H3.3 BOTTOM LOTIC (RIVERS AND STREAMS)

The bottom habitat of a lotic environment is the streambed. In some conditions, this habitat can extend across the entire width of the bed. In deeper channels with sloped edges, zonation may create a littoral or edge habitat. In shallow channels or low-water conditions, the streambed can be exposed intermittently.

The streambed can comprise a variety of physical and organic materials and can be either an eroding basin or a depositional environment. These situations can alternate in the same stream, as may be seen in riffles or ponds.

Plate H3.3.1: LaHave River north of Bridgewater (Unit 433). Hard rock bottom is exposed due to low water levels in late summer. Photo: R. Merrick

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FORMATION

The nature of a lotic environment is primarily determined by the velocity of the current, which can create either slow-moving or fast-flowing streams; each has very distinct characteristics. Fast-flowing streams are often comprised of two interrelated environments: the turbulent riffle area and the quiet pool.

The bottom of slow-moving streams is comprised mainly of sedimentary rock and thick glacial till. Soils consist of fluvial sediments; silt, mud, sand, gravel and varying amounts of organic material. In fast-moving streams, the bedrock is primarily resistant metamorphic or igneous rocks, with boulder or coarse gravel bottom. Soils consist of sand and gravel, with some organic material, and are often mobile due to water velocity.

PHYSICAL ASPECTS

1. *Bedrock:* (more important in fast-moving streams) exposures of bedrock; particularly resistant metamorphic or igneous rocks and boulder or coarse gravel bottom.
2. *Soil:* (more important in slow-moving streams) sand and gravel, with some organic material; often mobile due to water flow.
3. *Relief:* in hilly country, giving steep stream profiles or, on plains, giving low profiles.

ECOSYSTEM

In slow-moving environments, silt and decaying organic material accumulates on the bottom and becomes the main food source for invertebrates. Productivity is associated mainly with the breakdown of this imported material, such as leaf litter, by herbivores. Some of the organic material is exported, but some remains on site and can develop into peat.

In fast-moving streams, the riffle areas are responsible for most of the primary production. Groups of plants that cling to the bottom are dominant and become as important to streams as phytoplankton is to lakes. They consist mainly of microscopic and filamentous algae and can form a slippery cover on rocks during the summer months. However, this production is only temporary, as it is soon exported downstream by the strong currents. Populations of consumer organisms (chiefly particulate feeders) are relatively low.

The width of the stream also affects the amount of production. Streams two metres wide are four times as rich in bottom organisms as those which are six to seven metres wide.[1] This is one reason why small headwater streams are important spawning and nursery areas for salmon and trout.

SUCCESSIONAL SEQUENCE

In slow-moving steams, the development of habitat depends upon the depositional and erosional characteristics of the river. There is a progressive, downstream movement of meanders, leaving shallow or deep pools, backwaters, braided channels and oxbow ponds. Sediment is deposited on the floodplain during periods of high water, slowly filling up old erosional features. The plants and animals of the river ecosystem are constantly adjusting to these changing conditions (see Figure T8.2.2).

The fast-flowing young stages of streams will always be present as the river erodes the landscape. Over time, the young stage will mature into a slow-moving stream, but it can be rejuvenated when a geological obstacle (e.g., a waterfall) is encountered.

PLANTS

In slow-moving streams, vegetation is generally absent from the bottom habitat, except along the stream bank or hydrosere (see H3.5). In rapidly moving streams, diatoms, blue-green algae and green algae frequently are found on the rock surfaces, and there may be dense growths of liverworts and water mosses (e.g., *Fontinalis*), especially near the stream banks. The flowering plants bur reed (*Sparganium* spp.) and pondweed (*Potomogeton* spp.) are firmly rooted into the gravel bottom and have narrow leaves to provide the least amount of resistance to the current. The Riverweed (*Podostemum ceratophyllum*), found on the LaHave River, is specially adapted to adhere to rock surfaces in fast-flowing water.

ANIMALS

In slow-moving streams, there is an abundance of invertebrates, dominated by aquatic insects. Nymphs and larvae of insects such as blackfly, dragonfly, mayfly, stonefly and caddisfly, as well as adult and larval stages of waterbugs and water beetles, can be found. Many species of crustaceans, rotifers, nematodes and protozoans may also be present. Leeches, oligochaete worms and molluscs are plentiful in oligotrophic waters. Freshwater mussels may be abundant in some areas and include some species with limited distribution. Various sponges and

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ectoprocts are also commonly found. All of these organisms are significant, as they consume organic detritus and provide food for other bottom-dwelling animals. Adult newts and tadpoles inhabit the organic debris in pools and slow-moving sections of streams.

In fast-moving streams, aquatic animals are well adapted to withstand the fast current and seasonal variations in water level. The most important invertebrates are the aquatic larvae and nymphs of insects, especially stoneflies, mayflies and caddisflies. Blackfly larvae develop on rocks in the well-aerated water and form their pupae on the leaves of submerged plants. Other invertebrates include several sponges (e.g., *Spongilla*) and freshwater mussels (e.g., *Margaritifera*), which are found in patches of gravel. The larvae of river mussels are parasitic on the gills of fish, an adaptation that counteracts the tendency for populations to be carried downstream by the current.

The insect larvae of fast- and slow-moving streams provides the primary food source for many fish species, including White Sucker, American Eel and Bullhead Catfish (see Topic T11.16).

SPECIAL FEATURES

- The adaptation of plants and animals to resist current flow and maintain their populations in the stream.
- Important recreational fisheries, particularly Atlantic Salmon and Brook Trout.
- Hibernation of Wood Turtles in slow-moving streams.
- The association of the parasitic (glochidia) larval stage of mussels and fish. A rare mussel (*Lampsilis cariosa*) is found in the Sydney River.
- Modification of river courses by human activities, such as gravel extraction and dam construction.

DISTRIBUTION

Slow-moving streams are found in all regions of the province, except where high ground is located close to the sea. Some of the well-developed larger river systems include the Tusket, Medway, Mersey, LaHave, St. Marys (Region 400); the Shubenacadie and Stewiacke (Region 500); the Cornwallis and Annapolis (Region 600).

Fast-moving streams occur throughout the province in upland areas. These include the Cape Breton highlands (Regions 100 and 200), the Cobequid Hills (Region 300), North Mountain (Region 710), and South Mountain (Region 420). Slow-moving streams flowing to the Atlantic Ocean are often rejuvenated as they pass through the Meguma quartzite near the Atlantic Coast (Region 800). Examples of this occurrence are the Musquodoboit River and the St. Marys River.

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Associated Topics

T8.1 Freshwater Hydrology, T8.2 Freshwater Environments, T11.5 Freshwater Wetland Birds and Waterfowl, T11.11 Small Mammals, T11.13 Freshwater Fishes, T11.15 Amphibians and Reptiles, T11.16 Land and Freshwater Invertebrates

Associated Habitats

H3.1 Open-water Lotic (Rivers and Streams), H3.4 Bottom Lentic (Lakes and Ponds), H3.5 Water's Edge Lotic (Rivers and Streams)

Reference

1 Smith, R.L. (1990) *Ecology and Field Biology*. Harper and Row, New York.

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