THE BRODIE CLUB

ROYAL ONTARIO MUSEUM OF ZOOLOGY

THE 1,047th MEETING OF THE BRODIE CLUB

The 1,047th meeting of the Brodie Club was held at 7:30 pm on Tuesday, February 15, 2011 in Room 432 of the Ramsay Wright Laboratories of the University of Toronto.

Chair: Ricky Dunn
Secretary: George Bryant

The meeting was attended by 26; 23 members and 3 guests.

Roll Call:
Present: E. Addison, R. Addison, Aird, Bertin, Bodsworth, Bryant, Currie, Curry, Dunn, A. Falls, B. Falls, D. Hussell, J. Hussell, Iron, Machin, McAndrews, Pittaway, J. Rising, T. Rising, Seymour, Slessor, Speakman, Tasker.

Regrets: Abraham, J. Bendell, Y. Bendell, Bousfield, Eadie, Larsen, Lumsden, Sutherland, Tomlinson, Strickland.

Guests: Eric Davies, guest of B. Falls; Sharon Hicks, guest of J. McAndrews; Locke Rowe, guest speaker

Minutes: There being no changes to the March meeting minutes, they were adopted as circulated.

Announcements and New Business
Ed Addison notified members that Jeremy McNeil of UWO will be guest speaker at the October meeting discussing Lepidoptera migration in response to habitat change.

Rose Addison reminded members of the Ontario Nature petition for a Biodiversity Charter. It can be accessed and signed on-line at
http://www.ontarionature.org/protect/campaigns/biodiversity_2020_vision.php

Rose Addison asked members to review and make any changes to a membership list which was circulated at the meeting and by e-mail.

Jean Iron and George Bryant discussed the September 10-11 Brodie outing (details and maps appended). Bryant will e-mail members in early August to ascertain numbers.

J. McAndrews circulated a notice re ROM Waterlife Conference to be held April 21.

SPEAKER

The guest speaker, Dr. Locke Rowe, was introduced by Bruce Falls. Locke completed a PhD in entomology at UBC in 1983. In 1984 Locke joined the faculty at U of T and moved into the office across the hall from Bruce. Locke is Chair of the Department of Ecology and Evolutionary Biology (E.B.B.), U of T, and is currently the Canada Research chair in evolutionary ecology. http://www.eeb.utoronto.ca/people/faculty/rowe
The subject of his presentation to the club was titled

Sexual conflict in the evolution of sexual dimorphism
Patterns and process

Dr. Rowe introduced his talk by quoting Darwin who stated: "amongst many animals, sexual selection will give its aid to ordinary (natural) selection, by assuring to the most vigorous and best adapted males the greatest number of offspring"(1859). In recent years, there has been a sea change in the views of mating systems biology. Instead of thinking of mating systems as harmonious, scientists may now consider these systems as ones in which the sexes are in conflict. There is a major difference in male and female sexes between species in the sense that humans are monomorphic while many other species are not. Often traits in sexes lead to dimorphism: female traits are similar but males not so—they can diverge quickly. Some males, such as Birds of Paradise and Frigate birds, have elaborate mating display traits. The question then is: are these traits driven by sexual selection? If this is correct, then natural selection and sexual selection both operate in the same direction. The best males get the most matings and have good genes for offspring.
But some things do not look harmonious; e.g., garter snake mating balls. In spring in Manitoba, large numbers of males trying to mate with a female may cause her demise through suffocation. Clearly here male and female do not have harmonious shared interests.

Over the years, Dr. Rowe has used laboratory studies and mathematical analysis to analyze sexual selection, conflict, antagonistic traits and the evolution of dimorphism amongst water striders; in particular, the genus *Gerris*. It can be said that sexual conflict equals mating rates with more mating equaling more offspring. Males push to mate more while females, with other things to do, push to mate less. This creates a conflict. Females with lower mating rates will have lower offspring production. Shared traits between sexes include mating rate, mating duration, oviposition rate, offspring investment and fertilization. Sexually antagonistic traits are distinguished from these. If males invent traits that make mating rate increase, the differences between males and females will increase.
Dr. Rowe was attracted to water striders because he noted about six species, including a lot of mating *Gerris*, on one lake. Adults mate from once to 15 times a day—there is a lot of mating going on here! Females store sperm up to 14 days. They lay four to six eggs/day

gluing them to the bottom surface of vegetation. After the eggs hatch, the larva moult five times. They feed at the water surface by piercing and sucking body fluids from flies and midges. The fifth instar, the adult, develops wings and may fly to other lakes.

