The intestinal parasites of an assemblage of stream fishes in central Utah

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Fish parasites can have potentially significant effects on the health (Hursky and Pietrock 2015), reproductive output (Moravec and Barton 2015), and behavior (Barber et al. 2000) of their hosts. However, understanding large-scale patterns of parasite infection and ecological processes that affect host-specific transmission of parasites within a community requires comparison among geographically and taxonomically diverse populations (Poulin and Forbes 2012, Heins et al. 2014, Strona 2015). Stream fishes of the western USA represent a taxonomically and geographically unique assemblage, and parasites of these fishes are not well known. Recent studies of fish parasites in western North American streams and rivers have focused on metazoan parasites in salmonids. Concern about whirling disease caused by Myxobolus cerebralis has prompted a significant effort directed toward detection and management of this protozoan (Kaeser et al. 2006, Koel et al. 2006, Eby et al. 2015, Fetherman et al. 2015, Murcia et al. 2015, Nehring et al. 2015). Whereas, the effort to curb whirling disease is an important management goal for salmonid sport fishes, the consequence has been that studies on internal nonprotozoan parasites in stream fishes of the western United States have been neglected.


We surveyed for intestinal parasites in 5 species of co-occurring native stream fishes from the Spanish Fork River in Utah County,
Utah (40°00’52.94”N, 111°29’50.44”W). Specifically, they are southern leatherside chub (Lepidomeda aliciae), redside shiner (Richardsonius balteatus), and longnose dace (Rhinichthys cataractae)—all 3 in the family Cyprinidae; mottled sculpin (Cottus bairdii: Cottidae); and mountain sucker (Catostomus platyrhynchus: Catostomidae). Southern leatherside chub and redside shiner are found in the midwater column in areas of slow current, and they feed on aquatic macroinvertebrates (Bell and Belk 2004, Nannini and Belk 2006, Wesner and Belk 2015). Longnose dace are benthic omnivorous fishes and mottled sculpin are benthic carnivorous fishes. Both occur in habitats with faster current velocities and feed on aquatic macroinvertebrates (Sigler and Sigler 1987). Mountain sucker are benthic, mostly herbivorous fish that occur in habitats with faster current velocities. (Sigler and Sigler 1987, Wesner and Belk 2015).

We collected and dissected small samples of each species each week from mid-September to late November 2014. In total, we examined 52 southern leatherside chub, 28 mountain suckers, 40 longnose dace, 50 mottled sculpin, and 23 redside shiner. Samples of all species included a mix of juveniles and adults. To examine fish for parasites, we split the intestinal tracts (including stomachs) and carefully examined the inside under a dissecting microscope at 10× to 20× magnification. We temporarily preserved all parasites in an alcohol-formaldehyde-acetic acid (AFA) solution, then stained them using the following process: 70% alcohol for 20 min, 30% alcohol for 15 min, water for 15 min, Mayer’s stain for 5–10 min, water for 15 min, 30% alcohol for 10 min, 70% alcohol for 10 min, 90% alcohol for 5 min, 100% alcohol for 3 min, xylene for 1 min, and Canada balsam for the permanent mount (Pritchard and Kruse 1982). We identified parasite species using the keys and descriptions in Hoffman (1999). We calculated prevalence of parasites as number of infected fish divided by total number of fish dissected, and intensity of parasites as number of total parasites divided by number of infected fish (Bush et al. 1997).

We found 2 species of parasites among all fishes examined (Table 1): a single unidentified trematode species and a single cestode species that is either Biacetabulum sp. or Glaridacris sp. However, identifying these individuals to the species level is challenging because cestodes have many similar morphological features, and genetic tests are necessary to discriminate between species. We found trematode metaceraria (Fig. 1) in southern leatherside chub, mountain suckers, and longnose dace, but no parasites were detected in mottled sculpin and redside shiner. Prevalence and intensity of the trematode metacercaria were considerably higher in southern leatherside chub than in mountain suckers and longnose dace (Table 1). We found adults of a cestode (either Biacetabulum sp. or Glaridacris sp.) in the family Caryophyllaeidae (Fig. 2) only in southern leatherside chub.

