Peatlands and Creatures Great and Small: Part II – Invertebrates and Microfauna

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Wetland Series (Part 5)

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by David A. Locky

Introduction

This article is the last of a two-part series on peatland creatures. Here, I focus on peatlands and invertebrates and some microfauna, and then outline wetlands from the perspective of conservation and creatures of all sizes. A table with peatland creatures, great and small, is included below.

Invertebrates are essential food sources for animals in higher trophic levels and some plants at lower trophic levels. They are a common component of most wetland types and appear to be less affected by the acidity of water than other animals. Water availability appears to be the critical aspect, with ephemeral and permanent pools providing key habitat; temporary extreme conditions such as drought or too much water can play havoc on specific lifecycle stages (Neckles *et al.* 1990).

Invertebrates are closely tied to their environment and their fossilized parts are important aspects of understanding plant succession (Roper 1996, Whitehouse 2004) and the potential impacts of global warming (Mitchell *et al.* 1999), especially in peatlands.

Macro invertebrates

Some insects have developed symbiotic relationships with peatland plants. Perhaps the best known is that between pitcher plants and flies. The larval stages of these flies develop within the cupped leaves of the plants, catching insects that become trapped. It is surmised that the larvae assist the plants by breaking down food matter for them (Hardwick and Giverson 1996). Another less known relationship is that between orchids (commonly found in peatlands) and mosquitoes, bees, fungus gnats, and moths (Kevan *et al.* 1993). Orchids are neither numerous nor diverse in the boreal region, but have the most specialized pollination mechanisms of the angiosperms; they require insects for successful pollination because they rarely self-pollinate. Mosquitoes, in particular, are important pollination vectors in peatlands (Gorham 1976) and can be found with orchid pollinia affixed to various body parts.

Although not well known, ants are commonly found living within the hummocks of peatlands. Imagine pulling a clump of moss from the top of a hummock and finding your hand covered in ants! Restricted generally to the warmer, drier hummocks of senescing *Sphagnum*, ants may actually contribute to the regression of dying hummocks with their tunnelling (Luken and Billings 1986). It has also been found that ant-inhabited hummocks have elevated levels of nutrients and minerals that, in conjunction with the aerating effects of their tunnels, are conducive to vascular plant growth. Rhizomatous graminoids are commonly found on active mounds, but abandoned mounds are often covered with shrubs and other vascular plants that take advantage of drier, warmer conditions. The interesting twist is that the ants tend aphids on these shrubs, and these aphids provide much of the nutrition ants require, potentially creating a positive feedback relationship (Lesica and Kannowski 1998).

We often do not think much about snails but there are currently at least 42 species of land snails in the fens of Iowa, Wisconsin, Minnesota, and New York (Nekola as reported in Bedford and Godwin 2003). The tiny land snail, *Vertigo morsei*, is better known as a Pleistocene fossil, but is actually one of the rarest species in eastern North America, and is restricted to fens.

In the early 1990s, a survey of Hymenopterans (narrow-waisted insects like wasps and ants) revealed an astonishing diversity of species at the Wagner Natural Area (Finnamore 1994). Almost 2,200 species of insects were collected, more than any other study of peatlands. Based on this study and data from a study of beetles, it was estimated that almost 6000 species inhabited this small area, including Hymenopterans (22.6%), beetles (5.6%), Diptera (two-winged insects, 29.3%), butterflies and moths, 31.3%, and others (spiders, etc., 11.2%). This translates into approximately 30% of the 20,000 estimated insects and spiders in Alberta. This high species richness of insects has been attributed to the diverse physiognomy, or architecture, of the vegetation in the area (Finnamore 1994). This diverse vegetation physiognomy has also been indirectly related to the high number of vascular and non-vascular plants (471 species) found at the Wagner Natural Area (Hrapko 1988, Wagner Natural Area Society 2000), which thus reflects the large number of habitats, including boreal forest, mixed wood, second growth shrub, forest edge, and fields (Thormin 1982).