Water striders vary in size with the largest, a monster from Viet Nam, *Gigantometra gigas*, reaching 25 cm. in length.

Male water striders have modified appendages to grab females. If the hooks can then hold the female, she becomes immobile; this is successful in only one percent of the cases. In most mating attempts, there is a struggle, the male is dislodged and the female escapes. Most mating is superfluous because females have already mated and stored sperm.

For both sexes, mating is costly because of risks of predation, energy expenditures, foraging inefficiencies and potential for disease. Predators attack from below; the female being under the male during mating, is a closer target—hence, predation is a disincentive for females to mate. One experiment compared mating frequency between fed and unfed water striders. Fed females mated a lot; unfed females don't because they struggle to get rid of male so they can feed. There was no observed difference between fed and unfed males. Larger males mate more often than smaller males.

At mating the male genitalia are inflated, twist and come around under the female. Large male genitalia assist in grasping the female. Females have a set of spines to ward off the male; the longer the spines, the farther away they keep male. A large male could be physically abusive to a female.

Dr. Rowe conducted an experiment in which he removed these spines. He collected most North American and European species of the genus *Gerris* and conducted morphometric analysis. He predicted that elongated male genitalia would be matched by elongated spines in females. Results demonstrated body shapes of male and female are correlated with one another. The long genitalia of males are matched by females with long spines while species in which males had short genitalia match females with short spines. The upshot is that there is conflict over mating and this continues to drive differences in both species and sexes. With water striders we seem to have an "armaments race" within the species.

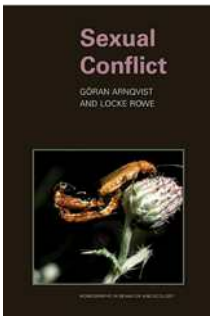
One of Dr. Rowe's students went across Canada studying one water strider species. It was clear that the species is evolving quickly—they can actually study evolution in real time.

Darwin called genitalia 'primary sex traits' to distinguish them from 'secondary sexual traits'. He considered sexual selection restricted to the latter. Rowe looked at this using the "shape" and "complexity" of the genitalia.

While non-genital parts of water striders are similar between species genitalia are amazingly diverse and are species-specific. For study, genitalia were divided into external and internal parts. They are sclerotized making the parts of the genitalia easier to measure. They are tiny (1-2 mm) and complex. External genitalia of females were found to be less complex and less divergent than internal genitalia. Does evolution of these parts reflect current and or past indices of sexual selection? At least for external ones, there must be some mechanical constraints. Genitalia are evolving very quickly. They are highly diverse

and closely related to sexual selection. Females are doing something in internal sex tract that is driving change.
Water striders look different in different ways. In 32 species, the females look almost the same; the males of each species look different. If conflict over sex is the root of this, it is pretty remarkable. Antennae of the females are varied even though all are used for grasping. Dr. Rowe postulated that a simple gene was responsible for creating the varied antennal hooks but how to find this gene? This can now be done with technology. Lab technicians removed appendages from 300 males and 200 females and measured the RNA. From this information the specific gene for antennae development was determined. Most genes have multiple functions but this gene affected antennae only—they did not create a genetic monster. This was then injected into insects at varied times (a graded experiment) to determine how reduction of antennae affects fitness consequences. If the gene was injected in an early instar, the antenna was substantially reduced.

Overall Dr. Rowe's conclusion is that sexual antagonism can act as an engine on the evolution of sexual dimorphism. Thinking about sexual conflict has enriched the study of male-female co-evolution. Genitalia are indeed complex and highly divergent, while sexual selection is driving much of this. Finally, this is an opportunity to understand the simple and complex mechanisms involved in the origin of this diversity.
Members can access further information at http://labs.eeb.utoronto.ca/rowe/research.htm and in a book co-authored by Dr. Rowe.



