

THE
BRODIE
CLUB



ROYAL ONTARIO
MUSEUM OF ZOOLOGY

THE 1010TH MEETING OF THE BRODIE CLUB

The 1010th meeting of The Brodie Club was held on March 20, 2007 at the Ramsay Wright Zoology Laboratories of the University of Toronto.

Chair: Alexandra Eadie
Secretary: Ed Addison

There were 18 members and four guests.
Brenda Gibson, guest of John Sparling
James Fullard, speaker and guest of Bruce Falls
James and Simon Turland, guests of Rosemary Addison

A motion [Ron Tasker/Ann Falls] was passed to accept the minutes of the 1009th meeting.

Bruce Falls reported that the lecture of the April 17th meeting will be by archeologist Peter Storck of the Royal Ontario Museum. He will speak on paleo-Indians.

The May meeting will be held one week earlier than usual on 8 May. The speaker will be Bob Johnson from the Toronto Zoo, who will talk on amphibians and reptiles.

Members are invited to suggest a venue for the June Field Day. Robert Ritchie (the younger and son of a long-time corresponding member) has suggested going to Niagara where he could arrange a program.

NEW BUSINESS:

Sandra Eadie described an FON meeting on the proposed Endangered Species Act for Ontario, indicating that it was a promotion to lobby our MPPs and encourage them to pass the new act.

John Riley is on a leave from the Nature Conservancy for one year as the inaugural recipient of the Metcalf Foundation Field Fellowship.

John Sparling and Jock McAndrews mentioned the Carden Plain weekend in which one presenter will be Brodie Club member Ellen Larsen, who will speak about nature photography. Jock sent the following link to the Larsen's talk: <http://www.cardenguide.com/Festival/> and click on "Wildflower Photography." She will lead a photographic walk on Saturday June 16 from 2 pm until 6 pm:

Participants, armed with their own film or digital cameras and light tripods, will walk into the Prairie Smoke property, nearby the Carden Recreation Centre, looking for photographic

subjects. *Photographic tips will be provided but the emphasis will be hands-on photography. With luck, we should be able to photograph Columbine, Bellwort, Hairy Beardtongue and of course, Prairie Smoke, among many others. Up to ten can be accommodated. Bring insect repellent and wear long sleeves and slacks.*

The Carden Nature Festival will be held on June 15 to 17. All activities start and end at the [Carden Recreation Centre](#), 258 Lake Dalrymple Road, Sebright, Ont.

SPEAKER:

The speaker was James Fullard who was introduced by Bruce Falls. Prior to spending the past 25 years on the U of T faculty at the Mississauga campus, James conducted graduate studies at Carleton University, where Brock Fenton interested him in bats. James spoke on:

The Ecology and Evolution of Moth Hearing

There has been a great deal of attention paid to bats during the past 20 years, in part how they emit chirping sonar sounds that allow them to determine where and sometimes what their possible prey ‘targets’ are. This is accomplished by the process of echo-location.

Concomitantly, the pulsing ultrasound chirps of the bat also allow the insects to identify the location of the bat in the same way that a radar detector can establish the location of a radar trap on the highway.

In addition to moths, many other insects, including some beetles, mantises, butterflies, katydids, crickets and grasshoppers, have ears that sense sounds. However, it is only moths that appear to use their ears for moth avoidance.

Much of Fullard’s Canadian fieldwork is conducted at the Queen’s University Biological Station at Chaffey’s Locks. There

Bats have existed for terms of obtaining their prey, bats groups. One group practises pursue prey that are in flight. gleaners,’ which collect their

Noctuid moths have has been known since late in the ear was unknown. sounds, there was no moths. It was after Don sending out sonar signals

Treat were two scientists who, during the 1950s and 1960s, raised the profile on the research on avoidance of bats by moths. Roeder and Treat established that moths raised their survival rates by 40% when they responded to the presence of bats.

