

THE BRODIE CLUB



Established 1921

Website: <http://thebrodieclub.eeb.utoronto.ca>

THE 1,123rd MEETING OF THE BRODIE CLUB

The 1,123rd meeting of the Brodie Club was held on Tuesday, 19 November, 2019 in Room 432 of the Ramsay Wright Laboratories of the University of Toronto.

Chair: Katie Thomas

Secretary: Ricky Dunn

The meeting was called to order at 7:34 pm and was attended by 36; 27 members and 9 guests.

Roll Call:

Present: E. Addison, Bacher, Beadle, Crins, Currie, Curry, N. Dengler, R. Dengler, Dunlop, Dunn, Eckenwalder, Harris, Hussell, Hutchinson, Johnson, Kortright, Kotanen, Lindsay, McAndrews, Moldowan, Peter, Reading, Riley, Rising, Slessor, Stones, Thomas

Guests: Wilma Bassett and Mary-Lou Bacher (guests of Bacher), Autumn Watson (Moldowan), Sharon Hick (McAndrews), Bill Lamond (Curry), Dan Koslovic (Rising), Oscar Johnson (Johnson), Jarmo Jalava (Riley), Gavin Miller (Juhola).

Regrets: Abraham, R. Addison, Bell, Bertin, Bryant, DeMarco, Eadie, A. Falls, B. Falls, King, LaForest, Larsen, Machin, Martyn, Obbard, Tomlinson

Minutes:

Minutes of the October meeting were accepted with no corrections.

Committee Reports:

The next meeting (17 December) will feature Christina Davy, Ontario Ministry of Natural Resources and Forestry, speaking on “Thinking like a turtle – overcoming short-term challenges to being a long-lived species.”

Announcements:

Remember to bring Christmas treats for sharing at the December meeting.

Trudy Rising is giving away an electronic device that lowers the frequency of bird song – useful for people whose hearing loss in high registers isn’t already corrected with hearing aids. Contact her if you’re interested.

Cards were circulated for all to sign, sending best wishes to Enid Machin and the Falls, all of whom are undergoing health issues. The Falls have a daily helper, but if you wish to visit you should arrange through their daughter, Kathryn (whose number you can get from Trudy Rising).

SPEAKER:

Justin Peter introduced the speaker, member Patrick Moldowan.

Patrick began his presentation with an overview of salamanders and their biology. Though out of sight most of the year and therefore unfamiliar to most non-biologists (and even many of them), total biomass of salamanders in a region can outweigh that of small mammals or birds. They are extremely diverse in size (finger-tip to a meter long) and habitat (fresh water, tree tops, deep in caves). The center of salamander biodiversity is in the Appalachians of eastern North America, where there can be 35 species within relatively small areas. Although salamanders have spread across most of the world, other regions are far less speciose. Salamanders are important contributors to ecosystem function as predators of aquatic and terrestrial invertebrates, and also play a role in carbon cycling.



Adult Spotted Salamanders (*Ambystoma maculatum*) return to their natal ponds to reproduce, travelling up to a kilometer; then disappear back to surrounding woodland after the mating season. It was noticed over a century ago that eggs have a green tinge that comes from algae growing inside the egg capsule – the only known case of a vertebrate hosting a plant symbiont. This unique species of alga (*Oophila amblystomatis*) benefits from the embryo's nitrogenous and carbon dioxide waste, and in turn contributes oxygen to the embryo. Some algae are inside cells of the embryo itself, and they benefit from survival of their line as long as the host salamander lives and passes on algae with its reproductive cells. Salamander hosts get some benefit too, as they grow less well if the algae are removed.

Larvae of the aquatic Spotted Salamander have external gills, but lungs and stronger legs develop before their autumn dispersal to land. In cold weather the salamanders live in small mammal burrows or other underground niches, hibernating below the frost line. On wet nights in early spring there are mass returns to natal ponds. Males can be found in swarms, depositing conspicuous white packets of sperm near the edge of the pond – often piled one on top of another to ensure that theirs is on top. Once attracted, the female draws a spermatophore into her cloaca for internal fertilization.

Patrick has been working on salamanders in Algonquin Park for 11 of the 12 years since the start of program 'BLISS': 'Bat Lake Inventory of Spotted Salamanders.' Bat Lake is a fishless, heart-shaped kettle bog lake that doesn't dry up in late summer. Spotted Salamanders are very abundant here, with up to 4000 egg masses counted each spring when a few dozen per pond is more typical. Objectives of BLISS are to determine the best means for sampling Spotted Salamanders to learn about their ecology and density, and to understand how they influence – and are influenced by – their environment.