"*Sexual Conflict* offers an alternative interpretation of the idea of co-operation between males and females. . . . [It] provides a convincing account of an antagonistic relationship driving evolution. It sets out to illustrate the ubiquitous nature of sexual conflict and persuasively presents the evidence for this, concluding that traditional views of peaceful co-operation are perhaps not as accurate as once believed."--Helen L. Kroening, *Biologist*

After his talk, Professor Locke Rowe spoke of the association between the BRODIE Club and the University of Toronto. He noted that the new Department of Ecology and Evolutionary Biology (E.E.B.) is only five/six years old, having originated from parts of the Botany and Zoology Departments. In his position of E.E.B. chair, Locke is working to develop a culture and community in the department and is seeking connections to groups with similar interests. An example of this is a partnership with the Canadian chapter of the Charles Darwin Foundation. Locke is proposing to assist the BRODIE Club with facilities such as a meeting area in their new building, equipment for presentations and possibly a web page presence. In Locke's words "*no complex thought on taking it (the BRODIE Club) over*".
There may be merit in fostering a closer relationship between the two organizations thus permitting opportunities for interested people to become involved and for the future of the BRODIE Club to become more secure by maintaining its long association with the University. The new E.E.B department and the BRODIE Club have numerous common interests.
Discussions over refreshments among a number of Club members included the suggestion that BRODIE Club presentations may be of considerable interest to both

faculty and students in E.E.B. **A group representing the club should have further discussions with Locke to see what practical steps should be taken.**

QUESTIONS:

B. Falls: You showed the fit between male and female but you said no difference in females.
A: There are two approaches to this: 1) the male is perfectly adapted and 2) the male is not perfectly adapted and just throws a hook in anywhere. Locke now thinks the male can develop different adaptations to fit perfectly in female. If the female has a complex head, the male can build many different antennae. He sees change in real time in this species.

B. Falls: The tips of the abdomen of dragonfly differ and prevent mating with other species.
A: This is the lock and key hypothesis—basically a failed hypothesis. In water striders there is a huge diversity and you can see divergence happening in real time.

E. Addison: Most of your comments were about interspecific variation in genitalia. Have you looked at intraspecific variation in genitalia structure as might be affected by such things as absence of predators in some populations?
There are three measures to this; in a population, among populations, and among species. Locke has done a lot of work within populations and at species level and does observe some mis-matches, with 90 percent being forward transitions.
Dunn: From the various matings, which sperm are kept over the one to fourteen days?
Females undertake mixed paternity matings but do not dump sperm, generally laying about three-four eggs a day for 20 to 30 days. Scientists can now look at these eggs and determine paternity—generally about three-four males.
Curry: Is there conflict among males for females?
A. Locke has not observed this. There is some fighting. Males do seem to be able to signal or "talk to each other" in some way.

E. Addison: Is the intersex struggle a part of energetic considerations for male water striders?
A: Males occasionally try to take another male off a female. Basically a male water strider will jump on anything… jumping on pairs because they're there. Males rarely feed.

T. Rising: How does size of male affect mating success?
A: Larger males have more success than smaller.

Bryant: About 30 years ago I realized that about 90 percent of the time striders were grouped into a black blob was when the water is rough.
A: Yes, in rough water, insects congregate in clusters and do not mate often. They can also often be seen in clusters in the morning near docks. When water is calm, they will spread out.

Bryant: Are they diurnal, nocturnal or both?
A: Water striders are both. They feed and mate all the time. Social behaviour is diurnal.

Ed Addison thanked the speaker. Ed found the tests and demonstrations marvelous. On a personal note, Ed could relate to the discussion of sclerotized genitalia, perhaps because of his former work as a parasitologist studying nematodes.

NOTES & OBSERVATIONS

Bruce Falls commented on a pair of Peregrines which has taken up residence in Don Mills. Friends of the Falls live in a building with a telescopic view of the nest. Recently the Falls observed the female who was sitting on the ledge, scraping around a bit and the male who periodically arrived with food. *Fred Bodsworth* added that there are now perhaps a half dozen or so Peregrines around Toronto.