Ears of moths are very simple. Many moths have only two auditory sense cells, some have one and others have four sensory cells. In contrast, humans have about 18,000 sensory cells per ear! If bats only use their ear to discern the presence of bats, they do not need to discriminate among sounds. The simplicity of the system provides an opportunity to study how a nervous system is adapted to a single function.



are eight species of bats in the area.

approximately 60 million years. In can be differentiated into two ‘aerial hawking,’ whereby they The second group are ‘substrate prey off leaves or the ground.

an ear under their wings. The ear the 19th century, but the purpose of Because moths make no discernible apparent need to listen to other Griffin discovered that bats were

that things changed. Ken Roeder and Asher

Moths are capable of hearing and responding differently to different bats. Moths are sensitive to sounds across a wide spectrum, from five to 100 kHz. In contrast, humans and most other mammals and birds are sensitive only to a narrow range of sounds of less than 20 kHz. While moths can hear across a broad range, their sensitivity is greatest in the 20 to 40 kHz range which, in general, is the range where bats are calling. Some bats disguise their calls to at least one species of bat 200 kHz, while the spotted only 9 kHz. These unusual insects are outside the enough, some of these bats

The flight responses pattern discernible by of unpredictability in allows moths to survive

If the sole function of the circumstance in moths bats? In an evolutionary the manner of vestigial eyes in cave fish and breasts in male humans. Darwin had hypothesized that the benefit of vestigial organs was the saving on energy by not investing in structures insignificant for increased survival. There are at least two evolutionary questions about this system.

- Do ears still exist in moths that have evolved in areas devoid of bats?
- If they do retain ears, do the ears retain any function?

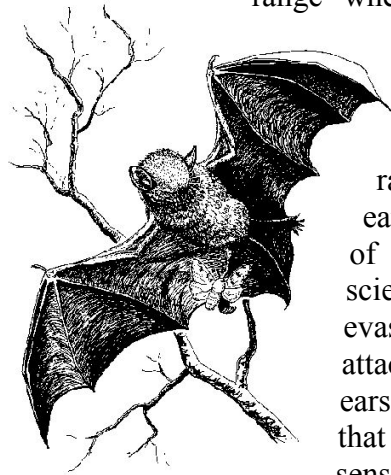
Two areas of the world without bats over prolonged evolutionary time are the High Arctic and parts of French Polynesia. French Polynesia has been free of bats because they are far removed from Australia (with 50 species of bats) and New Guinea (with 48 species of bats), two regions that are both 'up wind' of French Polynesia. The further east that bats have been blown from Australia and New Guinea, the fewer of them survive to find land.

Hawaii has one species of bat and it was imported from North America, which is down wind.

Fullard chose Moorea, Tahiti Nui and Tahiti Iti of the Tahiti group of islands for his field work. He did so because there is no evidence that bats have been there. There is no word for bats in the native human language and no fossils of bats. The islands appeared out of the ocean as volcanoes six to 12 million years ago. An additional advantage of these islands is that their high elevation and variable relief has provided a diversity of niches for a diversity of speciation. On these islands, there are endemic species of moths known nowhere else in the world. The implication is that these endemic species of moths evolved locally.

With the high degree of tourism and development, it is only areas with endemic vegetation that support endemic species of moths. The three areas of Tahiti Nui with endemic vegetation all occur high in the mountains, the highest area being at 2060 m. These regions remain foci for ongoing evolution.

Do ears still exist in these moths that have evolved for up to five million years in the absence of bats? Yes, some of these moths have ears just like those that have evolved sympatrically with bats. Perhaps the ear persists, but it is the avoidance behaviour that becomes 'vestigial', i.e.,



disguise themselves. There is at calling at frequencies in excess of bat of western Canada calls at echo-location calls for locating range of hearing of moths. Sure eat exclusively moths!

of moths are unpredictable with no science. It may be that this high degree evasive flight is the characteristic that attacks by bats.

ears in moths is bat detection, what is that have evolved in the absence of sense, one might expect vestigial ears in

Darwin had hypothesized that the benefit of vestigial organs was the saving on energy by not investing in structures insignificant for increased survival. There are at least two evolutionary questions about this system.

becomes extinct. Perhaps an ear with two sensory cells is inexpensive to retain but it is the behaviour that is energetically expensive to retain and is hence lost.

Fullard compared the flight behaviour of two moths in Tahiti. One, *Chasmina tibialis*, is an introduced species on Tahiti; the other, *Hydrillodes crispipalpis*, is one of the remaining endemically evolved species of moths. With the introduced species in flight, there is a significant decrease in the time spent in flight when bat sounds are played. However, with the endemic species, the moths spend as much time in flight when the bat calls are played as when they are not played. In short, the endemic species of moths that evolved in the absence of bats are not responsive to the presence of bat sounds. If a moth need not drop to the ground to avoid bats, there are some evolutionary advantages. For example, if a moth drops on to water, it will often rapidly be consumed by a fish. There are advantages to maintaining flight and choosing a landing spot with care.

