
The Freshwater Gastropods of the Great Smoky Mountains National Park

A report submitted to the GSMNP
Office of Inventory and Monitoring

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Introduction

In recent years substantial concern has been raised regarding the conservation status of the freshwater gastropod fauna of North America (Lydeard et al. 2004, Strayer 2006, Lysne et al. 2008). Yet the gastropod biodiversity inhabiting most of America's rivers, lakes and streams has never been systematically surveyed. Indeed, until quite recently the only published references to the freshwater snail faunas of North Carolina and Tennessee were the simple checklists of Dawley (1965) and Bickel (1968), neither of which contains more than spot records of individual taxa gleaned from the scattered literature. And the freshwater gastropods of the Great Smoky Mountains have been entirely unsurveyed and almost entirely unknown.

Initiated in 1998, the FWGNA project is a long term, collaborative effort to survey the entire continental freshwater gastropod fauna north of Mexico. Results from four states had been brought online as of 2010: Virginia (Atlantic), North Carolina, South Carolina, and Georgia (Atlantic), with Tennessee under development. The entire freshwater gastropod fauna of each state is identified, tabulated by relative abundance, reviewed for conservation status, catalogued in a photo gallery and distinguished by dichotomous key. Range maps are provided for each of the 78 species inhabiting the region covered, with notes on life history, ecology, habitat, and taxonomy. More information is available at <http://www.fwgna.org/>.

In late August we were contacted by the Office of Inventory & Monitoring about the feasibility of a freshwater gastropod survey in the Great Smoky Mountains National Park. Specific tasks were to include:

1. Verify or identify the freshwater gastropod holdings currently held in park collections.
2. Survey the freshwater gastropod fauna inhabiting at least 10 major stream sites to be specified by The Park.
3. Deposit identified and labeled representative specimens collected for future reference.
4. File a brief report on the findings, to include comments on relative densities, species richness, links to water quality, and future work.

We have been pleased to comply with these requests. The present document, detailing the results of a field survey undertaken Sept 9 - 11, 2011, is submitted in fulfillment of item (4).

Methods

The (ultimately 11) sites specified by The Park were distributed across the range of water bodies present in the Great Smoky Mountains accessible by road, including five streams on the Tennessee side - Abrams Creek (two sites), Chilogatee Creek, Little River (two sites), West Prong Little Pigeon River, and Cosby Creek, as well as four streams on the North Carolina side: Cataloochee Creek, Oconoluftee River, Deep Creek, and Noland Creek. The Chilogatee site (at its mouth) touched Chilhowee Lake, and the Noland

site (at its mouth) touched Fontana Lake. We added 9 sites to the 11 specified by the Park: Parson Branch (two sites), Mill Creek, Little Pigeon River, Crying Creek, Bradley Fork, Noland Creek (a second), Abrams Creek (a third) and Little River (a third), for a total of 20 sites visited in three field days.

At each site a simple untimed search was performed across the entire range of benthic habitats present, at all wadeable depths. Freshwater gastropods are surprisingly diverse in their habitat preferences, and a variety of rather specialized searching techniques are required to conduct an adequate survey. For details see Dillon (2006). Representative samples were taken in denatured ethanol of every freshwater gastropod species observed at each site surveyed.

Results

A **spreadsheet** detailing our survey results is appended to this report, as well as a **map** locating all 20 sites visited. No freshwater gastropods were recovered at the seven sites marked as open circles.

From the 13 snail positive-sites we identified 12 species, an unexpectedly high species richness given the relatively harsh environment of the Smoky Mountains. Most widespread was the pulmonate limpet *Ferrissia rivularis* (10 sites), with *Pleurocera proxima* also common at 6 sites. These two species are especially well-adapted to high gradient, low nutrient streams. We were surprised, however, to discover populations of several gastropod species more adapted to the richer waters of the Ridge and Valley Ecoregion to the west of the Park (*Pleurocera claviformis*, *Leptoxis praerosa*, *Physa gyrina*), and some species more typical of lentic environments (*Lymnaea columella*, *Gyraulus parvus*).

Our field notes on habitat characteristics and gastropod abundances follow. **Sites marked in bold** were originally suggested by the Park staff; those in plain font were added subsequently.

911-GSM-01A1. Abrams Creek, 200 M downstream from footbridge, Cades Cove. The stream here shows effects of mixture with (much softer water) Mill Creek (01A3) approximately 200 M upstream. *Physa gyrina* still moderately common. *Ferrissia rivularis* surprisingly rare. *Pleurocera proxima* not common, but the population density seemed to suggest viability, unlike (perhaps) site 01A2.

