (May-June, and October 2006), the Uur river had an approximate wetted width of 50–100 m with a variety of habitats (sand banks, riffles, gravel and cobble runs, and deep pools). The Upper Eg (Eg River above the Uur confluence) had an approximate width of 30–70 m, and was dominated by relatively fast runs, with only a few small riffle and pool areas. The Lower Eg (Eg River below the Uur confluence) shared many of the same characteristics as the Uur River but with a consistently wider channel (~100m).

Fish collections for this study were made at 12 sites in the vicinity of the Eg-Uur confluence between coordinates 50°15.131’ and 50°22.565’ N, and 101°52.000’ and 102°01.124’ E covering a river distance of approximately 50 km in both rivers and one tributary (the Zerleg creek) (Figure 1). All sampling sites were located at altitudes between 1057 and 1078 m above sea level. The majority of our sampling efforts were in shallow (20 - 70cm) areas of these systems, although a few sampling efforts were in reaches deeper than 150cm (see ‘Collections’, below). Zerleg creek had an approximate width of 2–5 m. The upper segments of the Zerleg were partially covered with ice at the time of sampling. Throughout the Zerleg, substrates were generally cobble and sand, with large woody debris creating occasional shallow pools. Average depth in the Zerleg was 30 cm. Water temperatures ranged from 2.5 (upper Zerleg) to 13ºC (Uur), pH was 6.8–7 for all sites.

Collections. Sites were visited once, except for one site in the Uur river (site 1) and one in the Eg river (site 9), which were sampled on two different

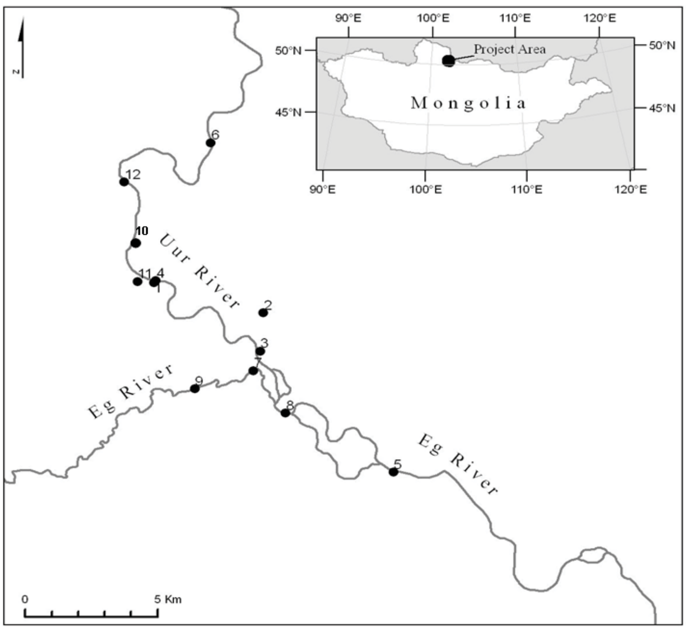

Figure 1. The Eg-Uur river system in northern Mongolia. Sampling sites are indicated.

occasions with different gear (seine and backpack electrofisher). All sampling was conducted during daylight hours (between 10:00 and 19:00 hours). The electrofishing device was a Wisconsin ABP-3 with multiple voltage output settings depending on site requirements. Two or three dipnets were used to collect shocked fish. A bagless seine (1.5m deep, 10m long with 8mm delta mesh size) was used for most littoral sampling in wadable areas. A large seine (3m deep, 50m long with 80mm knotless mesh [bag dimension 3 x 3 x 3 m with 20mm knotless mesh size]) was used for fish sampling in deep unwadable pools. In certain areas with fast current, we used a combination of small seine and electrofishing to capture individuals that would otherwise be carried away by the current. In this situation, we made an electrofishing pass downstream while the seine was placed blocking the lower portion of the run. Fish were collected in the seine and captured. Sites 1 – 9 were sampled with the small seine and electrofisher, and sites 10-12 were sampled with the large seine. A deep pool adjacent to site 1 was also sampled using the large seine.

