Mongolian Recreational Fishing Briefs

Taimen ecology, fishery management, and conservation.

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(# of 20)

TAIMEN CONSERVATION FUND – SCIENTIFIC RESEARCH TEAM

Fish Ecology: *Hucho taimen*

Taimen Population Dynamics

Key Points:

The relatively slow growth of taimen implies a low natural mortality rate and greater susceptibility to overfishing

Mark-recapture studies in the Eg-Uur suggest a population size of 2300 individuals > 3 years old within a 120 km stretch of river. This is equivalent to a density of 19 individuals per km.

The current catch levels in the Eg-Uur catch-release recreational fishery do not significantly impact the abundance of taimen. A larger catch-release fishery or harvest fisheries may adversely effect the population.

Related Topics

Population dynamics describes the processes (births, deaths, immigration, and emigration) that change the number of individuals within a population. Studying population dynamics is useful for fishery management because it allows managers to predict the effect of harvest (or incidental mortality in a recreational fishery) on the future size of a managed population. Frequently managers wish to know whether an existing or proposed fishery will reduce the size of a population below an acceptable level. To answer this question, scientists combine estimates of population size, natural mortality rate, and harvest levels in a mathematical model. Population dynamics parameters are difficult to estimate with any precision for populations that do not have either long time series of catch and fishing effort data or intensive scientific study within a closed population. Nevertheless, it is possible to use data from well-studied populations of ecologically or evolutionarily related species to infer values for an unstudied population. Here, we have combined information from a mark-recapture study in the Eg-Uur with information from studies of other fish populations to examine the impact of fisheries (current and potential) on taimen populations.

Eg-Uur Watershed taimen population dynamics study

The goal of this study was estimate the impact of the existing taimen recreational fishery and hypothetical expansions of this fishery on the abundance of taimen in the Eg-Uur study area. The fishery is 100% catch-release, so the first step was to estimate the mortality rate of released fish. Based on survival of radio and acoustic tagged fish and the fraction of captured fish observed to be bleeding from the gill area, we estimated that between 4% and 9.6% of released fish died from injuries sustained during capture. Combining these rates with an average annual catch of approximately 250 taimen, yields an estimate of 10 to 24 fish per year killed by the current recreational fishery. To put these numbers in context, we estimated the number of taimen occurring within the study area using a mark-recapture experiment. In addition, we estimated the annual natural survival rate (i.e., survival of adult taimen in the absence of fishing) using a well-documented relationship between somatic growth rate and natural mortality (Pauly 1980, Jensen 1996). For a population at equilibrium (neither growing nor shrinking), the number of new fish recruiting to the population (reaching adulthood) is equal to the population size multiplied by the annual mortality rate. To understand the impact of a fishery, it is helpful to compare the annual harvest rate to annual equilibrium recruitment.

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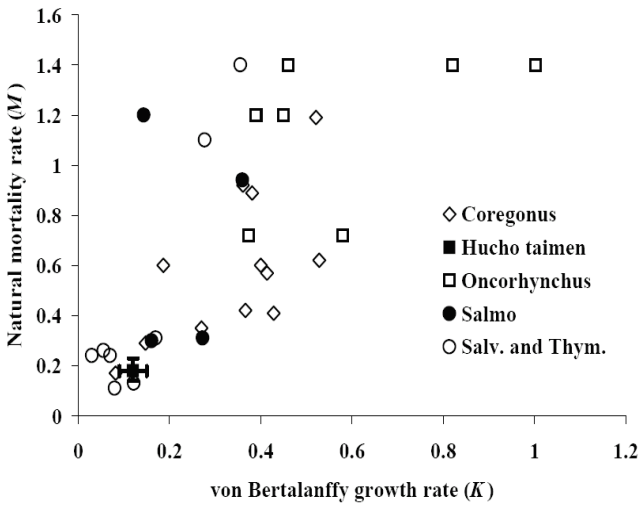
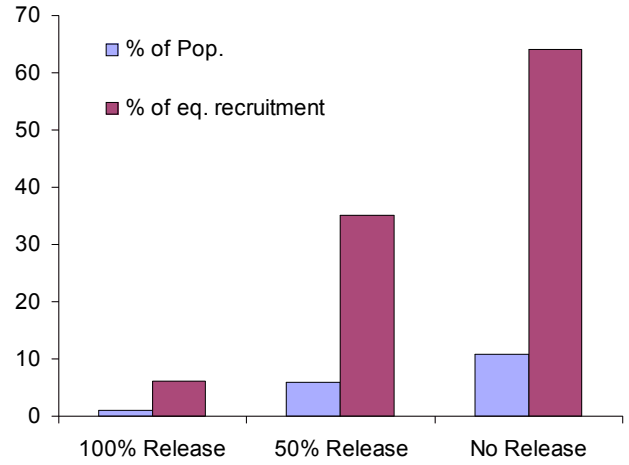


Growth rate and inferred natural mortality rate for taimen relative to other salmonids (top) and mortality caused by a recreational taimen fishery with a catch of 250 fish per year expressed as a percentage of the total Eg-Uur population size and as a percentage of equilibrium annual recruitment (below). For the 100% release and 50% release scenarios a post-release mortality rate of 9.6% was used.



Results

Analysis of data from 612 taimen tagged over a five-year period (2004 – 2008) resulted in an estimated population size of 2300 adult (>3 years old) taimen in the 120 km study area. This is equivalent to a density of 19 individuals per km. Fish with a growth rate similar to that of taimen typically have annual natural survival rates of 83% per year. The slower growth and presumably high natural survival of taimen makes them unusual compared to other species of salmonids (see top figure at left). Fish with slow growth and high natural survival tend to be more susceptible to overfishing. Given these estimates of population size and natural survival, 390 taimen per year must recruit to the Eg-Uur population to maintain the same population size. The annual mortality inflicted by the catch-release fishery is small relative to the total adult population size (0.4 – 1%) and relative to the annual equilibrium recruitment (2.6 – 6.2%), indicating that this fishery likely has a negligible effect on the population. However, a fishery this size which released only half or none of the taimen caught would result in the death of a substantial fraction of the total population and total recruitment each year (see bottom figure at left).

Implications for Management & Future Research

References:

Jensen, A. L. 1996. Beverton and Holt life history invariants result from optimal trade-off of reproduction and survival. Canadian Journal of Fisheries and Aquatic Sciences 53:820-822.

Pauly, D. 1980. On the interrelationships between natural mortatlity, growth parameters, and mean environmental temperature in 175 fish stocks. J. Cons. int. Explor. Mer.:175-192.