The Distribution of Native Riverine Fishes in the Portneuf Drainage

Idaho State UNIVERSITY

MILES — Managing Idaho's Landscapes for Ecosystem Services

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Paiute Sculpin - Ernest Keeley

Cutthroat Trout – Ernest Keeley

Introduction

Goal
- The specific goal of this project was to assemble and visualize information on the distribution of native species of riverine fish in the Portneuf Drainage.
- It is part of the larger Managing Idaho's Landscapes for Ecosystem Services (MILES) study, an NSF/EPSCoR funded project to understand the impact of climate change and urban growth on social and ecological systems and services in mid-sized cities in Idaho.

Questions
1. What native species of riverine fish occur in the Portneuf Drainage?
2. How are the species spatially distributed?
3. How does fish species richness vary spatially?

Approach
Our approach was to assemble fish occurrence records from Idaho Museum of Natural History specimens and Idaho Department of Fish and Game fish surveys and visualize them as dot-distribution maps and a species richness map.

Application
This information will be used to develop distribution models for each species to gain a more complete picture of where fish are distributed within the Portneuf Drainage and what environmental factors are influencing where fish occur.

Importance
- The results from this study should help MILES researchers evaluate the effects of climate change and urban growth on ecosystem services provided by native species of riverine fishes.
- These services include the fishes roles in food webs, indicators of water quality, recreation fishing, associated economic benefits, and cultural significance.

Methods

- We obtained fish specimen records from the Idaho Museum of Natural History and fish survey records from the Region 5 office of Idaho Department of Fish and Game.
- We used the web tool Geolocate to georeference the museum records.
- We imported all of the fish records into ArcMap 10.2
- Our GIS layers included a Digital Elevation Model (DEM), a hillshade, hydrology, PRISM temperature and precipitation data, land cover, roads, watershed boundaries (6th and 8th level hydrological units), and National Agricultural Image Program (NAIP) imagery, all clipped to the Portneuf watershed boundary.
- We prepared dot-distribution maps for each fish species and then calculated and mapped the number of species per 8th level HUC.
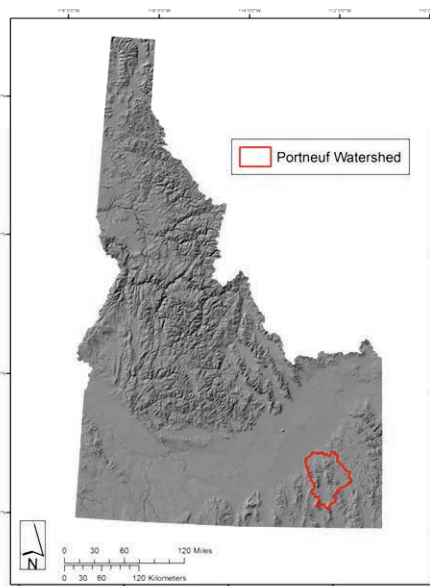
Study Area

Figure 1. Red boundary represents the Portneuf HUC 4 watershed.

Figure 2. 3D image showing cities, towns, exaggerated mountain ranges and course of the Portneuf River.

Figure 3. Upper Portneuf River. Photo by Colden Baxter.

Figure 4. Lower Portneuf River in concrete channel in Pocatello.