At each site, we identified and sampled all available habitats (e.g., shallow pools, runs, undercuts), except when using the large seine, which was used exclusively in deep pools. With the electrofisher and smaller seine, sampling efforts at each site continued until no significant changes in species composition or their relative abundance occurred. When using the large seine, we made two to five passes in deep pools (> 1.5m deep) and did not cover the same pool area twice in consecutive pulls. The large seine was deployed using a boat to create an encirclement on a portion of river and pulling the net into shore where fish were retrieved from the net, processed, and released.

All captured fishes were identified to species following descriptions in Travers (1989) and taxonomic considerations in Kottelat (2006). We obtained total length (mm) and weight (g) from a subsample of captured specimens. Spring weight scales (Pesola®) were used for weight determinations. After identification and measurement, fishes were released to the river unharmed.

At each site, we estimated water temperature (°C) and made qualitative observations on the availability of different habitats in the site (pools, riffles and runs), flow (fast, moderate, slow, nil), type and abundance of bottom substrates (silt, gravel, cobble, boulders), and presence and abundance of structures that provide cover for fishes (overhanging vegetation, macrophytes, riverbank undercuts, large woody debris). We also noted the average depth and width of the channel. We used these observations to describe the general habitat used by each species.

Analysis. *Species composition and abundance*: We quantified the number of individuals of each species captured per site. We then calculated the relative abundance of each species for a site by dividing the total number of fish in a species by the total number of captured fishes. We considered samples collected with two sampling techniques, electrofisher and seine, separately from samples from the big seine. For each sampling effort, we calculated the percent contribution of each species to overall fish catch at each site. Further, we calculated the average relative abundance for all species in the study area based on the small seine and the electrofisher.

Fishing technique capture comparison: We compared the species composition and abundance of fish captures made independently with the small seine and the electrofisher in site 1 (Uur River). We did not use samples from site 9 in the comparison because of low catches using the seine (only two individuals captured in repeated seining efforts). Samples with either technique were taken on separate days, but the same habitats were sampled and there were no major differences in water flow or temperature on either sampling occasion. To compare techniques, we considered the total number of fish captured per unit effort. For electrofishing, we calculated the number of fish captured per minute. For seining, we divided the number of fish by the number of seining hauls made. Further, we compared the relative number of fishes with preference for benthic habitats captured by each method following the same procedure. Fish habitat preference was established by direct observation and considering their morphological attributes (i.e., presence of barbels, depressed body shape).

Length weight relationships: For species with sufficient length and weight data we obtained length-weight relationships and estimated the “a” and “b” parameters in the $W = aL^b$ relationship where W = weight (g), “a” is the intercept of the length weight relationship, L is length (mm) and “b” is the slope of the relationship (Anderson &

Neumann, 1996).

Habitat use: We identified the preferred habitats of the species collected from our field observations. We identified the substrates where species were captured and made observations of the type of habitat each species occupied (e.g., pools, runs, riffles), and the general location in the river (e.g., mid-channel, shore). Further, we obtained biological and ecological information for each species in the Eg-Uur watershed from literature.

Results

Species composition and abundance. We captured 666 fishes of six species in the same number of families (Table 1). Considering all fishing techniques described above, the most abundant species was the cyprinid *Phoxinus* cf. *phoxinus* (*P. phoxinus* hereafter), followed by the nemacheilid *Barbatula toni*. Relatively less abundant were *Brachymystax lenok*, *Thymallus arcticus*, *Cobitis melanoleuca*, and *Lota lota*, respectively. For all small-seining and electrofishing efforts across all sites, *P*. *phoxinus* also had the highest mean relative abundance (68%), while all other species had mean relative abundances below 20% (Figure 2). All species were present in the Uur and Eg rivers. Only *P. phoxinus*, *B. toni* and *B. lenok* were captured in Zerleg creek, with the upper section of the system having relatively few individuals of either species and very low water temperatures (~2.5 ºC). No *Hucho taimen* were captured in our sampling efforts, nor were other species known to occur in the watershed (i.e., *Coregonus* sp., *Acipenser* sp., *Esox lucius*).

