THE 943rd MEETING OF THE BRODIE CLUB

MINUTES

The 943rd meeting of the Brodie Club was held on Nov. 16, 1999 in the Ramsay Wright Building of the University of Toronto.

Chairman: Jennifer Young
Recording Secretary: Oliver Bertin
Attendance: 17 members and two guests
Rosalind Holeton, guest of Trudy Rising
Glenn Morris, guest of the club

Minutes of the previous meeting were approved with minor amendments on a motion by Trudy Rising, seconded by Bill Crins.

ANNOUNCEMENTS:

Bill Carrick moved that the December meeting be moved one week ahead to Dec. 14, from Dec. 21, to avoid conflict with Christmas. Seconded by Ann Falls. Young suggested that members bring Christmas goodies.

Harry Lumsden attended the FON regional meeting at Brighton last month. He reported there was considerable antagonism to naturalists at Presqu'ile Park among local residents, and considerable controversy over future plans for the park.

The FON's new executive director, Ric Symmes, has obtained new funds and is using these monies to hire new staff and contract people. The FON has also bought 17,000 acres on Manitoulin Island, where the deer population has become so numerous it needs to be controlled.

Crins reported on the progress of the Lands for Life policy, which is slowly wending its way through the bureaucratic process.

SPEAKER:

Bruce Falls introduced the speaker, Prof. Glenn Morris of UofT's Erindale College. Prof. Morris graduated from the University of Guelph before going to Cornell University for his graduate work. His field is bioacoustics, particularly of grasshoppers and katydids.

KATYDID CONVERSATIONS

The last time that Prof. Morris spoke in Room 432 of the Ramsay Wright Zoological Laboratories was 30 years ago, when he won his current position as biology professor at Erindale College. He has spent many of the intervening years listening to the conversations of grasshoppers and katydids, two families of orthopterans.

Katydids appear in many forms, and go under a variety of common names. In Britain, they are called Bush Crickets. In New Zealand, they are Giant Wetas. Elsewhere, they are often referred to as Camel Crickets.

Katydids can usually be identified by the length of their antennae. These are typically longer than the body, while those of grasshoppers are shorter.

Katydids occur in a wide range of habitats. There are 20 species in Canada, of which one is unique to this country. It is believed to be have arrived from the Soviet Union via the Bering Straits, and is now found in Ontario spruce bogs.

Morris has studied other species in the Ecuadorean Andes, from tropical jungles in the lowlands to as high as the tree line or, as in one new species Morris has found, on the edge of an active volcano.

Many species are nocturnal. Using a bright light, he usually finds them at night sitting on tree branches or among the leaves. They tend to move around at night, typically returning to their favourite hiding spots at daybreak. They can often be found in the same spot every morning, giving the impression that they never move.

Nocturnal katydids are often brightly coloured, presumably to ward off predators that come across them during the daylight hours. Many are camouflaged to look like leaves in their local environment. They are often coloured green, but can be red, yellow, brown or any combination of the above. Morris refers to one species as the Crayola Katydid because of its lurid coloration. This one secretes a nasty chemical to dissuade predators that come too close.

The camouflage can be "very, very good," Morris said. They mimic green leaves in the summer and dead leaves in the fall. Some of these "leaves" have bits chewed out of the edges, as if a leaf-eating insect had passed by. In the spring, the larvae can resemble leaf buds. Some species mimic lichens or bark, and are almost indistinguishable from their surroundings.

Some have cone-shaped heads so they can dive through vegetation without hindrance. Others have "hay rakes" on their front legs so they can grab flies that land on nearby leaves. Another kind dives into water to escape. It is capable of staying under for five minutes before returning to the surface.

Some are flat, some tall, some slender and some wide to blend into their habitat. They can be bovine or aggressive. One chased Morris around a hotel room with its claws in the air.

Most of the katydid species have a complex communication system. But he said they do not really "converse," as much as "broadcast" their identity and whereabouts to members of the opposite sex, usually as part of the courting ritual.

Male orthopterans typically have a complex signal, which the female of the species recognizes and responds to with a 'tick.' The female sound is a simple one, presumably to avoid detection by sharp-eared predators. It sounds like two human thumb nails being clicked together. Morris has successfully clicked his nails in this manner on field trips to attract males.

Grasshoppers and katydids broadcast their sounds in different ways. Male katydids have teeth on the underside of one forewing; the other wing has an upturned edge which rubs along the teeth like a scraper on a file, causing special cells to vibrate.

Males often make two different sounds, by opening and then closing their wings. One of the sounds is a single sine wave, a pure tone of about 35 kHz in the ultrasound range far beyond the ability of human ears to detect. In some species, the sound can be far higher, reaching 85, 90 or even 135 kHz in the extreme ultrasound.

The male backwards rub is very different. Instead of a high-pitched pure tone, it tends to fall in the 15 to 40 kHz range and is highly variable in pitch and intensity. In other words, it is "noise."

Humans can hear sounds up to about 20 kHz so we hear only the "noise" half of the katydid sound, giving the impression of an intermittent call, somewhat like the dots and dashes of Morse code without the dashes.

Male crickets use a slightly different system. They usually emit a pure sine wave of less than 10 kHz, well within the range of human hearing, while the common field cricket often broadcasts at 5 kHz.