- The Portneuf Drainage is located in the Northern Basin and Range Ecoregion in Southeastern Idaho. (Figure 1).
- It has an area of 3,434 km2 (343,400 ha).
- The drainage ranges in elevation from 1,309 to 2,821 m and includes the Bannock and Portneuf mountain ranges.
- It contains 927 km of perennial streams, 1,453 km of intermittent streams, and 225 km of excavated canals. (Figure 5)
- The largest watercourse is the Portneuf River with a length of 156 km (Figure). The river has been highly modified by a dam to form Chesterfield Reservoir, channelization, diversions for irrigation, and flood control structures. (Figure 5)
- The drainage's climate can be characterized as temperate and continental. Average temperatures and precipitation are shown in Figures 7 and 8.
- The primary land cover types are shrub-scrub, cultivated crops, evergreen forest, herbaceous vegetation, deciduous forest, and development (Figure 6).
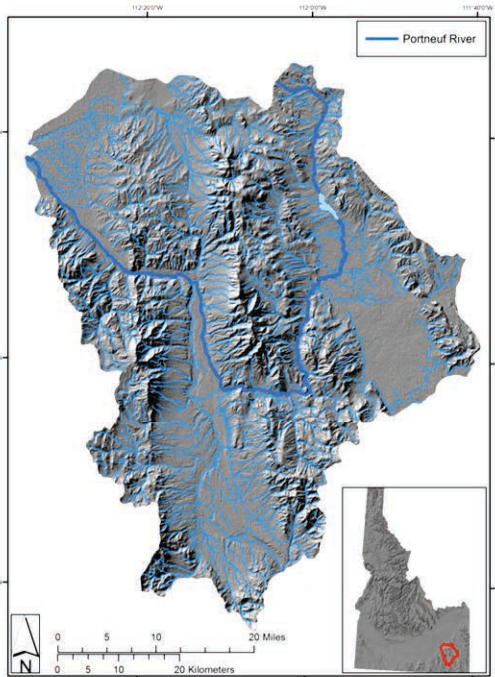

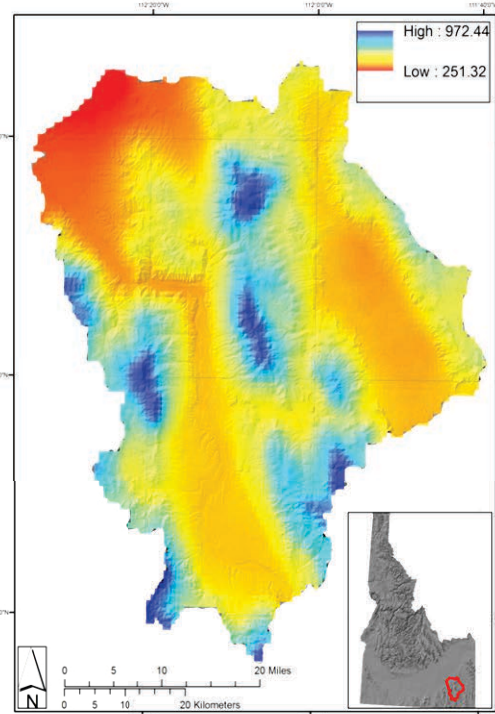Figure 5. A shaded relief of the watershed showing mountain ranges and hydrology

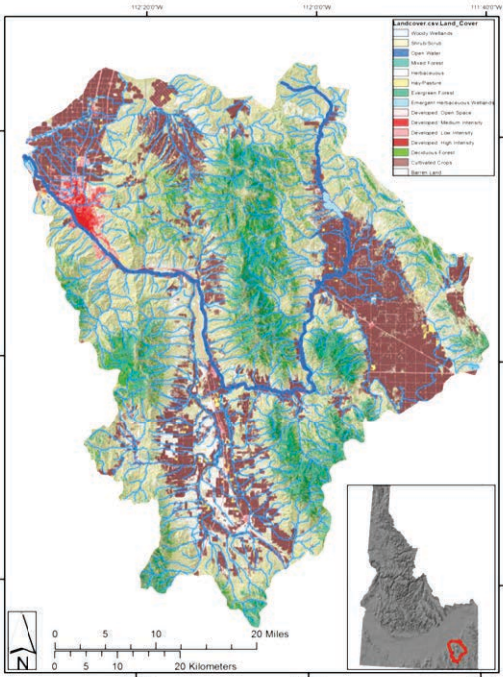Figure 6. Land cover of the Portneuf HUC 4 watershed