Across sites sampled with electrofisher and seine, the lowest relative abundance for *P. phoxinus* was observed in Zerleg creek (sites 2,3; 20% and 45%, respectively) (Figure 3). The highest relative abundance of *P. phoxinus* was found at site 5 (98%). The creek also had the highest relative abundance of *B. lenok* (60%, site 2) and *B. toni* (42%, site 3), although very few fish were caught in site 2 (Figure 3). The highest relative abundance for *C. melanoleuca* (10%) and *T. arcticus* (7%) was observed in sites 4 and 9, respectively.

Phoxinus phoxinus and *B. toni* were present in all sites. *Brachymystax lenok* was collected in 8 sites. *Cobitis melanoleuca* and *T. arcticus* were present in only 4 sites. Finally, *L. lota* was captured only in sites 1 and 9 (Figure 3). Site 1 was the only one where all species were captured. Five species were captured in site 9 and sites 4, 5 and 6 each had four species. Sites in Zerleg creek (2, 3), and 7 and 8 each had three species (Figure 3).

Only relatively large fish were targeted with our large seine. We captured a total of 55 fish with this technique in 4 sites (1, 10-12). We were only able to capture *T. arcticus* and *B. lenok*. In site 10, *T. arcticus* was relatively more abundant (82%) than *B. lenok* (18%) (total n = 29). In sites 1 and 11, *B. lenok* was more abundant than *T. arcticus* (70 vs 30 %, 75 vs 25%; respectively) (total n = 17, 8; respectively). We only captured one *B. lenok* in site 12.

Fishing technique capture comparison. Sampling with the electrofishing device produced all species in Table 1. We were able to capture 5 species in our beach seining efforts, but did not capture *Lota lota*. In site 1, 11 seine hauls (small bagless seine) produced 60% (3 fish per haul) of all individuals captured during 30 minutes of electrofishing (1.8 fish per minute). In this site, we were unable to capture three species with the

Table 1. Fishes captured in the Eg-Uur watershed (Selenge River basin), Mongolia, and parameters for their length-weight relationships. Total length (TL) (mm) and weight (g) means, maximum and minimum values are included. N = number of fish captured. "a" and "b" are described in the methods section, n = number of individuals used in building the length-weight relationship. Taxonomical considerations follow Kottelat (2006)

Species	N	TL	Weight	n	a	b
		Mean (Max; Min)	Mean (Max; Min)			
Brachymystax lenok	49	281 (557;78)	390 (1600;4)	48	5.03^{-6}	3.0958
Thymallus arcticus	37	211 (395;48)	190.5 (520;0.8)	36	4.36^{-6}	3.1071
Phoxinus cf. phoxinus	463	47 (84;3)	2.31 (4.1;0.3)	41	3.89^{-7}	3.7044
Barbatula toni	103	53.27 (95;7)	1.025 (2.5;0.3)	8	3.12^{-6}	3.1171
Cobitis melanoleuca	11	67.6 (100;48)	1.73 (2.6;0.8)			
Lota lota	3	380 (500;300)	-			
TOTAL	666					

