

# Spawning behaviour of taimen (*Hucho taimen*) from the Uur River, Northern Mongolia

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**Abstract** This study presents the first observations of *Hucho taimen* spawning in the wild based on underwater video recordings. One pair of taimen was monitored during a 19 h period, supplemented with visual observations from two other spawning pairs. We recorded two full spawning events performed in two different locations separated by approximately 30 m. The absence of an established male hierarchy along a nesting female was the most important difference between taimen and other salmonine breeding biology. Taimen spawning, based on our observations, is a single pair event. The male prevented the approach of other males by launching intense attacks that extended for several meters away from the redd. Our data suggests that taimen females, differently from other salmonines, do not cover their eggs immediately after having spawned but rest for a variable number of minutes before covering them.

**Keywords** *Hucho taimen* · Underwater video · Spawning act · Salmonines

## Introduction

The taimen (*Hucho taimen*) is a freshwater salmonid inhabiting rivers throughout Siberia and northern Mongolia. Practically all of the information on taimen ecology is published in journals that are not readily available to the western scientific community (Matveyev et al. 1998), and no papers exist in English describing spawning based on first-hand observations. Even the impressive book by Holc̣ík et al. (1988), which concentrates on the taimen's sister species huchen (*Hucho hucho*), only cites Russian papers for a few taimen spawning behaviours, making it difficult to verify the descriptions (Pravdin 1949; Bukirev 1967; Misharin and Shutilo 1971; Sigunov 1972; Kifa 1974; Olfier 1977). A summary of what we currently know about taimen spawning is as follows (based on Holc̣ík et al. 1988): In spring, normally coinciding with thawing, taimen migrate from larger, deeper rivers to smaller, shallower streams looking for clean gravelly substrates with the right hydrological conditions. Females prepare redds, elliptical depressions with the longer axis along the stream line, in which they build nests to deposit their eggs. At least one major difference in the spawning ecology separates huchen and taimen from the rest of the salmonines: timing of pair

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formation. In most salmonine species, pair formation is an active process that occurs on the spawning areas and continues throughout the entire mating process (Esteve 2005b and references therein). Pair bonding in huchen and taimen, on the other hand, apparently occurs before reaching the spawning areas. Males and females bond days or weeks before spawning starts. Once on the grounds, the pair remains together and the male prevents any other male from approaching (Ivas'ka 1951, Rez'ny' 1951 and Sigunov 1972 cited by Holc'ik et al. 1988; Witkowski 1988).

In this paper we present the first detailed description of taimen spawning based on underwater video recordings from the Uur River (Hovsgol Province, Northern Mongolia). The Uur River runs through an undisturbed area comprising meadows, grasslands and forested hills. Only a few families with their cattle temporarily live in the area and, contrary to other regions in Mongolia, there is no mining or logging in the area. This makes this region an exceptional location to study taimen spawning in a pristine environment.

## Methods

Underwater recordings took place in the Uur River (50.3646°N, 101.8933 E; 1,076°m altitude) during 21 and 22 May 2006. A Sony TRV 900 colour digital video camera mounted inside an underwater housing and black and white AquaVu Z underwater video camera were used to monitor the mating activities of a single pair of taimen during a 19 h period. The pair was monitored successively spawning in two redds designated as A and B, separated by 30 m, at depths of 0.45 meters and 0.5 m respectively. The cameras were placed simultaneously on each redd at approximately two meters from the shore. Video signals for both cameras were transmitted via cable to digital recorders located on a boat situated at an equidistant point between the redds. The size of each fish was independently visually estimated by two observers to be between 90–110 cm, the male slightly larger than the female. The sex of the individuals was determined from minor morphological dimorphism – the male was slightly more dark and red, with a vaguely more robust head (Fig. 1) – and confirmed using behavior. For example, one fish positioned slightly behind the other, intermittently performing *quivering* (consisting



**Fig. 1** Taimen pair on redd A. The female is positioned below the male

of low amplitude and high frequency body vibrations from head to tail) demonstrates typical male salmonine courtship behaviour. Except for three brief interruptions to change the camera location or replace its batteries, the fish were observed undisturbed for the entire study period. We did not film at night because it was impossible capture images without using artificial lights. Visual observations from the shore of two different taimen pairs on 17 and 19 May were used to corroborate the later findings (50.3234°N, 101.8890°E; 1,065 m altitude).