Dunn noted the first Ruby Crowned kinglet singing in Simcoe today.

Jock McAndrews read an interesting report on the Victor Diamond mines, an open pit one kilometre in diameter about 100 kms. west of James Bay. Jock's report is included here:

> "Port Perry where Sharon I live has a jewellery shop that features diamonds from the Victor Diamond Mine; this mine is located in the James Bay Lowland about 100 km west of Akimiski Island where Jean Iron and Ken Abraham study birds.
>
> Diamonds usually occur in kimberlite pipes that are carrot- or martini glass-shaped. These pipes originate deep within the hot, high-pressure mantle where diamonds are formed. Kimberlite pipes intrude overlying rocks that range in age from 500 million to 50 million years ago. Unlike volcanoes, these pipes form not mountains but explosion craters surrounded by a rim of debris ejected from the crater. In time, the debris erodes into the crater and this collegial deposit is mined for diamonds. The open pit Victor Mine exploits a kimberlite pipe about 1 km in diameter that penetrates upward through marine Paleozoic and Mesozoic rocks. Other nearby pipes are being tested for their diamond potential. One pipe studied by the Ontario Geological Survey had non-marine lake sediment preserved in its crater. Magnetic properties of this lake sediment indicate an age of 3.7 to 3.4 million years, which makes this Pliocene rock Ontario's only rock dating between 140 million and 100 thousand years ago.
>
> We found that fossil pollen unlike the modern muskeg that produces much spruce pollen, this sediment to be loaded with pine, oak, elm, maple, beech, hemlock, ironwood, ash, sweet gum, black gum, gingko, umbrella pine and bald cypress. This pollen assemblage points to a warm-temperate climate something like Alabama today. Such a climate so far north indicates much warm tropical seawater and air moving toward the pole through the seaway between the American continents. Subsequent Pleistocene cooling was prompted by the blocking of this seaway by the Isthmus of Panama. "

Rosemary Addison reported that she and Ed were the fortunate hosts of four Turkey Vultures which have roosted overnight in their tall spruce trees. For Rose and Ed this is an omen of health, happiness and prosperity. The first sighting was the evening of March 15. They were seen regularly for approximately a week. Since then one to four Vultures have been observed coming in to roost. Some evenings they are harassed to the point of moving elsewhere by a murder of Crows.

Jim Rising thanked members for their well-wishes during his recent indisposition.

CORRESPONDENCE

On Wed, Apr 13, 2011 at 8:34 PM, Dan Strickland <dan@grayjaystudy.ca> wrote:
I was hoping that I would be free to come to the April meeting but, as things have turned out, next Tuesday will be a busy day banding nestling Gray Jays.

The snow is going very rapidly now. I have a few square metres left in my front yard but only because it is shaded by a big spruce tree. South-facing slopes in hardwoods are almost all bare now, bogs are snow free and flooded, but coniferous areas still have lots of knee-deep patches. Heard a Winter Wren a couple of days ago, Hooded and Common Mergansers are back as are Ring-necked Ducks, Wood Ducks, and loads of Robins, Grackles, and Red-winged Blackbirds. No sign of any spring flowers….

I have 22 Gray Jay nests on the go. Banded the first three nestlings (in one nest) last Sunday, April 10. Another nest will be done Thurs. 14 and two more on Friday.15.
Dan Strickland

The meeting was adjourned at 9:22

NEXT MEETING *****note CHANGE OF DATE*****
The next meeting will be held Tuesday, May 3 at 7:30 pm in Room 432 of the Ramsay Wright Zoological Laboratories. The speaker will be club member **Kevin Seymour**. His topic is "**What the Fossil Record tells us about the Evolution of Flight and Ecolocation in Bats."**