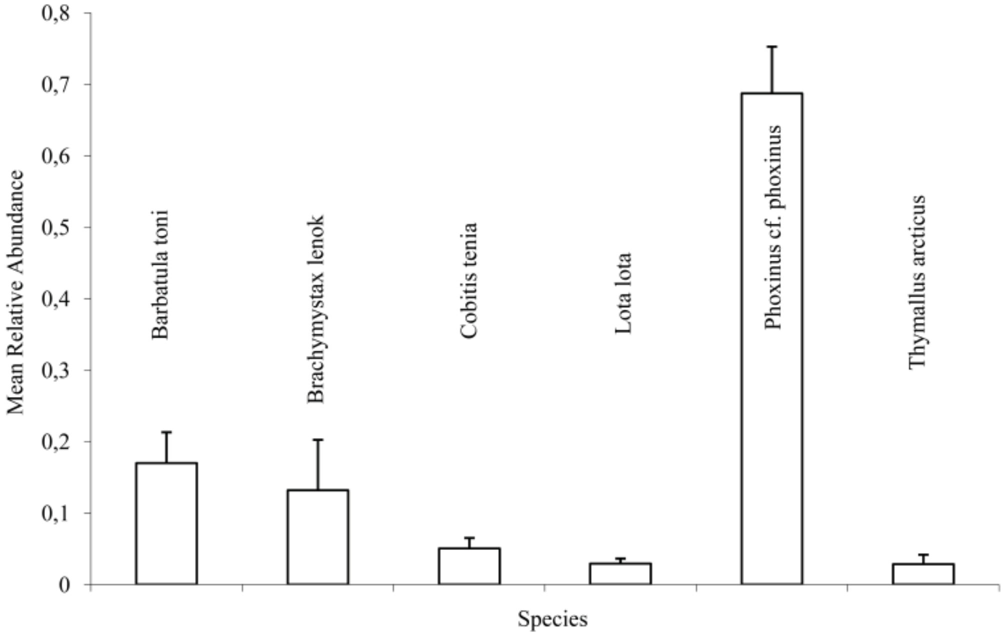

Figure 2. Relative abundance of fishes in the Eg and Uur rivers in Northern Mongolia. Standard error for mean abundances across all sites sampled are shown.

seine that were captured electrofishing: *L. lota*, *C. melanoleuca* and *T. arcticus*. However, species typically living in benthic habitats (e.g., *B. toni*, *C. melanoleuca*) were captured with both methods, and comprised between 9-12% of the total number of individuals captured with both techniques.

Length-weight relationships. We obtained enough data to construct length-weight relationships for 4 species: *B. lenok*, *T. arcticus*, *P.* cf. *phoxinus*, and *C. melanoleuca*. The parameters

