

The Value of Intermittent Streams in North Carolina: A Summary
NC Division of Water Quality
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North Carolina DWQ defines a perennial channel as one with water all year around and an intermittent channel as one that has water for a significant part of the year, but is dry for some part, during a year of normal rainfall (15A NCAC 2B.0233). Headwater streams (1st and 2nd order) drain 55-85% of a watershed (Gregory, in USFWS 2000) so they are very important conveyances of water and chemical constituents. The small size of the stream ensures a large amount of water-sediment contact, which removes nitrogen from runoff via nitrification and denitrification by bacteria in the sediments (Mulholland et al 2001, Peterson et al 2001). This increased contact also allows a higher rate of adsorption of phosphorus to soil particles in the headwater stream bed than in larger streams (James Gregory, pers comm.). Sweeny (USFWS 2000) has calculated that if the nutrient reduction functions of these headwater streams were removed (streams filled), it would be nearly impossible to successfully implement a nutrient reduction strategy in the watershed. Wallace (USFWS 2000) has also found that these headwater streams are a major source of organic carbon (food) to aquatic ecosystems. Up to half of the organic carbon flowing through aquatic ecosystems originally started as leaf litter in headwater streams that was broken down and converted to more usable forms of carbon by the bacteria, fungi and invertebrates in these headwater streams.

DWQ has completed a three-year EPA grant to document what lives in intermittent streams over the course of a year. We sampled 256 times at 75 sites on 15 Mountain and Piedmont streams using sweep nets, sediment cores and rock washes. We (and others such as Boulton and Lake 1992; del Rosario and Resh 2000; Feminella 1996) have found that rather than being discrete communities, biota in ephemeral, intermittent and perennial segments mostly are distributed along a gradient – the more tolerant or drought resistant the species, the further up the Ephemeral /Intermittent/Perennial (E/I/P) continuum it can be found. This community continuum shifts up and down the stream depending on the season and the wetness or dryness of the year.

Most taxa (species) in ephemeral reaches were terrestrial: ants, spiders, millipedes, earthworms and terrestrial fly larvae. There are usually a few aquatic taxa present, however these are mostly small, elongate, diptera (fly) larvae that survive in the damp spaces between the sand grains in the streambed. Intermittent stream segments have a much more even mix of terrestrial and aquatic species, with the exact composition shifting as the water table rises above the stream bed or falls below it. When the water table is above the elevation of the stream bed, the stream is wet and short-lived aquatic species dominate the community. Most of these aquatic organisms are also found downstream in the perennial reaches; only a few small species live solely in the intermittent segments. Terrestrial species, as listed above, dominate the community when the intermittent segment dries up. Clams and crayfish can live in lower intermittent areas as well as perennial reaches due to their adaptations to avoid drying – a shell for the clam and the ability to burrow down to the groundwater for the crayfish. Also, there is a suite of taxa (e.g mayflies, caddisflies, damsel and dragonflies) whose older life stages only occur in perennial water. The presence or absence of these perennial indicator taxa can be used to predict the permanence of water in a stream.

Intermittent stream segments in both the Piedmont and the Mountains have about half of the aquatic taxa and 57% of the aquatic diversity of small perennial streams (Figure 1). This could be due to the effects of drying, reduced habitat heterogeneity, or both.

Table 1. Mean Taxa Richness and Abundance in Ephemeral, Intermittent and Perennial reaches in Mountains and Piedmont

	<u>Aquatic Taxa</u>		<u>Aquatic Abundance</u>	
	<u>Piedmont</u>	<u>Mountains</u>	<u>Piedmont</u>	<u>Mountains</u>
Ephemeral	4	3	34	6
Intermittent	16	15	162	239
Perennial	30	32	286	402

Intermittent streams are the exception, rather than the rule, in undeveloped catchments in the mountains. Most streams in the mountains, as well as some in the piedmont, start as perennial springs. Some, usually short, intermittent segments do exist, and are formed from two very different sources: wet weather springs and overland runoff from development.

The trend with wet weather springs is similar to that of piedmont intermittent systems that are more surface-water driven. When the segment is dry, there is little aquatic life in the segment, but when water is flowing, the abundance of aquatic life is comparable to perennial reaches, even if the diversity is about half that in the perennial stream.

Streams arising from overland flow in the Piedmont and Mountains show a similar pattern, but with increased aquatic life in mountain streams. The main differences were how quickly the streams turned perennial, and how much aquatic life the streams supported. Piedmont perennial stream segments supported 190-450 aquatic organisms from 22-45 species. The mountain stream segments supported 200-1200 aquatic organisms from 22-70 species.

The area required to support a perennial stream in this study was small. Watershed areas ranged from 2 acres to 25 acres. The major difference in watershed size appears to be whether the stream starts as a spring or as surface water runoff rather than the location of the stream (Mountain or Piedmont). The mean watershed size for a spring system was 4.2 acres, while watershed size for a stream formed by overland flow was 13.9 acres. Urban watersheds and watersheds in the Triassic Basin would be expected to require larger drainage areas to become perennial.

References

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