Morris does not know why katydids use these extreme frequencies. Perhaps, he said, the high frequency travels a shorter distance, allowing the male to attract nearby females without alerting distant predators.

Katydids have a complex listening mechanism that resembles a ship's speaking tube, like those made famous in war movies. One sphericle on the side of the abdomen is dedicated to listening, rather than breathing. It carries the sound down a trachea to a pair of eardrums on the knee of the foreleg. These eardrums are the only membranes in the tube, and are open to sounds from both sides, from the abdominal tube and from the external air at knee level.

Morris believes that katydids have such a complex listening system to allow them to sense direction. Their special problem is that noise at the frequencies they use has a long wavelength, usually comparable to the body length of the insect.

The wavelength of a field cricket's five-kHz chirp is 2.6 inches, while the wavelength at 135 kHz is 0.10 inches.

With wavelengths that long, katydids can't use the human technique of placing ears on each side of the head, far enough apart to tell where sounds are coming from. Morris believes that katydids use a different mechanism: They compare the wave that works its way through the trachea with the wave that hits the outside of the eardrum on the knee.

The purity of the sine wave may assist the katydid's direction-finding. These waves are often as good as that produced on an electronic wave generator, making it easier for the katydid to tell whether the tracheal wave is in phase with the external knee wave.

Some katydids have an extra mechanism to assist with their communications, a "box" on their back which could act as a resonator.

Preliminary experiments with these insects has answered some questions and raised others. Morris has placed electrodes on the listening ganglia of a female katydid and found that they hear both the high and low frequency calls at a distance of two meters, but only the low-frequency noise at 10 metres.

Other experiments have shown that males vocalize to defend their territory. He has found that males emit calls at the relatively low frequency of 13 kHz while fighting intruders on "their" tree trunk. The intensity of the fight seems related to the intensity of the noise. If he mutes one insect's call by placing wax on the wings, the other insect becomes more vicious.

<u>QUESTIONS:</u>

- Morris believes the sounds play a role in species recognition and in mating. He said there has been a lot of good data that indicates that males that communicate "better" get better mates;
- females apparently prefer some songs over others. Males that use four or five noise groupings appear to do better in the courtship game than males that have two or three groupings;
- females go to the male that makes the most noise;
- females respond to preferred males with a quieter, less intense series of clicks using a series of pegs on top of the wing. They do not use the file and scraper method. Perhaps, he said, the female clicking is harder to detect than the male sine wave;

- male grasshoppers have a different noise-generating system. They tend to rub their back legs together to communicate. Female grasshoppers, like their katydid cousins, have a very simple response;
- Morris detects these sounds using a sophisticated tape-recorder and an oscilloscope that shows the noise waves on a video screen. Modern tape-recorders use digitized sound, which works far better than analog machines, especially for high-frequency sound;
- tropical katydids live perhaps six months; Canadian species live from July to September. They seem to live long enough to get the job done, from spring to fall, a time-span that depends on the climate. For this reason, tropical katydids live longer;
- Morris feeds his laboratory katydids on apples and carrots, a diet that serves his purpose. More nutritious foods are available if necessary;
- he uses directional microphones to find katydids in the field. An ultrasound microphone from an Admiral television channel-changer has worked very well at far less cost than some modern devices;
- he has used these microphones to map katydid territories;
- the frequency of cricket chirps is a very accurate way to tell the temperature, often to within one degree Fahrenheit. The temperature-frequency relationship is an almost perfect linear curve.

The speaker was thanked by Trudy Rising.

NOTES & OBSERVATIONS:

- John Riley saw six Bald Eagles at the west end of Manitoulin Island;
- Crins saw a Ross's Goose in Toronto's Humber Park on Nov. 11. It was still there on Nov. 15;
- Claire Muller saw a Merlin in a beech tree on Oct. 30 and a flock of 34 Robins near Toronto's Don Valley Parkway at Finch Ave. on Nov. 6. There were 15 Pine Siskins in a birch in her garden;
- Carrick noted that Snow Buntings are back;
- Don Huff saw four or five Bald Eagles on Manitoulin Island;
- Claire Muller recommended two books: 'Common Dragonflies of Wisconsin,' $19.95 (U.S.), available through karindot @bankpos.com / tel: 608-643-4926. It describes 76 species of dragonfly, with colour photographs and complete details of identification and behaviour;

Muller also recommended 'Swampwalker's Journal: A Wetland Year,' by David Carroll, $39.95. This is a "wonderful" diary of the author's visits to pools, swamps, marshes, ponds and floodplains in New Hampshire, describing the terrain, vegetation, insects, mammals and reptiles he saw over a 20-year period;

- Carrick recommended 'Cranes: Their Biology, Husbandry and Conservation,' edited by David Ellis et al.

The meeting adjourned at 9:51 pm.

THE NEXT MEETING:

The next meeting will be held one week earlier than usual on Dec. 14 at 8:00 pm in Room 432 of the Ramsay Wright Zoological Laboratories at the University of Toronto when Bruce Falls will show a video entitled: "The Brodie Club Goes to Brazil."

Christmas cheer is more than welcome. For those who can't come, Merry Christmas and a Happy New Millenium.

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