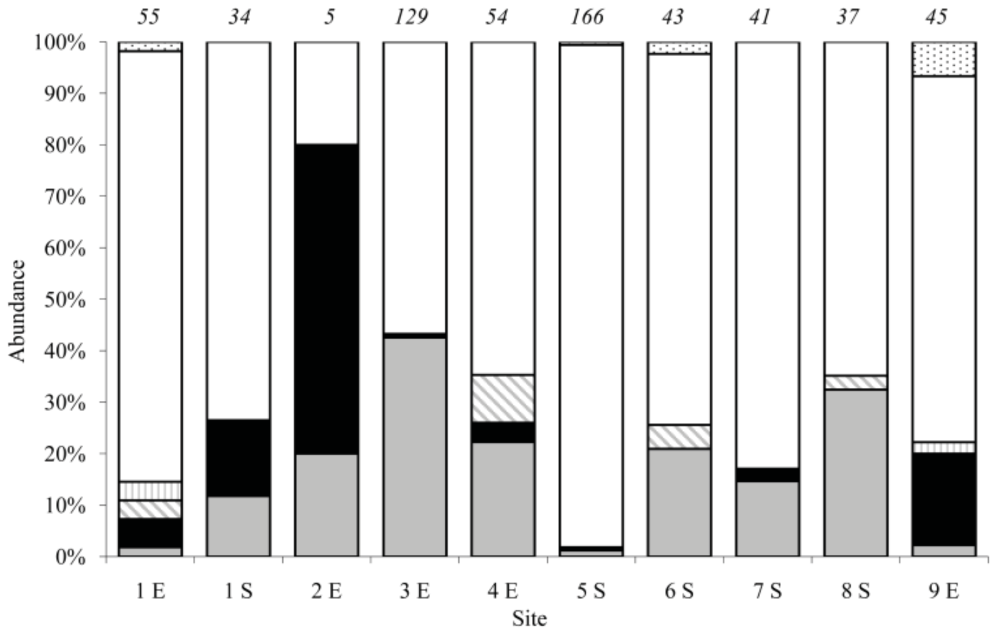

Figure 3. Percent contribution of each species to overall fish abundance in 9 sites of the Eg and Uur rivers in Northern Mongolia. Figure includes samples obtained with small seine and electrofishing only (E = electrofishing, S = seining). Site 9 was also sampled with a seine (not shown), but only two fish (1 *Brachymystax lenok* and 1 *Cobitis melanoleuca*) were captured. Solid grey: *Barbatula toni*; solid black: *B. lenok*; diagonal lines: *C. melanoleuca*; vertical lines: *Lota lota*; solid white: *Phoxinus phoxinus*; dotted: *Thymallus arcticus*. Total number of fish captured at each site is indicated in italics.

for the length weight equations are shown in Table 1.

Ecological attributes and habitat utilization. A list of some ecological attributes for all species in the Eg-Uur watershed is presented in Table 2. *Barbatula toni* was found mostly in sites where runs and riffles were common and pools were comparatively rare. Most were caught in waters with moderate flows, but were also present in some areas with fast flows. They were usually caught in sites where cobble and sand were common, and gravel was occasional, and were absent from areas with soft substrates. They were also abundant in sites with occasional to rare cover, especially among woody debris and overhanging vegetation. In the Uur and Eg systems, *B. toni* were not found in the middle of the channel but just a few meters (~5) from the shore, depending on habitat structure. *Brachymystax lenok* were found in all three runs, riffles, and pools in waters with a variety of velocities. They were usually found in gravel and cobble substrates, but were occasionally present in sites with sandy substrates. *B. lenok* did not require the presence of structures that would provide them with cover such as large woody debris, undercuts or overhanging vegetation. However, they sought cover when we approached them. *Cobitis melanoleuca* were found mostly in areas where runs were common and riffles occasional. They were also present in pools and backwaters, thus occupying mostly areas with moderate to low water flows. They occupied sandy and cobble substrates in all habitats, and rarely were they present in areas with extensive cover, except for undercuts of Zerleg creek. Similar to *B. toni, C. melanoleuca* were not found but in close proximity to the shore in larger systems. *Lota lota* were usually found occupying undercuts and areas covered with woody debris in sites with riffles and occasional pools. *Lota lota* individuals were captured when extracted from hiding in crevices and woody debris. *Phoxinus* cf. *phoxinus* were commonly found in riffles and runs, but were also found in sites where pools were occasional or rare. They were present in habitats with a variety of water flows, but usually not in fast waters. They utilized all substrates available, but were most common in sand, gravel and cobble areas. They formed schools in areas with rare to occasional cover in the form of wood or undercuts. *Thymallus*

Table 2. Biological and ecological attributes of fishes reported in the confluence of the Eg and Uur rivers in northern Mongolia. Information obtained from our own observations and collections, and from published literature. Taxonomical considerations follow Kottelat (2006). For Preferred substrate 'none' means no preference; for trophic guild (T.G.) detritivore = D, zoobenthivore = Z, piscivore = P, insectivore (terrestrial) = I, omnivore = O, terrestrial fauna (e.g. mammals, birds) = TF; for Habitat B = benthic, W = water column; for reproductive strategy (R.S.) egg scatterer = E, Red egg layer = R, open water egg scatterer = O, brood hider = B, eggs laid in vegetation = V, gynogenesis = G; for IUCN status: L = lower risk, N/A = not listed, V = vulnerable; for water flow preference: S = slow, M = moderate, None = no preference.