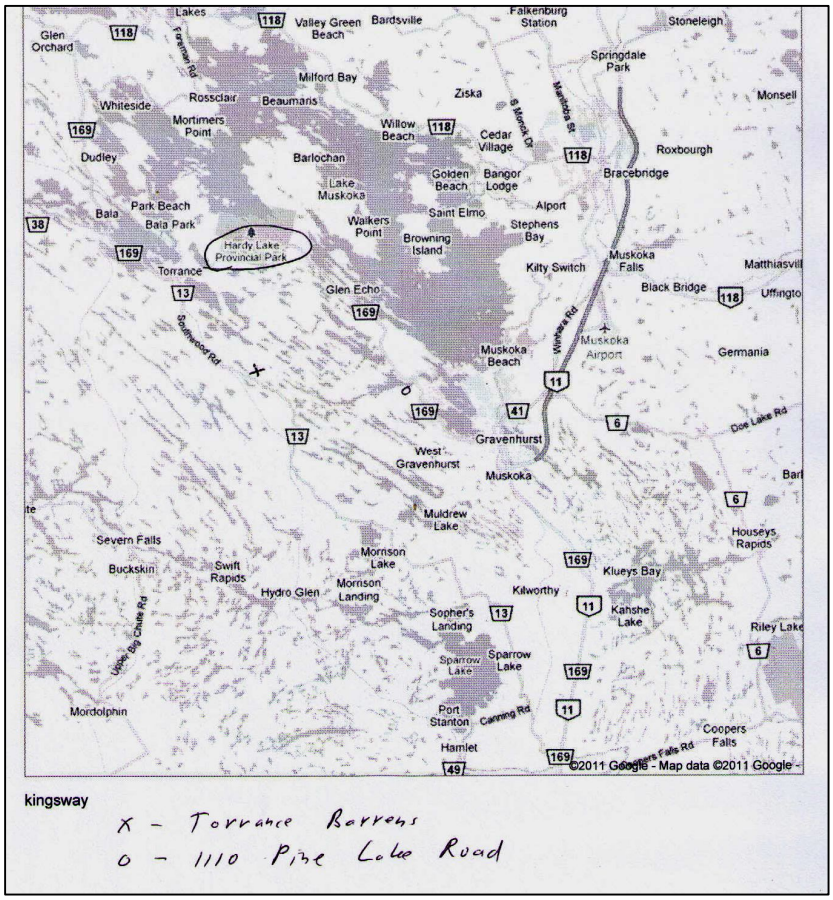
2011 BRODIE CLUB PICNIC AND FIELD TRIP

This year the BRODIE Club picnic and field trip takes a departure from the traditional date of mid- June. Instead it will take place on Sat. Sept.10 and Sun. Sept.11.

A map to the area and the original flyer from the Outing Committee of George Bryant, Jean Iron and Trudy Rising are provided for your information.

Members planning to stay overnight Friday and/or Saturday are encouraged to book accommodation early as there are several other major events in the area that weekend.

Members will be contacted in August to get an estimate of numbers.



2011 Brodie Club Outing

Torrance Barrens

Muskoka

Saturday/Sunday
10 and 11 September 2011

Meet Saturday at 10:30 a.m.

Torrance Barrens Conservation Reserve Parking lot
~8 km southwest of Torrance on Muskoka Road 13

Leader: George Bryant

Torrance Barrens are spectacular in fall with lots of colour and no bugs. Expect to see asters, goldenrods, shrubs and Atlantic Coastal plants. Butterflies, dragonflies, mammals, herptiles and birds will all still be evident. There are several trails, walking is easy — one does not have to walk far to see lots. Bring lunch and wear hiking boots.

Dinner Hosts

George and Stephanie Bryant invite all to dinner at their cottage on nearby Pine Lake

After Dinner Star Gazing

George and Stephanie's cottage is close to Torrance Barrens Dark Sky Reserve

Overnight Accommodations

Trudy and Jim Rising can accommodate several people at their cottage

Hotels and Motels in Gravenhurst

Sunday

George Bryant will lead a half day outing to nearby Hardy Lake (a "reserve" provincial park). We will take an excellent 2 km trail with interesting views and entirely different flora and fauna.

Getting there

Gravenhurst is ~150 km (1 ½ hrs) from junction of Hwy 400 and 401; Torrance Barrens parking lot ~25 km (1/2 hr) from Gravenhurst

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