

Perception of fishermen towards invasive salmonids in Hokkaido and the contribution of citizen science to their long-term monitoring

(北海道の外来サケ科魚類に対する釣り人の認識、及び市民科学がその長期モニタリングに与える貢献)

Graduate School of Environmental Science, Hokkaido University, Division of Environmental Science Development, GEM Course
Elijah Caldwell

This study aims at testing the grounds for the creation of a citizen science community that effectively provides ancillary data to improve monitoring of invasive sports fish (rainbow, brown, and brook trout, as well as sockeye salmon) in Hokkaido's rivers. Local fishermen were contacted and engaged through advertisements, a project web site, and cooperation with organizations and angling shops to ask them to share catch information via a dedicated web application or by email. Social media platforms were used as alternative 'passive' citizen science and queried for geotagged pictures or information on species location. The resulting combined data set was compared with historical data (1980-1998) and new (2004-2020) scientific data from published papers and grey literature, testing its effectiveness in assessing species distribution predictions. A total of 928 georeferenced locations were collected from April to October 2020. Of them, 53% were citizen science data and was 47% scientific data. By species, rainbow trout accounted for around 74% of all observations (24% from passive data), followed by brown trout (15%), sockeye salmon (8%), and lastly brook trout (3%).

To test the potential scope of citizen science data for improving distribution range estimation, basic distribution maps were created with historic scientific, new scientific and the combined citizen science data at the scale of municipalities and watersheds. Watersheds with occurrence of the rainbow trout in the pooled data set, had 73% newly reported sheds from citizen science. A GLM was then used to predict occurrence probability of rainbow trout (most data-rich species) using relevant environmental and climatic parameters at the scale of river segments throughout the entire Hokkaido river network. Three models were developed a historical data (1980-1998), and two current data models (2010-2021); current scientific data alone and combined current scientific and citizen science data. The combined model clearly improved its performance relative to the scientific-only model and predicted an overall net range increase for the species of 12% relative to its historical range, suggesting a rapid expansion of the species across over the last 25 years. Other than the analysis of the distribution ranges, a questionnaire was also conducted to understand fishermen attitudes towards these invasive species and associated environmental issues. A majority (68% of 38 people) did not consider them an environmental problem for Hokkaido rivers and a large proportion of them regarded the species as having high value for fishing. However, environmental issues like habitat loss and habitat fragmentation were described as major concerns. Ordinal logistic regression models further teased apart these relationships indicating that education and age group had a significant effect on fishermen attitude towards fishing practices and the invasive salmonids. For example, adults (age 50-69) were statistically significantly more likely to keep invasive species with high sport value and less likely to see them detrimental for fishing than fishermen belonging to most of the other age groups.

The results demonstrate promising potential for citizen science to improve the monitoring and assessment of invasive species, while involving citizens in the conservation of natural resources. Although fishermen have an idea of the foreignness of these species, concern over the impact on the environment is at most mixed. Rainbow trout, for example, showed that fishermen of all ages both valued and fished it. Together with the prediction that suggests rapid expansion of species over the last 25 years, these results exemplify the difficulties of implementing management measures curbing expansion of valued and socially accepted invasive species. However, they also demonstrate how citizens can complement science to help achieve a more comprehensive monitoring and assessment of invasive species.