Family	Species	Preferred substrate	T.G.	Habitat	R. S.	IUCN	Water flow preference
Acipenseridae	*Acipenser baerii*	Gravel	Z	B	E	V	S
Salmonidae	*Brachymystax lenok*	None	P, I	W	R	N/A	None
Salmonidae	*Hucho taimen*	None	P, TF	W	R	N/A	S-M
Coregonidae	*Coregonus autumnalis*	None	Z, P	W	O	L	S
Thymallidae	*Thymallus arcticus*	Cobble	Z, P	W	B	N/A	None
Esocidae	*Esox lucius*	None	P	B	E	N/A	S
Cyprinidae	*Carassius gibelio*	Soft sediments	O	W	O, G	N/A	S
Cyprinidae	*Phoxinus cf. phoxinus*	Gravel cobble	O	W	O	L	S-M
Cyprinidae	*Leuciscus idus*	Gravel	Z, P, I	W	O	L	S
Nemacheilidae	*Barbatula toni*	Cobble	Z	B	E	N/A	S-M
Cobitidae	*Cobitis melanoleuca*	Sand (soft)	D	B	E	L	S
Lotiidae	*Lota lota*	Dense vegetation	Z, P	B	O	N/A	S

arcticus were mostly found in runs and riffles, but were also relatively common in areas with pools. They were most common in waters with fast water flows over sand, cobble and gravel. Similar to *B. lenok*, they were mostly found in sites with little or no cover.

Discussion

Many of the large river systems of northern Mongolia remain relatively unimpacted by anthropogenic activities. As a result, these river ecosystems have great potential to support high value recreational fisheries for *Hucho taimen*. As such, these rivers provide an important conservation opportunity, as well as an important economic resource for local communities. Little research has examined the broader ecosystem context of taimen fisheries. As part of ongoing efforts to manage and conserve Mongolian rivers, and *H. taimen* in particular, we provide an assessment of fish community composition for an unimpacted ecosystem that can serve as a baseline for monitoring future environmental changes, as well as comparative analyses with fish communities elsewhere in Asia and Europe.

Fish communities in the Eg and Uur watersheds are species-poor relative to other systems in Mongolia and specifically to the lower Selenge river from which 22 species are known (Dulmaa, 1999). A total of 12 species are known from the region of the Eg-Uur watershed where our work was conducted. Our collection efforts failed to produce 6 of those species - *Hucho taimen, Coregonus* sp. (most probably *C. autumnalis* [Kotelatt, 2006]), pike *Esox lucius*, carp (*Carassius gibelio*), *Leuciscus idus*, and the vulnerable Siberian sturgeon *Acipenser* sp. (most likely *A. baerii* [Kotelatt 2006]). At the time of our study, *E. lucius* and *H. taimen* were readily caught in the Eg and Uur rivers by recreational fishermen using hook and line, but we were not able to capture these species with the three methods used. Catches of *H. taimen* smaller than 40 cm by angling have been extremely rare. Although not during our fish community sampling efforts, two juvenile *H. taimen* were caught in 2006 and two more in 2008. In late July 2006, during a rising and highly turbid Uur River, a young *H. taimen* (140mm, 1+ year) was caught sticking half-way through the mesh of the large seine in knee-deep riffle water. The area seined was inundated with flood water and during normal flows was mostly a dry, gravel shoreline. In October of 2006, as water temperatures were rapidly dropping, another small *H. taimen* (110 mm, 0+ year) was caught by hand in about 15 cm of water from under large cobble. In June of 2008 two slightly larger juvenile taimen (208 and 220 mm, both 1+ year) were again captured while seining the Uur during a turbid, high-water stage. The three juvenile taimen caught while seining were captured among adult lenok and grayling and appear to be occupying similar habitat as they do. The low captures of juvenile *H. taimen* points to the rareness of the species, our limited of knowledge of the habitat type they occupy, or both. *Carassius gibelio* and *Leuciscus idus* were captured during independent sampling efforts in spring 2007 and can be considered first reports for the Eg-Uur system.

