Conclusions and Future Directions:
Ecology and Conservation of the Threatened Blackside Dace, *Chrosomus cumberlandensis*

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Summary and Common Themes

The 12 articles in this volume collectively contain a wealth of new information regarding the ecology and conservation of *Chrosomus cumberlandensis* (Starnes and Starnes) (Blackside Dace). Notable findings of each article are summarized in Table 1. Although each article addresses its own particular set of questions and objectives, a number of common themes emerge from the collection. In the following paragraphs we highlight several themes that merit attention.

**Threats and impacts are still occurring.** Despite the advantage of legal protections provided by federal and state regulatory mechanisms, Blackside Dace populations continue to be exposed to threats across much of their distributional range. Human-induced impacts associated with extraction of natural resources, construction of road crossings, channelization of streams, alteration of riparian zones, as well as impacts from *Castor canadensis* Kuhl (Beaver) are all touched upon in this volume. McAbee et al. (2013), Bivens et al. (2013), and Black et al. (2013b) noted empirical evidence and expert opinion regarding impacts of coal mining on stream water quality. Rakes et al. (2013) propagated dace in captivity for use in toxicity studies related to degraded water quality. Mattingly and Black (2013) observed degradation of four stream habitat variables at sites adjacent to active logging operations. Papoulias and Velasco (2013) detailed the water-quality changes and fish-tissue damage caused by hydraulic fracturing-fluid releases associated with development of natural gas wells. Eisenhour and Floyd (2013) and Floyd et al. (2013) discussed effects of perched culverts, stream channelization, and poorly maintained riparian zones. Finally, Compton et al. (2013) chronicled the collapse of a dace population in a watershed where Beavers altered the stream’s hydrology and ecology.

**Conductivity appears to be an important water-quality parameter.** Black et al. (2013b) observed that Blackside Dace are more likely to be present and persist in stream reaches where conductivity values are <240 μS/cm. Stream size (link magnitude) and water temperature played supportive roles alongside conductivity in the strongest reach-scale habitat models. McAbee et al. (2013) also found that coal-mining impacts such as elevated conductivity were the most influential variables affecting predictions of dace population persistence in their analyses. The mechanism underlying the tendency for dace to be absent in reaches with elevated

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