Figure 7. 30 year temperature mean across the Portneuf HUC 4 watershed
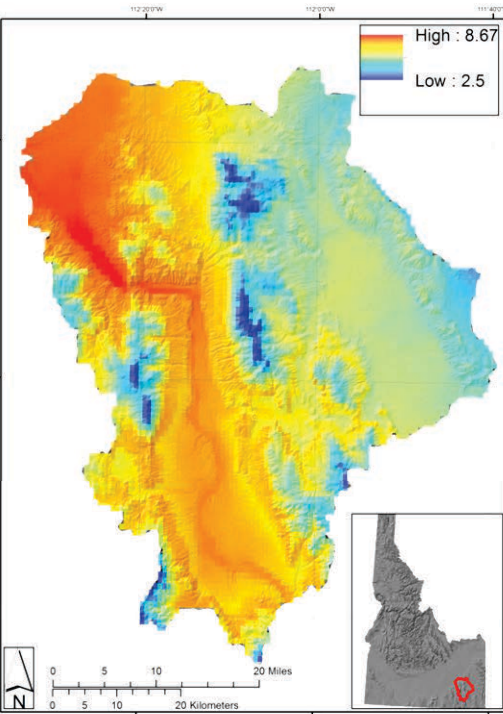

Figure 8. 30 year precipitation mean across the Portneuf HUC 4 watershed

Results

Family	Scientific Name	Common Name	Native	IDFG Survey Locations	Museum Locations
Catostomidae	Catostomus ardens	Utah Sucker	✓	6	5
	Catostomus discobolus	Bluehead Sucker	✓	0	3
	Catostomus platyrhynchus	Mountain Sucker	✓	10	4
Cottidae	Cottus bairdii	Mottled Sculpin	✓	38	14
	Cottus beldingii	Paiute Sculpin	✓	5	14
Cyprinidae	Cyprinus carpio	Common Carp		1	1
	Gila atraria	Utah Chub	✓	2	6
	Rhinichthys cataractae	Longnose Dace	✓	3	13
	Rhinichthys osculus	Speckled Dace	✓	8	15
	Richardsonius balteatus	Redshide Shiner	✓	3	11
Salmonidae	Oncorhynchus clarki	Cutthroat Trout	✓	56	5
	Oncorhynchus mykiss	Rainbow Trout		18	6
	Oncorhynchus mykiss	Rainbow Trout Hatchery		12	0
	Prosopium williamsoni	Mountain Whitefish	✓	0	1
	Salmo trutta	Brown Trout		12	1
	Salvelinus fontinalis	Brook Trout		9	3
		Rainbow / Cutthroat Trout		25	1