The fish community associated with *H. taimen* in the Eg –Uur river resembles that of other areas of *H. taimen* distribution. In lower-gradient rivers of the Selenge watershed (Arctic drainage), *H. taimen* populations can overlap with populations of roach (*Rutilus rutilus*), dace (*Leuciscus leuciscus*), Baikal sturgeon (*Acipenser baeirii baicalensis*), pike (*Esox lucius*), perch (*Perca fluviatilis*), the migratory Baikal whitefish known as the omul (*Coregonus migratorius autumnalis*), and the non-natives Amur catfish (*Parasilurus asotus*) and common carp (*Cyprinus carpio*). The upstream range of the two non-native fishes overlaps with the range of *H. taimen* in the Lower Yuröö, the Orkhon, and Selenge rivers. The fish communities in Mongolia's Pacific drainage rivers have a greater number of fish species than the Arctic drainage rivers (Kottelat 2006), and therefore likely exhibit very different community dynamics. It would be worth investigating how different species abundances and inter-species interactions influence *H. taimen* at different life stages. Additionally, primary productivity comparisons between regions could be assessed to better determine carrying capacity of fish biomass.

In our identifications of the fishes of the Eg-Uur watershed, we have followed descriptions by Travers (1989) and taxonomical considerations of Kotelatt (2006). Hence, it is possible that our identifications in the field for some of the species, may refer to two separate subspecies, or to different species altogether. For example, Kotelatt (2006) considers that there may be a handful of unnamed species all grouped under *Barbatula*. We noticed morphological differences among individuals of *Barbatula toni* in the field and encourage further taxonomical study. Similarly, there may be more than one species or subspecies under *Phoxinus*. These could be different from the European *Phoxinus phoxinus*, but further study is required.

Our estimations of relative abundance were based on samples taken electrofishing or seining. These techniques were more selective for smaller-sized fish and usually failed in capturing large-sized individuals in wide river areas. Thus, it is important to note that the relative abundance of *B. lenok* and *T. arcticus* in the Eg-Uur system could be higher than our data suggest. Our efforts with the large seine may provide a better assessment of the abundance of these two species. In addition during independent hook and line sampling efforts, 90 minutes of sampling produced five *T. arcticus* and nine *B. lenok*, suggesting that this approach is adequate for sampling populations of these fishes.

A variety of sampling methodologies often need be used to obtain a comprehensive account of the community of fishes in an ecosystem since not all methods are equally effective in sampling all fishes or habitats (Willis & Murphy, 1996; Cailliet *et al*., 1996). Seining and electrofishing appear to be similarly effective when sampling the fishes of the Eg and Uur watershed, but future efforts should consider the limitations of either technique. While seining was efficient in capturing fishes with preference for benthic habitats, it failed in producing *Lota lota*, a species that commonly hides in crevices and other structures that are hard to reach with a seine. On the other hand, electrofishing may not be as effective in areas with extensive sand or cobble bars, where fishes can easily escape the electric field. In addition, we recommend that the necessary precautions be taken when electrofishing is used to prevent damage to sensitive fishes. Spinal injuries and/or hemorrhages have been reported in fishes (especially salmonids) caught by electrofishing' especially when care is not exercised to regulate the intensity, current type or pulse type that is applied (Snyder, 2003). We did not use gillnetting because of the potential high mortality of fishes and thus we recommend that this technique not be used in future research efforts in the area. Our use of a large seine in deep pools proved to be successful in quickly capturing moderate sized salmonids, but we suggest the use of other passive fish capturing methods (i.e., fyke nets) for future studies, especially for capturing highly motile species (Utrup & Fisher, 2006) that we were unable to collect in our efforts.

Though our techniques covered a broad spatial area, we were limited in deeper habitats to one sampling technique – tows with the large seine. In these areas, accurate representation of fish species and relative abundances for smaller individuals (less than 15 cm in total length) are lacking due to their potential for escape through this seine's mesh. Deep, fast water, deep water with abundant rocks or woody habitat were also not seined effectively. Electrofishing, although very effective where it was used, was limited to depths of shallower than 80 cm. The use of an electrofishing unit on a boat or small raft, instead of a backpack unit, or passive traps could potentially allow more effective sampling of deeper water and river reaches with large rocks or woody material.