Parasites with complex life cycles (like the 2 species we found) use trophic webs as a route of transmission between fish hosts (Timi et al. 2011, Rossiter and Sukhdeo 2014). By exploiting predator interactions in an aquatic system, parasites can evolve transmission tactics and promote host range expansion (Strona 2015). Thus, we expected to find similar parasite occurrence and prevalence in species with similar diets (i.e., southern leatherside chub and redside shiner, or longnose dace and mottled sculpin). On the contrary, almost all parasites were found inside the digestive tracts of southern leatherside chub, and none were found in redside shiner and mottled

### Table 1. Host fish species, parasite taxa, number of parasites, prevalence (number of infected fish divided by total number of fish dissected), and intensity (number of total parasites divided by number of infected fish) in Spanish Fork River, Utah, USA. No parasites were found in mottled sculpin (Cottus bairdii) or redside shiner (Richardsonius balteatus).

<table>
<thead>
<tr>
<th>Fish species</th>
<th>Habitat</th>
<th>Diet</th>
<th>Parasite</th>
<th>Number of parasites</th>
<th>Prevalence</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lepidomeda aliciae</td>
<td>Midwater</td>
<td>Carnivorous</td>
<td>Trematoda (metacercaria)</td>
<td>611</td>
<td>25.0%</td>
<td>47</td>
</tr>
<tr>
<td>Catostomus platyrhynchus</td>
<td>Benthic</td>
<td>Herbivorous</td>
<td>Cestoda</td>
<td>3</td>
<td>5.7%</td>
<td>0.2</td>
</tr>
<tr>
<td>Rhinichthys cataractae</td>
<td>Benthic</td>
<td>Omnivorous</td>
<td>Trematoda (metacercaria)</td>
<td>3</td>
<td>3.5%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Trematoda (metacercaria)</td>
<td>3</td>
<td>2.5%</td>
<td>3</td>
</tr>
</tbody>
</table>
sculpin. This pattern suggests strong host specificity rather than a general pattern of trophic transmission.

Host specificity is rare in stream fishes (Barger and Esch 2002, Vincent and Font 2003). Thus, another likely explanation for the pattern we observed is high temporal variation in parasite communities and a tendency toward stochastic dynamics (Bartha et al. 1997, Morand et al. 2002, Kennedy 2009). Under this view, parasite occurrence and prevalence are unpredictable, and associations between parasites and hosts result mostly from chance events and conditions rather than as a consequence of ecologically based assembly rules or host specificity. The low level of trematode metacercaria found in mountain suckers and longnose dace is consistent with an accidental infection as predicted by stochastic models of community composition and structure (Bartha et al. 1997, Morand et al. 2002, Kennedy 2009). In contrast, the high levels of infestation in leatherside chub are likely a result of host specificity of cestodes (Calentine et al. 1970). There appear to be few general rules that govern parasite occurrence in freshwater fish assemblages (Kennedy 2009, Bellay et al. 2012). One reason may be that the environment in which these fish live is also highly variable both seasonally and within seasons (Braicovich and Timi 2010). Additional studies of parasite communities in stream fishes are required to test these hypotheses. We view this study as a baseline that will provide opportunity for comparison with future efforts.

We thank the Biology Department at Brigham Young University, the Utah Department of Wildlife Resources for collection permits, and members of the Fish Parasitology and Ecology class for assisting in dissections. We also thank Dr. Tomas Scholz and Dr. Mikulas Oros for help with parasite determination.

LITERATURE CITED


in native cutthroat trout *Oncorhynchus clarkii* (Richardson) and its relationships to tributary environments in the Yellowstone Lake Basin. *Journal of Fish Disease* 38:637–652.


Received 23 March 2016
Accepted 26 April 2016