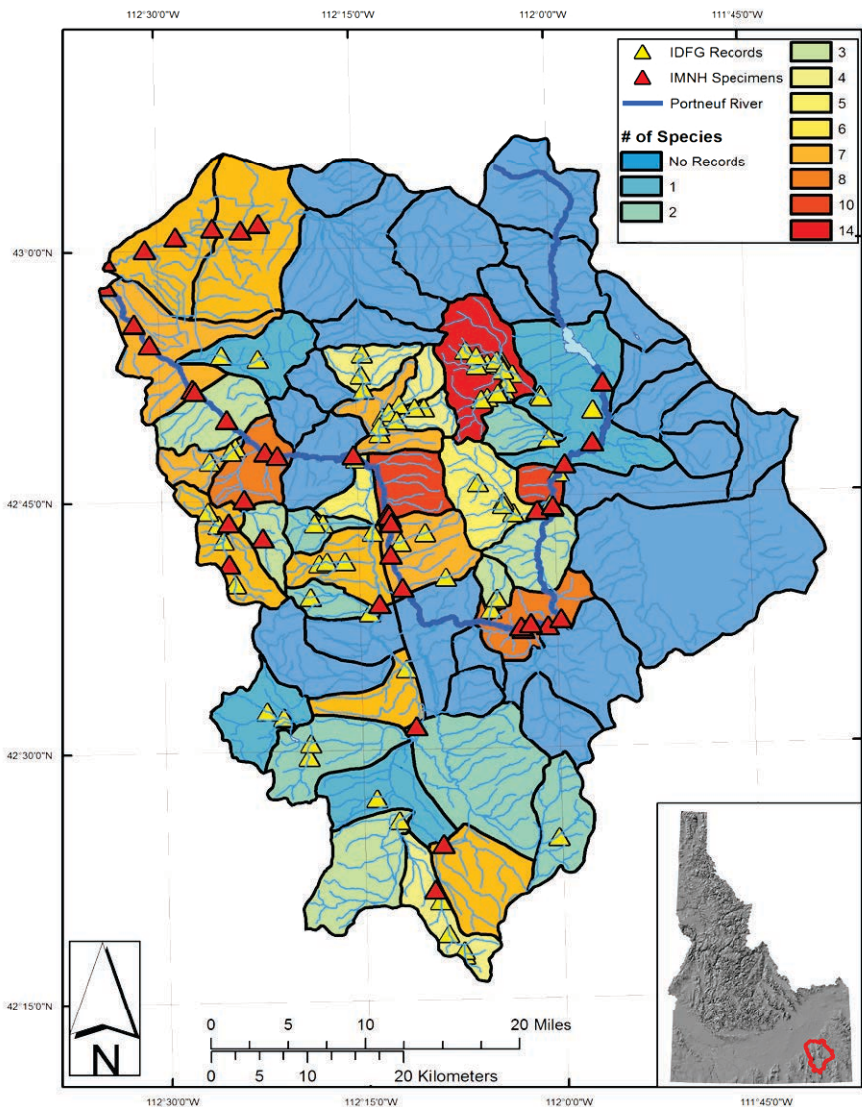Table 1. Native and non-native species records for the Portneuf HUC 4 watershed.

Figure 9. Distribution and species richness of native and non-native records throughout the Portneuf drainage.
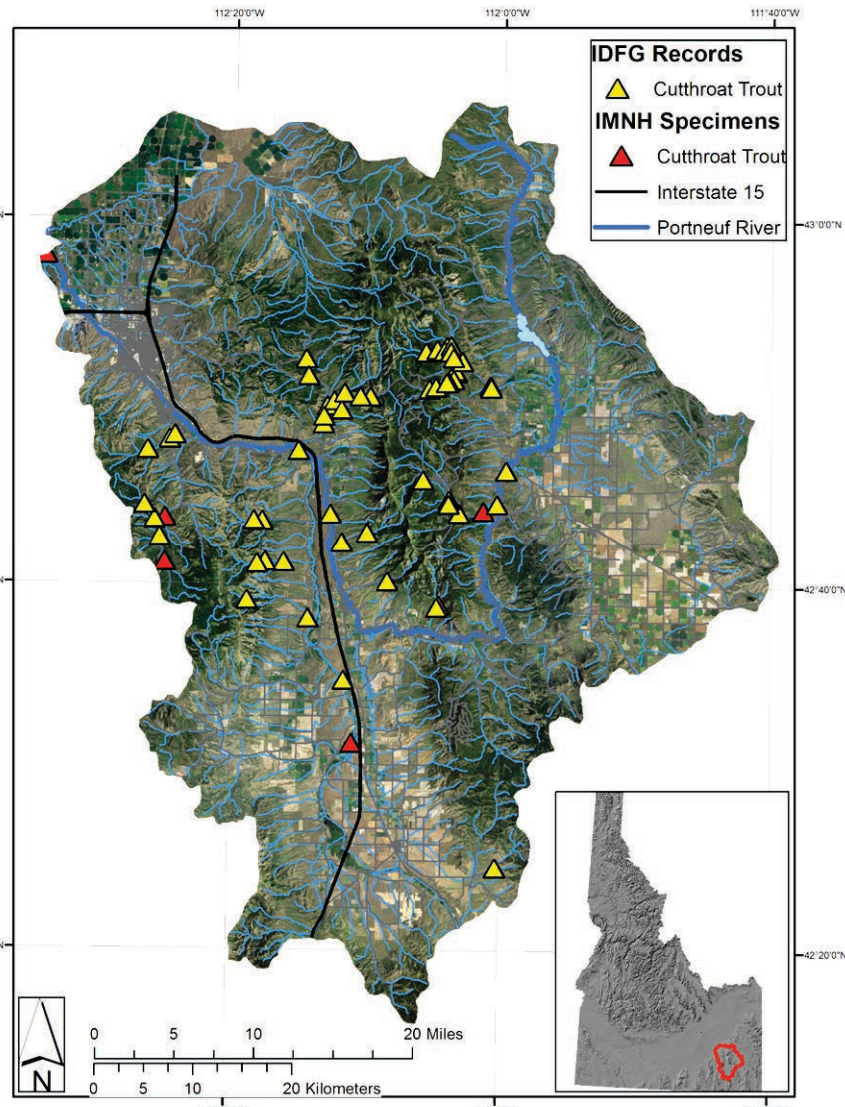