At present, our description of ecological attributes and habitat preferences for fishes in the Eg-Uur system presents basic information about the role each species could be playing in the community. This information could serve future efforts towards determining natural or anthropogenic influences on river resources. Environmental evaluation techniques often rely on attributes from biological communities that encompass their structure and function to understand the influence that environmental changes could have on the biota. The attributes we have described could also aid in the study of other aspects of the community such as the feeding interactions among species.

While *H. taimen* populations are focal in ongoing conservation efforts in Mongolia, many of the threats they face are shared by the rest of the fish community and freshwater ecosystems in general. In the rural upper Selenge watershed, aquatic biota are threatened mostly by the impacts from placer gold mining (Melchert, 1998; Farrington, 2000), overgrazing, or infrastructure development, with potential impacts from overfishing. In the Eg and Uur rivers, pollution from gold mining and infrastructure development are potential threats to the whole community, while overfishing could threaten populations of *T. arcticus* and *B. lenok*, in addition to *H. taimen*. Ecosystem changes from overgrazing or infrastructure development could change channel morphology and substrate type, reducing the available habitat for certain fishes, and altering the habitat that macroinvertebrates (main sources of energy to the food webs atop which *H. taimen* sits [Chandra *et al*., 2006]) require to survive. These potential impacts have not yet affected the Eg-Uur River system. Thus, conservation of these ecosystems still has great potential to succeed in providing long-term protection to biota and the ecological services they provide.

Acknowledgements

We wish to thank P. Tsogtsaikhan, M. Amaraa, J. Handsuren, J. T. Maxted, U. Nemekhbayar, M. Adams Mercado, T. Gibbard, T. Munkhnasan, N. Densmaa, and Buryat, for assistance with this research. The Taimen Conservation Fund, Sweetwater Travel and Hövsgöl Travel supported and assisted in this research. Financial support was provided by the Taimen Conservation Fund (Mongolia) and The National Geographic Society (U.S.A.).

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Хураангуй

Монгол орны голууд хүний үйл ажиллагааны нөлөөнд ихээхэн өртөж байна. Гэвч алслагдсан байрлалтай зарим голууд загасны өвөрмөц бүлгэмдлийг, тухайлбал тул загасны (*Hucho taimen*) популяцийг хамгаалахад ихээхэн ач холбогдолтой юм. Тулыг хамгаалахын тулд бусад загасны бүлгэмдлийн бүрэлдэхүүн, экологийг танин мэдэх зайлшгүй шаардлагатай. Бид Сэлэнгэ мөрний ай савд хамаарах Эг, Үүрийн голын загасны бүрэлдэхүүн, харьцангуй элбэгшил, экологийн шинж төлөв зэргийг дээж цуглуулах янз бүрийн арга, шууд ажиглалт болон ном зохиолын мэдээ зэрэгт үндэслэн тодорхойлов. Бид энэхүү судалгаагаар тус ай савд тэмдэглэгдсэн 12 зүйлийн загасны 6 зүйлийг цуглуулсан ба *Phoxinus* cf. *phoxinus* зүйл хамгийн элбэг, *Lota lota* зүйл хамгийн бага тохиолдоцтой болохыг илрүүлэв. Бид тус голын саваас *H. taimen* зүйлийг илрүүлж чадаагүй бөгөөд үүнийг уг загас ховор тохиолдоцтой, эсвэл түүний жарамгайн амьдрах орчин тодорхойгүй байсантай холбоотой хэмээн үзэж байна. Загасны дээжийг цуглуулах янз бүрийн аргуудыг харьцуулж, цахилгаан төхөөрөмжөөр барих арга нь хамгийн олон зүйлийг илрүүлэх боломжтойг тогтоосон ба 4 зүйлийн загасны биеийн урт ба жингийн харьцааг судалж, нийт зүйлийн экологийн шинж төлөв (идэш тэжээлийн холбоо, амьдрах орчны сонголт) зэргийг тодорхойлов.

Received: 18 August 2008
Accepted: 26 March 2009