## Results

Recordings of spawning activity started on redd A at 19:02 (Table 1). The female was continuously monitored until she spawned at 19:54. Recordings continued until 22:14 when light levels were too low to be detected by the cameras. In the 9 min period immediately before spawning the female performed four *false spawnings*: female imitates genuine spawning by quivering her body, but does not release eggs. The real spawning act lasted 25 s. The female then stayed resting over the nest for 3 min and 17 s without any apparent movement other than lateral motions of her tail to maintain her position. She then initiated a series of cover digs characterized by a few gentle beats of her tail (one to four beats per dig, 13 diggings) for 6 min, when her digging started to become gradually more intense, possibly starting a new nest. The male left the area, returning twice briefly to the nest in the

**Table 1** Video recording history of taimen spawning

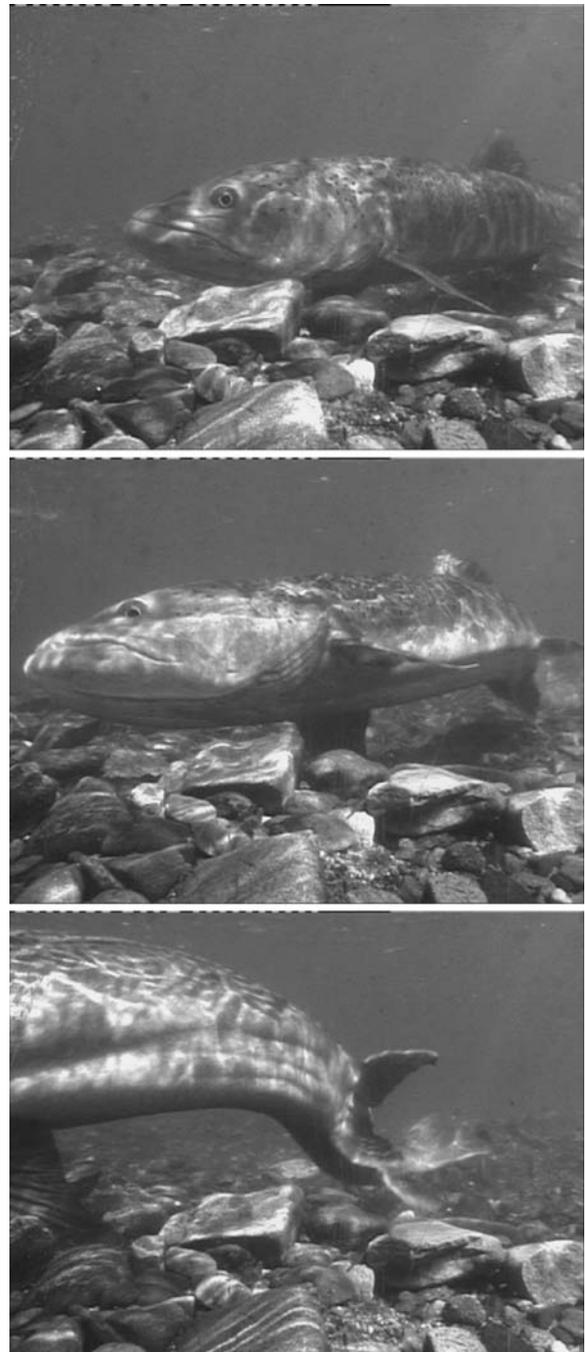
|               | Total time (min) | Female digs | Male quivers |
|---------------|------------------|-------------|--------------|
| <b>Redd A</b> |                  |             |              |
| Time Period   |                  |             |              |
| 19:02–19:54   | 52               | 40          | 30           |
| 19:54         | 25 s             | Spawning    | NA           |
| 19:54–22:14   | 140              | 70          | 81           |
| Total         | 192              | 110         | 111          |
| <b>Redd B</b> |                  |             |              |
| Time period   |                  |             |              |
| 9:57–12:29    | 152              | 84          | 136          |
| 12:29         | 36 s             | Spawning    | NA           |
| 12:29–13:19   | 50               | 48          | 0            |
| Total         | 202              | 132         | 136          |

The number of female diggings and male quiverings on the time periods before and after spawning is included.

5 min immediately after spawning. He finally returned and stayed on the nest 21 min after spawning. At the time the cameras were removed, the female was actively involved in building a new nest. At 00:42 we confirmed the presence of the pair on redd B, indicating that another spawning event might have occurred on redd A during the 22:14–00:42 interval. Recordings of spawning activity at redd B started at 9:57 (Table 1). The female was continuously monitored until she spawned at 12:29. Recordings continued until 13:19. In the 13 min period immediately before spawning the female performed 7 false spawnings. The spawning act lasted 36 s. The female stayed resting over the nest for 4 min and 19 s. She then initiated a series of cover digs for the next 4 min (one to five tail beats per dig,  $n=13$ ) then digging progressively increased in terms of intensity and number of tail beats. The numbers of male quiverings and females diggings prior and after spawning are summarized in Table 1.