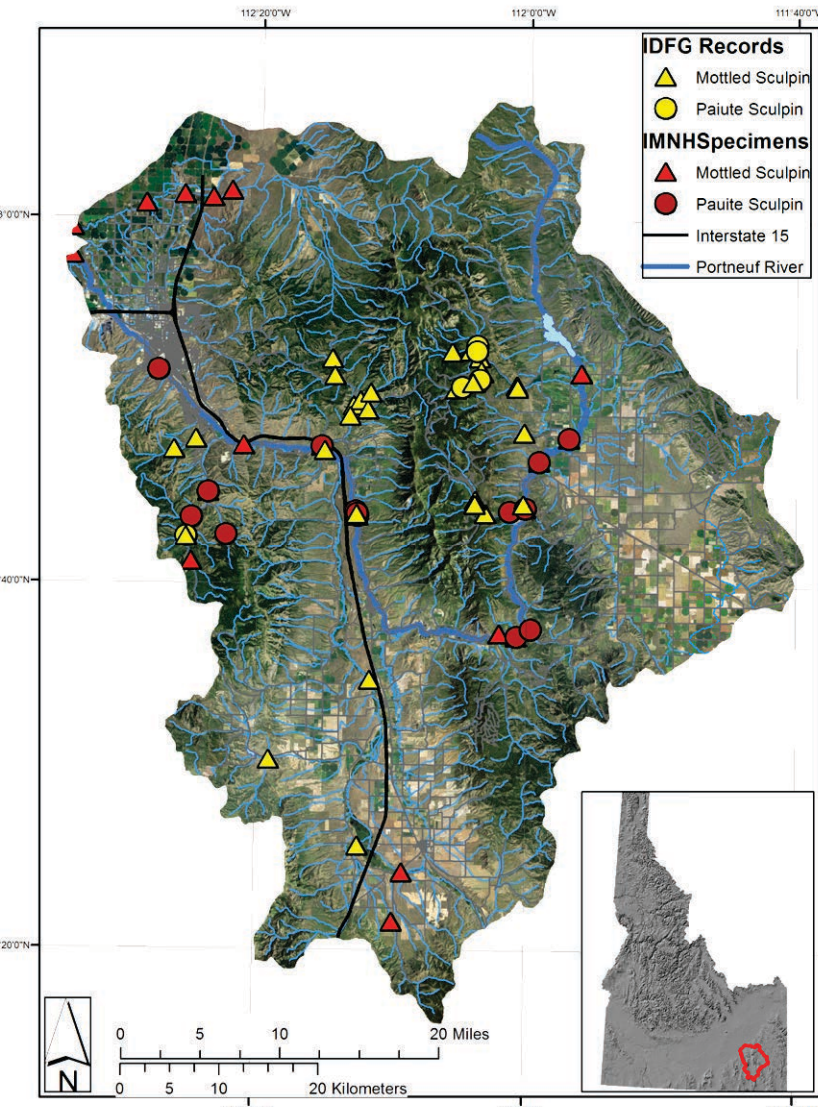Figure 10. Distribution of cutthroat trout records throughout the Portneuf drainage.