911-GSM-01A2. Abrams Creek above footbridge at Cades Cove. The stream here seems as rich as most rivers of this size in the Ridge and Valley Province to the west. There is a good mixture of habitats, including soft flocculent mud on the pool margins, as well as the usual riffle environments. Large *Physa gyrina* common, and *Lymnaea humilis* uncommon on mud above the waterline. N=1 *Menetus dilatatus*. *Pleurocera proxima* uncommon. The water quality here may be too hard to sustain a *proxima* population - these individuals may be crawl-ups from below. See site 01A1. No limpets - maybe D.O. problems?

911-GSM-01A3. Mill Creek above confluence with Abrams Creek, Cades Cove. This appears to be much softer water. A pretty stream, more like one would expect at this altitude in the Smokies. No

freshwater gastropods observed, however, not even limpets. Perhaps still showing effects of historic agricultural impacts/logging?

911-GSM-01B. Abrams Creek at the parking lot near Ranger Station, 13 km NE of Tallassee. A lovely river, although not as rich or productive as its origin in Cades Cove. The water quality seems to have softened considerably. No mud, nor indeed much leaf litter. Rocks clean and slick. *Leptoxis praerosa* very uncommon... on the ragged edge of its range and habitat requirements. But one of the most limpety streams I have seen in many years. *Ferrissia* all over everything, both species.

911-GSM-02. Chilogatee Creek by Happy Valley Rd. at Chilhowee Lake. Surprisingly nice - really about as pretty as TVA reservoirs get around here. Lake levels seem to be fairly stable... emergent vegetation healthy. Lots of organic litter/debris. *Lymnaea columella* moderately common on dead leaves & sticks. *Physa acuta* uncommon (surprisingly) as well as *Menetus dilatatus* and *Gyraulus parvus*. *Helisoma anceps* uncommon on solid substrates - more characteristic of the firm substrate at the creek mouth.

911-GSM-03. Little River at Foothills Pkwy Overpass, 1 km SW of Walland. Very pretty. The river here is beginning to take the character of the Ridge and Valley Province... not rich, but becoming so. Some quiet pools and backwaters, although not (as yet) much organic matter beginning to collect. Both *Leptoxis praerosa* and *Pleurocera clavaeformis* uncommon to moderately common in spots. *Ferrissia rivularis* uncommon. I was surprised not to find any *Physa*, *Helisoma*, or other larger pulmonates - perhaps the river is still not quite productive enough here.

911-GSM-04A. Little River at parking lot on E Lamar Alexander Pkwy, 5 km E of Townsend. Absolutely bare-rock nothing. The river suggests very low productivity here, and obviously flashy.

911-GSM-04B. Little River at parking lot off Little River Road, 10 km W of Gatlinburg. Pretty trout-type stream. River is obviously soft and low in nutrients, but apparently stable... not as flashy as at site 04A. *Pleurocera proxima* uncommon. A few *Ferrissia rivularis* on sticks/debris.

911-GSM-05A. West Prong Little Pigeon River at US321/441, 4 km N of Gatlinburg, at northbound tunnel. Absolutely bare-rock nothing. Is this natural, or the result of urbanization upstream? Obviously very low nutrient here - dark, cold, almost no leaf litter at this time of year. Even sticks/organic debris rare. Decision to sample Little Pigeon River (05B) - environmentally similar but without urbanization - as some sort of control.

911-GSM-05B. Little Pigeon River at US 321, 9 km E of Gatlinburg. Bare-rock nothing, once again. The river here seems quite similar to the West Prong Little Pigeon - dark, cold, unproductive, and possibly even flashier. This suggests that the absence of a freshwater gastropod fauna from the Little Pigeon is not a direct consequence of Gatlinburg urbanization.

911-GSM-06A. Rock Creek at Cosby Park Road, 1 km N of Cosby Campground. A pretty little stream, although no mollusks whatsoever - possibly too soft? Surprising, since I was advised to expect "lots of snails" here. But see site 06B.

911-GSM-06B. Crying Creek at Cosby Park Road, 3 km N of Cosby Campground. Looks similar to nearby Rock Creek (06A), but *Pleurocera proxima* moderately common - very common in spots. *Ferrissia rivularis* also moderately common. It's not clear why Crying Creek seems so much better than Rock Creek just 2 km up the road. Crying Creek may be lower-gradient? Or possibly land use history?

911-GSM-07. Cataloochee Creek at National Park Road bridge, 1 km N of Ranger Station. A wide, shallow, cold, lovely, crystal clear river apparently just productive enough to support a sparse population of *Ferrissia rivularis*, although (perhaps) still too soft for *P. proxima*.

911-GSM-08A. Oconaluftee River at Blue Ridge Parkway origin, 4 km N of Cherokee. Another wide, shallow, cold, lovely, crystal clear river apparently just productive enough to support a sparse population of *Ferrissia rivularis*, although again (perhaps) still too soft for *P. proxima*.