There are moths that do not have ears but they are rare. One such species in the Amazon basin is diurnal in flight activity, thus temporally isolating their flight from nocturnal bats. It appears that it must take more than the five million years of isolation of moths in Tahiti for auditory organs to disappear.

Why do research of this nature?

- Moths can be models to learn how ears work.
- Moths can be models to study how animals turn sounds into behaviour.
- To assess the impact of bats on insect populations [e.g., bats have limited impact on mosquito populations.]
- Bats can be a measure of ecosystem health.

QUESTIONS:

We may have moths that emerge in cooler weather before bats emerge in spring. Have these moths been examined for occurrence of ears and avoidance behaviour?

There is one species in High Park in which the female is flightless and lacks ears. The male is attracted to the female by pheromones and flies to seek out females. The males do have ears. Some other species of moths temporally isolated from bats do appear to have less-developed ears.

What about large moths that may not be preyed upon?

Bats will attack the large underwings and other large moths. Underwings have large and excellent ears. Silkworm moths are 'earless' and survive by flying in quite a different manner. "Ears on moths are like helmets in going to war. Having a helmet doesn't mean that you won't be killed."

Where are ears located in moths?

This depends on the moth. In noctuids and many other moths, the ears are on the last segment of the thorax. However, on some moths the ears are located on the abdomen or even on the face or wings. The hypothesis is that moths evolved without ears and that ears started to evolve only after the evolution of bats.

What is the situation in the Arctic?

One species in the gypsy moth family takes five years to emerge as an adult. There are no bats in many areas. However, there are bats in the southern range of some of the High Arctic moths and perhaps there has been some need for the perpetuation of ears and avoidance behaviour.

Does ultrasonic pollution adversely affect moths?

There are not many things producing these ultrasound emissions.

Are there insects that 'jam' the bat sounds?

There are a couple of hypotheses. One is that some moths might send back messages that indicate that 'I taste bad'. A second 'jamming' technique could be that some moths might send back sounds indistinguishable from bat sounds. This would create lots of false echoes to the bats.

The African Bold Worm Moth is a small brown noctuid. This species tends to cluster beside a screeching cicada that produces a loud ultrasonic noise. The moths seem to be adapting to this sound because they do not fly away. Perhaps bats could adapt to this by seeking out cicadas, knowing that the cicadas are 'jamming' the hearing of the moths. Hence, the moths would be easy prey for the bats.

Tent caterpillar moths lack ears and it is hypothesized that they survive by being present in such large numbers over a short period of time.

The speaker was thanked by Enid Machin.

NOTES & OBSERVATIONS:

Jock McAndrews: In the Humber Valley near the Old Mill subway station on Thursday, he and students were walking on cakes of ice covered with two centimeters of mud. They saw raccoon tracks and fresh deer tracks. There was no recent beaver activity and no crows. Bufflehead ducks were on the river. *Euonymus fortunei* was climbing trees and there were old buck rubbings on saplings.

Harry Lumsden: Harry uses a chain saw to cut ice so that his swans can get water in winter. He turned a chunk of ice on its side. During breakup, the candling on the ice on the pond was vertical, but on the ice on its side was horizontal. Harry repeated this process this winter and with a piece of ice 15 inch thick. He again noted the horizontal candling on the piece on its side. Why is this? Nobody provided a specific explanation, but there was a general consensus that the molecular structure of ice may have some vertical stratification.

John Speakman: The arrival date for his robin is usually 10 March. He heard robins in the recent warm spell and then when the cold re-appeared he saw robins flying south.

Ed Addison: A friend called and reported a large hawk with a broken wing in central Aurora and asked Ed for help. By the time Ed got there, the hawk, an immature red-tailed hawk, was perched in a nearby tree and was reluctant to move when approached. When on the ground, the hawk had been seen within a metre of the front steps of a house and within three metres of the

front door. Upon inspection, there was a dead grey squirrel at that site and it was partially eviscerated. Rosemary Addison concluded that, when first seen, the hawk was ‘mantling’ with spread wings to protect a recently killed prey.