Many methods are used to sample salamanders, including funnel (minnow) traps, egg mass counts, arrays of cover boards (under which salamanders will hide), and drift fences that steer animals into traps of various kinds. Each method has its own biases, often under-sampling particular age or sex classes. The BLISS project uses multiple methods and will compare results with those from an essentially complete count: salamanders diverted into traps by a drift fence that completely surrounds the lake. Traps are checked daily and each animal is measured and photographed. The spots on these salamanders vary in size, position and number, allowing individual identification from the photos (with the help of some fancy software). Toes are clipped and later sectioned to allow age rings in the bones to be counted – similar to dendrochronology. (Salamanders can regenerate their toes, and even whole limbs.)

Two years of sampling with the drift fence has produced nearly 10,000 captures of Spotted Salamander, as well as large samples of other amphibian species that have led to many spin-off studies. Most comparison among trap types lies ahead, but early results show the complete sample sex ratio is 50:50 as opposed to about 3-7 males per female in the animals caught by minnow traps. The age data show that males first return to the ponds only when 4 years old, and females at 6 years. Delayed age of first breeding is usually seen only in long-lived animals, and indeed, Spotted Salamanders can live for 20 or more years. Early results also show that body condition of adults in spring is low when daily mean temperature was high the previous July. These animals don't like hot dry conditions; a conservation concern because these conditions are predicted to become more frequent.

Patrick updated the Club on the study of salamanders being captured by Northern Pitcher Plants (*Sarracenia purpurea*). After a student (Teskey Baldwin, University of Guelph) noticed the phenomenon a few years ago, Patrick got involved in finding out how common it might be. In 2017 6% of 144 plants surveyed once were found to have a salamander in them. In 2018, only 92 plants were surveyed, but this time each was visited 5 times – and 20% were found to be occupied. Repeated surveys proved to be important, as corpses can rapidly decompose. In 2019 the study got really serious, with near daily surveys of 92 plants for a month. Occupancy patterns appear much greater than previously documented, with estimates from 2019 exceeding 50%. It's possible that up to 10% of animals leaving the lake meet their demise in these plants.



It's still a mystery how salamanders are attracted, and why they climb up the plant from the leaf litter where they spend most of their time. They are visual predators and unlikely to be attracted by scent. About half of leaves with salamanders in them had their mouths open towards the pond, and only 15% facing away, posing a 'why' question that requires more study. Patrick pointed out the keel on the front of these plants (visible on photo at left), which might guide climbers (like a drift fence). The actual cause of death may be from overheating, as liquid in sun-lit plants can reach 35-37° and animals in them may die in under a day; as opposed to dying of starvation after spending up to a month in well-shaded plants. A new line of study is to find out how the plants use the huge pulse of nutrients that salamanders provide: produce more leaves? Or more seed? Since the initial study was published many people have contacted Patrick to report having also seen salamanders in pitcher plants, so it may be a regular feature where salamanders and pitcher plants co-exist.

Questions following the presentation:

Q: Pitcher plants aren't often found near vernal lakes, so how widespread might their interaction with salamanders be?

A: Other reports are from widely scattered locations, and bog lakes not uncommon through much of the range in eastern North America.

Q: What is the attractant to the plants? Surely salamanders are not just lumbering in at random.

A: Most likely attractant would seem to be food, but there aren't many prey items on plants. The researchers would like to analyze gut contents to see what newly-trapped animals have been eating. If pheromones are involved in navigation back to natal ponds, those might be involved, but it hasn't been studied either in the plants or the salamanders.

Q: Might the hole at the top of the pitcher plant leaf look enough like a burrow to be an attractant?

A: It seems unlikely a salamander would climb UP to a hole, but the researchers hope to use models of plants to do some tests.

Q: Might salamanders be scavenging already-captured insects?

A: They aren't scavengers, so probably not. As aquatic larvae they feed through suction, but that ability lost as adults and they capture prey with tongue, so they probably can't eat anything once they're caught.

Q: Are predators attracted to your traps, possibly removing some salamanders before you check?

A: We worried about that for pit traps (and small mammal by-catch high with those), so BLISS uses box traps from which small mammals can escape and salamanders are safe from larger mammals such as mustelids. Trail cameras show that mink do not patrol the drift fence – although Canada Jay has been observed once with a salamander.

Q: When the salamanders leave the pond, do they head in any particular direction?

A: The juveniles leave in all directions. No analysis yet done on whether there is any bias in age or sex according to the directions from which adults return to breed.

Ed Addison thanked the speaker for his notably informative, well-presented and enthusiastic talk.

OBSERVATIONS

Harris recommended the book 'Wytham Woods,' covering history of the wood and its biota, with a focus on the long-term scientific studies and researchers who have made the Wood world-famous for contributions to ecological thinking.

Ed Addison praised a book (seconded by Dunn) by David Quammen: 'The Tangled Tree,' a New York Times Notable Book in 2018 that tells how advances in molecular biology have upended everything most of us learned at university about relatedness of organisms. 'Horizontal gene transfer' between individuals--and even species--is evidently as important in evolution (even for humans) as direct transmission of genes from parents.

Riley reported that Snow Buntings have shown up in Mono.

The meeting was adjourned at 9:20 pm.