911-GSM-08B. Bradley Fork at Smokemont Campground. Here approximately 6 km upstream from Oconaluftee site 08A, the productivity has (I suppose) dropped so low that not even limpets can sustain a population. No snails whatsoever.

911-GSM-09. Deep Creek at W Deep Creek Road parking lot, 3.5 km N of Bryson City. And yet another wide, shallow, cold, lovely, crystal clear river apparently just productive enough to support a population of *Ferrissia rivularis*, although (perhaps) still too soft for *P. proxima*. The limpets are very common here, however - much higher densities than at sites 07 or 08A.

911-GSM-10A. Noland Creek at Fontana Lake. The reservoir seems to be down at least 20 feet below full pool. I walked through a wide, trashy scar to the lake itself. Found *Lymnaea columella* surprisingly common on floating debris - sticks, logs, and garbage. Nothing else.

911-GSM-10B. Noland Creek at Fontana Road bridge, 8 km W of Bryson City. The creek upstream from the reservoir is a pretty trout-type stream, however, with *Ferrissia rivularis* very common and *Pleurocera proxima* moderately common.

911-GSM-11A. Parson Branch by Parson Branch Road, 12.7 km E of Tallassee. Exiting Cades Cove via the one-way "primitive road," I did not see any freshwater gastropods along most of the length of Parson Branch. A lovely stream, but cold, dark, and unproductive.

911-GSM-11B. Parson Branch at US 129, 12.6 km E of Tallassee. Although still very rugged and apparently low in nutrients at its exit from the park, Parson Branch does support both *Pleurocera proxima* and *Ferrissia rivularis* in moderate densities in its lower reaches.

Discussion

At the time we were contacted by the GSMNP Office of Inventory and Monitoring about the feasibility of undertaking the present study, FWGNA efforts to bring a "Freshwater Gastropods of Tennessee" website online were already well advanced. A database of over 1,600 records had been collected from the four-state region drained by the Tennessee River above the Alabama line, including approximately 500 records from southwestern Virginia, 300 from western North Carolina, and 50 from north Georgia, as well as over 700 from East Tennessee. Not only has funding from the GSMNP allowed us to fill a large hole in our coverage, it has enabled us to bring the entire effort online. See <http://www.fwgna.org/FWGTN/>

The completion of the larger FWGTN project (for the eastern third of the state) enables us to place the results of the present survey into context. The 12 species recovered from the Great Smoky Mountains National Park represent approximately one-third of the 38 freshwater gastropods known to inhabit the waters of the Tennessee River drainage above the Alabama line. Six of the GSM pulmonate species are widespread elsewhere throughout the entire upper Tennessee region, as well as in all other states we have thus far surveyed, in both Atlantic and interior drainages: *Lymnaea humilis*, *L. columella*, *Physa acuta*, *Helisoma anceps*, and *Ferrissia fragilis*. *Pleurocera proxima* is also very common in both the Atlantic and interior drainages throughout the southeast, although restricted to the Piedmont and Blue Ridge ecoregions of the five states covered.

Four freshwater gastropod species recovered from the Great Smoky Mountains are common but primarily (or entirely) restricted to interior drainages, not (typically) being found in Atlantic drainages to the east: *Physa gyrina*, *Ferrissia rivularis*, *Pleurocera clavaeformis*, and *Leptoxis praerosa*. The former two (pulmonate) species are, however, found further north in the Atlantic drainages of the Great Valley of Virginia. The latter two (pleurocerid) species are (essentially) Tennessee River endemics.

The twelfth species, *Gyraulus parvus*, is spottily-distributed in lentic environments around the Southeast, although not common anywhere. The population discovered in Chilhowee Lake is only the fourth record of the species in our Tennessee database. *Gyraulus* populations become much more common in northern lakes above the glacial maximum. It seems likely to us that this species may be expanding its range in Tennessee since the widespread impoundment of the larger rivers in the 20th century.

Detailed information about each of these 12 of these species, including specific habitat requirements, life history, taxonomic notes, range maps, and a complete bibliography, is available from the FWGNA site, as linked above.

Future Directions

The present survey returned two surprising results: the unexpectedly high overall species richness of the lands administered by the Great Smoky Mountains National Park (when combined across the diverse habitat types touched) and the unexpected rarity of at least one freshwater gastropod species specifically adapted to high gradient, low nutrient streams: *Pleurocera proxima*. From our field experience elsewhere throughout the Blue Ridge ecoregion, we would have expected to find *P. proxima* populations at many more than 6 of the 20 sites surveyed in the GSMNP.

Although I am not aware of any studies directly bearing on the question, it seems likely that *P. proxima* populations may be quite sensitive to acidification. To the extent that acidification is a cause for concern in the rivers of the Great Smoky Mountains National Park, some long term monitoring of the park's *P. proxima* populations may be in order.

References

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