James Turland: Two hours before the Brodie Club meeting, James spotted a woodcock in the snow-bound back yard of the Addison’s home in central Aurora. This was the first woodcock seen in that yard in 27 years.

Sandra Eadie: Sandra (and John Sparling on a different trip) has been in Trinidad and have both she and John have seen red-billed tropic birds nesting on the ground.

There appears to have been a hooded merganser-goldeneye pair together for the past number of years in the Toronto area. This is interesting because the two species are in different genera.

Hugh Currie: There is an unusual bird in the area. On one side, it has the plumage of a Clark’s grebe and on the other side, the plumage of a western grebe! Bruce Falls noted that Paul Hebert, the professor coordinating the bar code study at University of Guelph, had noted that Clark’s grebes and western grebes had the same genetic fingerprint.

John Sparling: After the meeting, Sparling sent members a reference to a rare species of large European bat that catches migrating birds.

Ken Abraham: After the meeting, Abraham sent members noted a book launch for *Silence of the Songbirds: How We Are Losing the World's Songbirds and What We Can Do to Save Them*. The event will be held at Innis Town Hall at UofT on Thursday, April 19, at 7:00. The event is free. The book is by York University biologist Bridget Stutchbury, who “warns of the catastrophe facing our migrating songbirds and she points to some solutions that each of us can take to avert this looming disaster.”

NEXT MEETING:

The next meeting will be held at 7:30 pm on April 17 in Room 432 of the Ramsay Wright Zoological Laboratories at the University of Toronto. The speaker will be archeologist Peter Storck of the Royal Ontario Museum speaking on a *"Journey to the Ice Age: The search for early humans in Ontario, past, present and future."*

Two Kinds of Otters

By Yorke Edwards

Our Western Correspondent

In British Columbia, there are two kinds of otters. River otters live in or near the edges of rivers, lakes and the sea; and sea otters that are almost always living in the sea, but usually not far from shore. They only go on shore when waves get big and white.

River otters sometimes travel by our garden by the sea or swim by us along the shore, usually alone except in early summer when there is often a family of two adults and three or four young ones.

River otters live on land near water and hunt for fish that are not far from shore. Several times, I’ve seen four or five young ones with their adults. They sometimes swim across our bay, then go along the rocky shore next to the ends of four gardens to

another large bay with good fishing. When in the water, they usually swim near the shore, but sometimes go further out to eat fish. Sometimes, there are a lot on the shore, especially when their young are small. Once, on our nearby golf course, I saw an adult running slowly, as usual, toward the sea while crossing between two groups of golfers. It was running from the back side of the course next to gardens at the back of houses. One year, otters dug under the back wall of a small, old shack behind our garage that was probably made for garden tools, and it became an otter's home for four new babies. We didn't know how many years otters had gone under the back wall into the tool shed. Once at a friend's house facing the sea, I watched an otter family running out from under the house next door. They ran to the sea, two adults with four or five young ones.

Sea otters once lived well beyond the ocean shores from Alaska to California, often eating fish far out, but sometimes coming near shore to eat sea weed. On land, they are clumsy, but in big winds, they come onto land to get away from big white waves.

I first saw these otters near Los Angeles. They were living in the ocean, not very far from shore, and they seemed not much afraid of people. But by about 1950, they were near extinction all

along the western coast. Some lived off Alaska, there were none in British Columbia, but a few living off the shore of southern California.

They almost disappeared south to Mexico because Chinese people wanted to make coats of sea otter fur. But they weren't the only ones. British ships had been collecting furs for 150 years because the fur sold for up to \$2,500 a pelt. In Russian waters in one year, 1911, 120,000 sea otter skins were collected.

Sea otters are a small bit like men and chimpanzees, having the ability to use tools, according to the *Mammals of Canada*, a government book from Ottawa. Sea otters carry a flat piece of stone to the surface and hold it against their chests, ready to use the stone to break up sea shells. In Alaskan waters, the sea otter eats limpets about seventy per cent of the time, but they also eat mussels, crabs, starfish, octopus and sea weed. In the far south, the main food is California abalones.

I often wonder if sea otters stay in water when there are orcas – or killer whales – about. Perhaps they hide on shore as they do when waters are dangerous.