While many of the insects at Wagner Natural Area have yet to be named, the great diversity of insects there is probably a conservative estimate. Studies of other peatland insects will probably have larger species lists (Finnamore 1994). For example, 55 species in of chironomids found in a NW Ontario peatland are probably found across the boreal region of North America (Rosenburg *et al.* 2001).

Microfauna

While not widely known, a great diversity of micro-faunal creatures called rhizopods, or testate amoebae, live in *Sphagnum*-dominated peatlands. These protozoans are not true animals but amoebae that are protected within a helmet-like shell of silica, calcium, or protein. Their pseudopodia emerge from an opening (Ogden and Hedley 1980). From a paleo-ecologic perspective, these organisms are important indicators of environmental change. They are very specific in their habitat requirements, which are related to peat pH and depth to water table (Mitchell *et al.* 1999), are quick to react to environmental changes, and their shells are well preserved in peat. This makes them excellent bioindicators in peatlands (Warner 1987). Rhizopods are associated more

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with mosses than vascular plants (Mitchell *et al.* 2000) and are often abundant and diverse in *Sphagnum* mosses (Warner 1987) and the poorly decomposed layers below (Gilbert *et al.* 1998). The also have a key position in the microbial trophic network of a peatland. Researchers investigating the microbial loop of a French peatland found that rhizopods made up 48% of the total microbial biomass, followed by 15% heterotrophic bacteria, 14% cyanobacteria, and 13% diatoms. Experimental nutrient inputs negatively influenced rhizopod populations, suggesting that these taxa are well-adapted to peatlands with low pH and low available nutrients (Gilbert *et al.* 1998).

Wetlands, animals, and conservation

In 1985, there were approximately 30 animals designated as species at risk in Canada that lived in or were reliant on wetlands (NWWG 1988). These included wood bison, piping plover, whooping crane, Henslow's sparrow, white pelican, caspian tern, king rail, prothonotory warbler, Ross' gull, and the trumpeter swan (COSEWIC 2003). Approximately one third of the species at risk listed by the Committee on the Status of Endangered Wildlife in Canada live in or adjacent to wetlands. This makes wetlands crucial habitats for many endangered species (Atlas of Canada 2003). Fens in the US are often frequented by uncommon, rare, threatened, endangered, or federally listed animals. Threatened species include bog turtles, copper-bellied water snake, grizzly bear, and Preble's jumping mouse. Endangered species include Fender's blue butterfly, Mitchell's satyr, Saint Francis' satyr, Hine's emerald dragonfly, gray wolf, red wolf, cougar, lynx, and Indiana bat. The eastern massasauga rattlesnake frequents eastern US fens and is currently a candidate for federal listing (US Fish and Wildlife Service 2002). In Iowa fens there are nine state-rare butterflies and skippers (Nekola 1994), and in small mountain fens of North Carolina there are six species of rare, threatened, or endangered animals (Murdock 1994).

Although most of our comprehensive studies on peatland fauna have been restricted to eastern North America, research conducted at Wagner Natural Area has contributed greatly to our knowledge of the fauna in western peatlands. Approximately 201 species of vertebrates have been known to use Wagner Natural Area (extrapolated from Wagner Natural Area 2001). Add to this the estimated 6,000 species of invertebrates (Finnamore 1994) and the diversity on an area only 215 ha in size is striking. The ecological value of such an area with a significant peatland component, especially in the midst of urban sprawl, is difficult to calculate. However, it is very important to consider and preserve a variety of peatlands, like those found at Wagner Natural Area; who knows what animal species, charismatic or not, are yet to be found?

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Table 1. Selected animals and micro-fauna that inhabit or use peatlands for all or part of their life cycles.
Compiled from the references cited in the text, plus additional species from Semechuk (1992) and Banfield (1977).