Female behaviour on both redds followed a similar pattern: the fish maintained her position over the nest by slight movements of her caudal fin; from time to time she turned onto her side and beat her tail over the substrate (Fig. 2). Three different types of digs were identified: (1) nest initiation – high number of tail beats per digging episode (9–19), female progressed upstream while digging (1–2 m approximately), the intensity of tail beats, visually judged according to the velocity by which the female repetitively flexed her tail and by the amount of gravel moved, was high; (2) nest completion – low number of tail beats per

digging episode (3–5); female did not progress further along the redd while digging but concentrated the digging in one single location; tail beat intensity medium; (3) nest covering – low number of tail beats per digging episode (1–5); female progressed while



**Fig. 2** Video frame sequence of a digging female, frames are separated by 0.3 s



**Fig. 3** Lateral view of taimen pair spawning on redd A. Female is the first fish

digging (0.5–1 m approximately); intensity of tail beating was very low.

Male courtship on both redds also followed a very predictable pattern: the male usually maintained a position above and slightly behind the female. He constantly touched her dorsal area with his inferior snout, frequently pressing the female's dorsal fin with one of his pelvic fins. From time to time, he left the female and positioned himself slightly upstream, 1–2 m away from one of her sides. From this position he approached her laterally until physically touching her. Very often the male alternated his position with respect to the female's sides by crossing over her caudal peduncle. Male digging was never observed. The pair was alone throughout the entire mating ritual, no other fish were present on the redds. The observations with two other taimen pairs on 17 and 19 May confirmed the absence additional males in the redd area.

## Discussion

As is the norm in the other salmonines, the observed female invested her time preparing the nest while the male invested his in courtship and mate guarding (Groot 1996). The activity of the pair changed according to the state of the nest; an observation that was most noticeable in the female's digging behaviour. At the beginning, she performed intense digs, swimming approximately 1–2 m while digging and displacing rocks with movements of her tail and gravel with movements of her pelvic fins. As the nest neared

completion, digs were concentrated in a single reduced spot. The male periodically performed quiverings during the entire recording period. Taimen quiverings lasted longer (2–9 s) than quiverings reported for other salmonines (0.5–3 s, see Esteve 2005a) and the male moved in a horizontal direction with respect to the water flow during the process, as opposed to other salmonines that tended to move vertically. A few minutes before egg release the female performed a series of false spawnings, something that is thought to occur because the female has not received enough stimulation to pass the threshold required to induce oviposition (Jones and Ball 1954; Esteve 2007). During the real spawning act, the pair remained with their bodies pressed to the substratum and their caudal fins flexed upwards while gaping their jaws and quivering their bodies (Figs. 3 and 4). Gaping was not as exaggerated in the observed breeding pair as in other salmonine species. The spawning act was longer than that reported for other salmonines (Esteve 2005a).

After spawning, the female rested on her nest for a short period of time before initiating a series of gentle digs with her tail to distribute her eggs and cover them with gravel. If resting before covering the eggs is indeed the norm for taimen, then this behaviour separates taimen from *Salmo*, *Oncorhynchus* and *Parahucho* (unpublished observations), all of which cover their eggs immediately after spawning, and from *Salvelinus*, which ventilates the eggs with tail swings before covering them. Our observations confirm another difference that also distinguishes



**Fig. 4** Frontal view of taimen pair spawning on redd B. Female is on the right

taimen, and possibly the entire genus, from other salmonines: taimen males do not form a dominance hierarchy around the nesting female. We never witnessed the presence of any other male on the redd or its immediate vicinity. Holc̃ik et al. (1988) and Witkowski (1988) reported that pair formation occurs days before reaching the spawning area in huchen, which indirectly implies that spawning is a one female-one male interaction as well, so it is possible that single pair spawning is a synapomorphy for *Hucho*.

It is important to note, however, that the absence of a male hierarchy does not imply that male fighting is absent during taimen spawning. On the contrary, on our observations on 17 and 19 May we witnessed several attacks whose intensity could hardly be paralleled by any other salmonine. We were alerted to attacks by sound and by sight from large distances on shore. Very often the backs of the fish were seen out of the waters as they accelerated through shallow waters. Many times the races ended in abrupt splashes, indicating violent physical contact, several meters away from the point of origin (20–50 m). Possibly, the fights we witnessed were the result of previously defeated males, during the pair formation process, attempting to congregate around the paired females. Differently from other salmonines, however, these fights never occurred in the redd area. The guarding male never allowed any other fish to approach within an approximate 20 m radius of the nesting female.

During this study we were able to distinguish two behaviours absent in other salmonines: female resting after spawning and single pair mating. Given the small sample size of our data these findings need to be corroborated by similar studies before we can conclude with certainty they are present in taimen. The dynamics of pair formation and the intensity of male competition and female choice in taimen remain unknown. Research in this direction is needed to build a more complete and robust history of the spawning habits of this unique species.

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