Figure 11. Distribution of the Family Cottidae records throughout the Portneuf drainage.
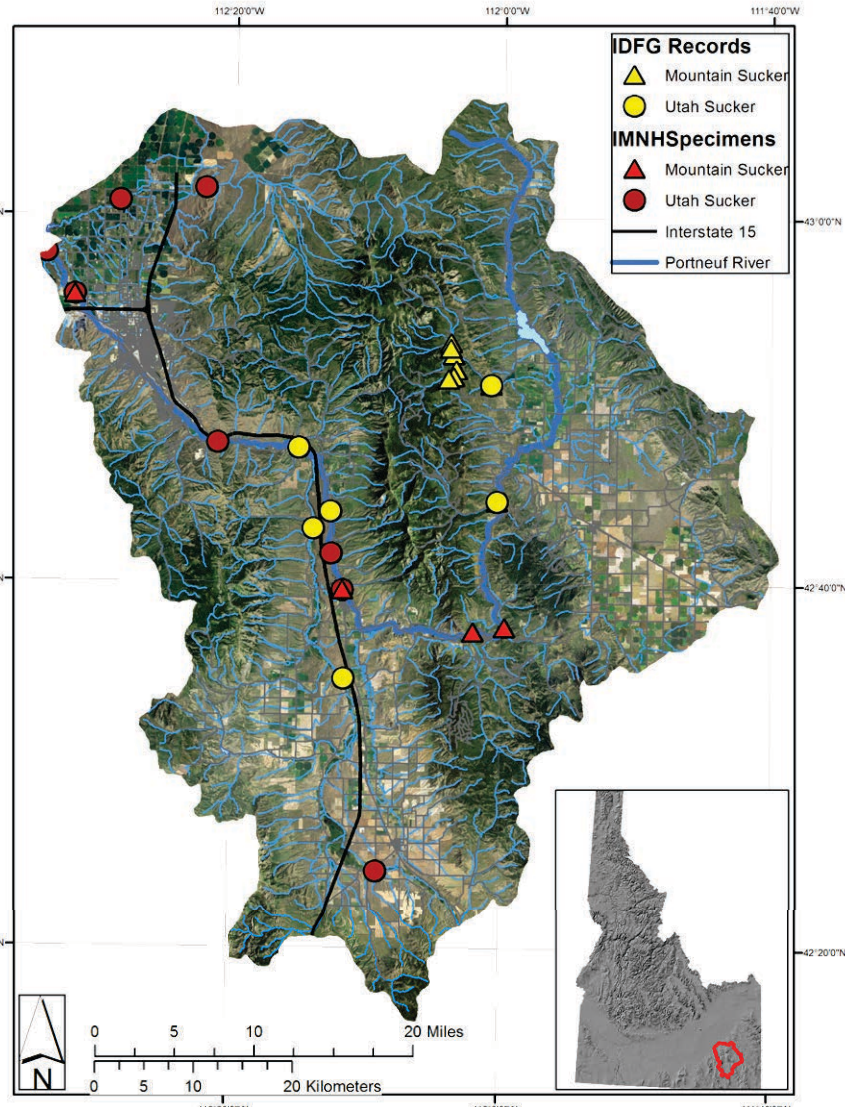

