

## Northern Range, Trinidad: The Guppy-Geomorphology Connection

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### Abstract

Trinidad's Northern Range is drained by north-south flowing streams that trend perpendicular to the general east-west strike of the range. The arrangement and character of mega-geomorphic features (e.g. coastline, alluvial fans, swamps, stream and peak elevations) indicate that the range is currently sinking westward into the Gulf of Paria pull-apart basin, and that the east side of the range is relatively rising "teeter-totter" fashion. Aside from the very short northward-flowing streams along the north coast, the modern streams that drain the bulk of the range flow southward and divide into two groups: those draining ultimately into the west-flowing Caroni River and those draining into the east-flowing Oropuche River. The Caroni and Oropuche trunk streams are separated by a drainage divide about midway east-west across the range that coincides with the Guatapajaro/Guaico bedrock high. New basin-wide <sup>10</sup>Be cosmogenic nuclide data show that modern erosion rates are systematically ~4 times higher in streams of the eastern Oropuche drainage system than in those of the western Caroni system.

The Northern Range streams are home to the freshwater guppy (*Poecilia reticulata*), which, from an evolutionary perspective, is one of the most well-studied species on Earth. Phylogenetic and morphological analyses indicate that the Caroni network guppies are closely related to Venezuelan populations to the west of Trinidad, whereas their Oropuche neighbors share features with populations south of Trinidad, in eastern Venezuela and Guyana. We argue that geological and biological findings are in concordance, and geomorphic-biologic connections can explain phylogenies that would not be expected among populations in close proximity on a small island.

We offer several models as a start, assuming that the connection is somehow related to stream capture, to try to explain the observed geomorphology-guppy connection. 1) During Pleistocene (ice-age) sea-level low stands, large rivers drained north-south across Trinidad's modern, now drowned, eastern continental shelf. These rivers may have eroded headward (northward) from the South American mainland near Guyana to the relatively rising eastern side of the Northern Range and caused whole-scale replacement of Venezuelan guppy stocks with Guyanese stocks. 2) The Guatapajaro/Guaico divide could behave like a rolling hinge; it could roll either east or west as sinking/rising occurs. As the hinge rolls, streams get captured one by one and added to either the Caroni network (with eastern hinge roll) or Oropuche network (with western hinge roll). These preliminary models are predictive, testable (e.g., using Guppy DNA fingerprinting and mitochondrial DNA age dating), and able to be refined.