



# HOKKAIDO UNIVERSITY

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## 学位論文内容の要旨

博士の専攻分野名称：博士（農学）

氏 名：Hiroki MIZUMOTO

### 学位論文題名

Understanding the current distribution and biomass of an endangered salmonid species,  
Sakhalin taimen, by using environmental DNA

（環境DNAを用いた絶滅危惧種イトウの分布域・生物量の解明）

Sakhalin taimen (*Parahucho perryi*) is the largest freshwater fish in Japan and considered critically endangered by the IUCN. Historically distributed in the Russian Far East and Northern Japan, this species has declined drastically due to human activities such as river modification and deforestation. In addition, there were few studies and update about their distributions or population status, and most of their contemporary distribution is unclear. The rarity and migratory nature of Sakhalin taimen make direct detection and observation difficult, which has been a major limitation of field survey of the endangered species.

As the breakthrough for those issues, environmental DNA (eDNA) technique has drawn attentions recently. This technique was first reported in 2008 for detecting aquatic vertebrate species in the wild from environmental water samples. The strong advantages of this technique are that there is no need to observe target species directly and that it is easy to collect samples for monitoring across large spatial and temporal scales.

In my study, I aimed to estimate the current distributions and biomass of Sakhalin taimen, and to reveal their seasonal migrations and associations to their prey fish by using eDNA. I have four chapters in my thesis targeting (1) the association between the eDNA concentration and biomass in aquarium experiments, (2) evaluation of the eDNA application to natural environments, (3) the current distributions and biomass of Sakhalin taimen, and (4) the association between the presence/absence of Sakhalin taimen and their prey fish across seasons.

In Chapter 1, I first developed Sakhalin taimen species-specific primers and probe for quantitative PCR. There were strong correlations between eDNA concentrations and age, fork length and body weight of Sakhalin taimen in aquarium experiments.

Furthermore, eDNA concentration turned out to be a good indicator of total fish body weight contained in the aquarium. In Chapter 2, I found a significantly positive correlation between eDNA concentrations and the number of fish counted using a sonar system in the season of their spawning migrations, once their week-averages were taken into account. In Chapter 3, I detected Sakhalin taimen's eDNA in some rivers in Hokkaido where had no reports or extinct areas. In Chapter 4, I documented the presence or absence of Sakhalin taimen's eDNA in all four seasons. According to the results of the Next-Generation Sequencing with fish universal primers, there was no clear association between presence/absence of Sakhalin taimen's eDNA and fish community compositions.

During my doctoral work, I gathered new information that would not have been available by conventional field surveys alone. It will be a first step for the conservation of Sakhalin taimen and it can be applied range-wide. At the same time, the new method still has several uncertainties, which take future studies for better understanding ecology of the endangered species.