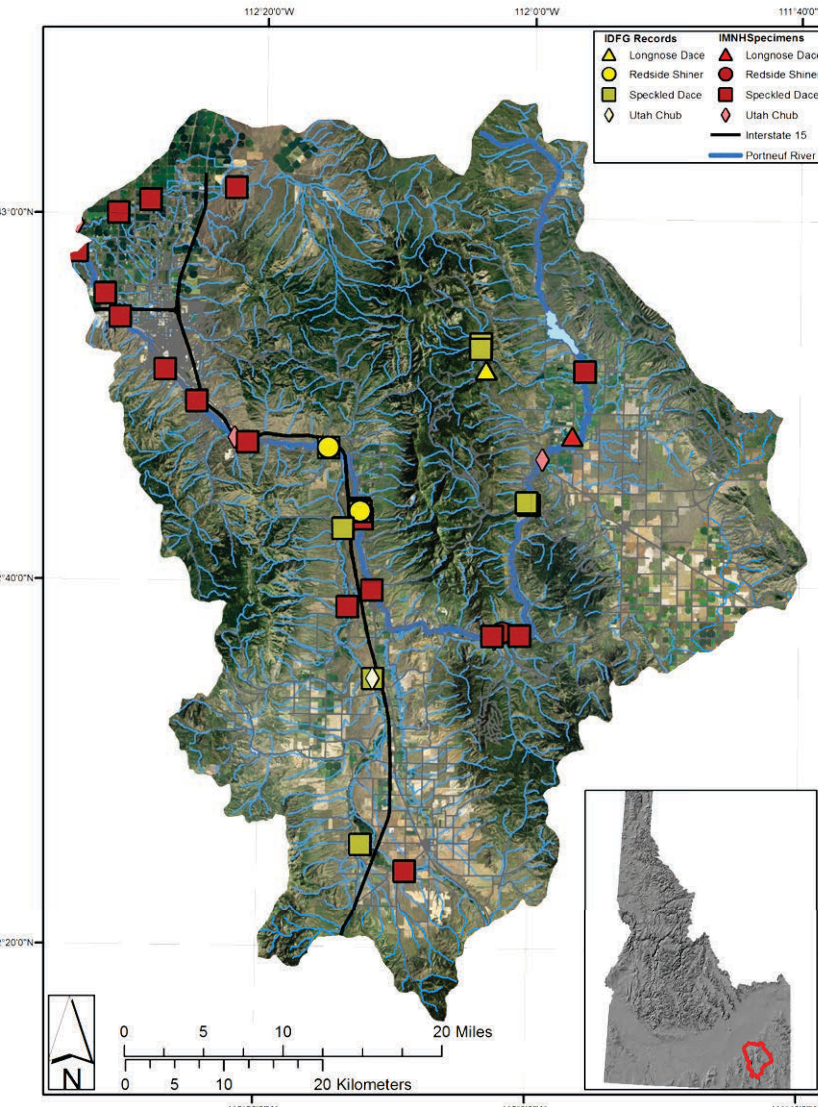Figure 12. Distribution of the Family Catostomidae records throughout the Portneuf drainage.

Figure 13. Distribution of the Family Cyprinidae records throughout the Portneuf drainage.

Summary

- Based on IMNH specimen and IDFG survey records, 11 native and 5 non-native species of fish have occurred in the Portneuf drainage.
- The hydrological units with the highest species richness are located in the upper portion of the drainage but many hydrological units were not sampled.
- The dot-distribution data are inadequate to provide an accurate picture of species distributions throughout the watershed because of uneven sampling.

Future Research

- We plan to develop predicted distribution maps based on habitat relationships (e.g., channel slope, position in stream network, temperature, and land cover type).
- The species that will probably be best suited for modeling (because of higher numbers of records) include cutthroat trout, mottled sculpin, Paiute sculpin, longnose dace, and speckled dace.
- We will use the models to understand the abiotic and biotic factors affecting the presence / absence of fish and to predict fish locations in unsampled areas.
- We will use museum and survey data from other sources to validate the models.

Acknowledgments

- NSF/EPSCoR MILES – funding
- Arnold Brimmer and David Teuscher (IDFG) - fish survey records
- Danelle Larson - discussion and poster review
- Colden Baxter - poster review and photograph
- Ernest Keeley – poster review and photographs
- Donna Delparte – mapping advice

Information Sources

- GIS layers were downloaded from; InsideIdaho.org, viewer.nationalmap.gov/viewer/, and giscenter.isu.edu/data/
- City boundaries- Idaho State Tax Commission
- NAIP imagery - USDA
- Portneuf watershed information - Portneuf Watershed Project portneufwatershed.org
- Rivers, streams, lakes, land cover - Idaho Department of Water Resources
- Satellite imagery - Landsat 8