MAMMALS
Shrews – Soricidae: Masked Shrew (*Sorex cinereus cinereus)*; Short-tailed Shrew (*Blarina brevicauda*); Word Shrew (*Sorex palustris*); Arctic Shrew (*Sorex arcticus*); Pygmy Shrew (*Sorex hoyi*).
Moles – Talpidae: Star-nosed Mole (*Condylura cristata*).
Bats – Chiroptera: Little Brown Bat (*Myotis lucifugus*); Silver-haired Bat (*Lasionycteris noctivagans*); Big Brown Bat (*Eptesicus fuscus*); Hoary Bat (*Lasiurus cinereus*).
Rabbits & Hares – Lagomorpha: Snowshoe Hare (*Lepus americanus*).
Rodents – Rodentia: Squirrel – Sciuridae: Least Chipmunk (*Tamias minimus*); Red Squirrel (*Tamiasciurus hudsonicus*); Northern Flying Squirrel (*Glaucomys sabrinus*). Beaver – Castoridae: Beaver (*Castor canadensis*). New World Mice – Cricetidae:
Deer Mouse (*Peromyscus maniculatus*); Southern Red-backed Vole (*Clethrionomys gapperi*); Meadow Vole (*Microtus pennsylvanicus*); Heather Vole (*Penacomys intermedius*); Muskrat (*Ondatra zibethicus*); Jumping Mice – Zapodidae: Meadow Jumping Mouse (*Zapus hudsonius*); Lemmings – Muridae: Southern Bog Lemming (*Synaptopmys cooperi*); Northern Bog Lemming (*Synaptopmys borealis*); Porcupines – Erethizontidae: Porcupine – (*Erethizon dorsatum*).
Carnivores – Carnivora: Dog – Canidae: Coyote (*Canis latrans*); Gray Wolf (*Canis lupus*); Red Fox (*Vulpes vulpes*). Bear – Ursidae: Black Bear (*Ursus americanus*). Raccoon – Procyonidae: Raccoon (*Procyon lotor*). Weasel – Mustelidae: American marten (*Martes americana*); Ermine (*Mustela erminea*); Least Weasel (*Mustela nivalis*); Long-tailed Weasel (*Mustela frenata*); Mink (*Mustela vison*). Cat – Felidae: Canada Lynx (*Lynx canadensis*); Ungulates – Artiodactyla: Deer – Cervidae: Wapiti (*Cervus elaphus*); Woodland Caribou (*Rangifer tarandus*); Mule Deer (*Odocoileus hemionus*); White-tailed Deer (*Odocoileus virginianus*); Moose (*Alces alces*). Cow – Bovidae: Bison (*Bison bison*).
BIRDS. Herons & Allies – Ciconiiformes: American Bittern (*Botaurus lentiginosus*). Waterfowl – Anseriformes: Ring-necked Duck (*Aythya collaris*); Plus, others that associated with peatlands to varying degrees. Hawks, Falcons & Allies – Falconiformes: Northern Harrier (*Circus cyaneus*); Red-tailed Hawk (*Buteo jamaicensis*). Pheasants, Grouse & Allies – Galliformes: Spruce Grouse (*Falcipennis canadensis*); Sharp-tailed Grouse (*Tympanuchus phasianellus*); Ruffed Grouse (*Bonasa umbellus*). Shorebirds, Gulls, Terns & Allies – Charadriiformes: Greater Yellowlegs (*Tringa melanoleuca*); Solitary Sandpiper (*Tringa solitaria*); Upland Sandpiper (*Bartramia longicauda*); Short-billed Dowitcher (*Limnodromus griseus*); Common Snipe (*Gallinago gallinago*); Ring-billed Gull (*Larus delawarensis*); Greater Black-backed Gull (*Larus marinus*); Red-necked Phalarope (*Phalaropus lobatus*). Owls – Strigiformes: Great Gray Owl (*Strix nebulosa*); Northern Saw-whet Owl (*Aegolius acadicus*. Nighthawks – Caprimulgiformes: Common Nighthawk (*Chordeiles minor*). Woodpeckers – Piciformes: Three-toed Woodpecker (*Picoides tridactylus*); Black-backed Woodpecker (*Picoides arcticus*); Northern (yellow-shafted) Flicker (*Colaptes auratus*). Perching Birds - Passeriformes: Flycatchers: Olive-sided Flycatcher (*Contopus cooperi*); Alder Flycatcher (*Empidonax alnorum*); Least Flycatcher (*Empidonax minimus*); Yellow-sided Flycatcher (*Empidonax flaviventris*); Eastern Kingbird (*Tyrannus tyrannus*). Larks, Swallows: Tree Swallow (*Tachycineta bicolor*). Jays, Crows & Allies: Gray Jay (*Perisoreus canadensis*); Common Raven (*Corvus corax*). Chickadees to Wrens:
Black-capped Chickadee (*Poecile atricapillus*); Boreal Chickadee (*Poecile hudsonicus*); Red-breasted Nuthatch (*Sitta canadensis*); Sedge Wren (*Cistothorus platensis*). Kinglets, Thrushes, and Shrike: Golden-crowned Kinglet (*Regulus satrapa*); Ruby-crowned Kinglet (*Regulus calendula*); Swainson's Thrush (*Catharus ustulatus*); Hermit Thrush (*Catharus guttatus*); American Robin (*Turdus migratorius*); Northern Shrike (*Lanius excubitor*). Vireos and Warblers: Blue-headed Vireo (*Vireo solitarius*); Red-eyed Vireo (*Vireo olivaceus*); Yellow Warbler (*Dendroica petechia*); Magnolia Warbler (*Dendroica magnolia*); Black-throated Green Warbler (*Dendroica virens*); Cape May Warbler (*Dendroica tigrina*); Yellow-rumped (Myrtle) Warbler (*Dendroica coronata*); Black-throated Green Warbler (*Dendroica virens*); Palm Warbler (*Dendroica palmarum*); Bay-breasted Warbler (*Dendroica castanea*);
Northern Parula Warbler (*Parula americana*); Black-and-white Warbler (*Mniotilta varia*); Nashville Warbler (*Vermivora ruficapilla*); Northern Waterthrush (*Seiurus noveboracensis*); Connecticut Warbler (*Oporornis agilis*); Common Yellowthroat (*Geothlypis trichas*). Cardinals: Northern Cardinal (*Cardinalis cardinalis*). Sparrows & Allies: Chipping Sparrow (*Spizella passerina*); Savannah Sparrow (*Passerculus sandwichensis*); Le Conte's Sparrow (*Ammodramus leconteii*); Song Sparrow (*Melospiza melodia*); Lincoln's Sparrow (*Melospiza lincolnii*); Swamp Sparrow (*Melospiza georgiana*); White-throated Sparrow (*Zonotrichia albicollis*); White-crowned Sparrow (*Zonotrichia leucophrys*); Dark-eyed (Slate-colored) Junco (*Junco hyemalis*). Blackbirds & Allies: Red-winged Blackbird (*Agelaius phoeniceus*); Rusty Blackbird (*Euphagus carolinas*). Finches & Allies: White-winged Crossbill (*Loxia leucoptera*); Evening Grosbeak (*Coccothraustes vespertinus*).
AMPHIBIANS. Mole Salamanders – Ambystomidae: Tiger Salamander (*Ambystoma tigrinum*); Blue-spotted Salamander (*Ambystoma laterale*); Four-toed Salamander (*Hemidactylium scutatum*); Mole Salamander (*Ambystoma talpoideum*). Toads – Bufidae: American Toad (*Bufo americana*); Western (Boreal) Toad (*Bufo boreas boreas*). Tree Frogs – Hylidae: Boreal Chorus Frog (*Pseudacris maculata*).; Frogs – Ranidae: Mink Frog (*Rana septentrionalis*); Northern Leopard Frog (*Rana pipiens*); Green Frog (*Rana clamitans*); Wood Frog (*Rana sylvatica*).
REPTILES. Snakes – Colubridae: Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*); Eastern Garter Snake (*Thamnophis sirtalis sirtalis*); Turtles – : Bog Turtle (*Clemmys muhlenbergii*); Spotted Turtle (*Clemmys guttata*).
FISHES. Minnows – Cyprinidae: Fathead Minnow (*Pimephales promelas*). Pikes – Esocidae: Northern Pike (*Esox lucius*). Sticklebacks – Gasterostiidae: Brook Stickleback (*Culaea inconstans*); Plus many others!
INVERTEBRATES. Insecta (insects) and Arachnida (Spiders): Assorted and many!
PROTOZOANS. Rhizopoda: Rhizopods (testate amoebae).

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