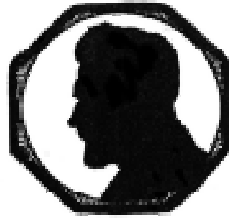


THE
BRODIE
CLUB



ROYAL ONTARIO
MUSEUM OF ZOOLOGY

THE 997TH MEETING OF THE BRODIE CLUB

The 997th meeting of The Brodie Club was held on Nov. 15, 2005 in Rm. 432 of the Ramsay Wright Zoological Laboratories at the University of Toronto.

Chairman: Ken Abraham

Secretary: Oliver Bertin

There were 19 members and five guests

Rosemary and Pete Addison and Melissa Rose, guests of Ed Addison

Jeremy Hussell, guest of David Hussell

Jeff Seidman, guest of Jennifer Young

The minutes of the 995th meeting were approved with minor changes. Ron Pittaway had referred to Black-capped Chickadees, not Boreal Chickadees, and Jock McAndrews had referred to a core taken in 2001 that showed signs of Canada Goose pellets and eutrophication at the 1268 AD level, not 20,000 BP.

NEW BUSINESS:

Rosemary Addison formally applied for membership. Her written application was included in the previous minutes.

Sandra Eadie and her committee have estimated the cost of the 1,000th anniversary dinner at \$50, plus about \$5 for incidental costs that include room rental, bar, speaker's meal, invitations, photographer's fee and mailing. There was considerable discussion about methods of financing that ranged from a levy on members, a higher ticket price or a dip into club funds. The club has about \$800 on tap, of which \$500 was donated to the Club by member Ken Reading to cover the cost of mailing written minutes. Various motions to finance the dinner were tabled to the next meeting while the anniversary committee investigates the total — and final — cost of the anniversary dinner. Bertin offered to speak to several professional photographers who would be willing to record the event. The cost would appear to be prohibitive. Kevin Seymour asked members to bring any photographs they may have of previous club events. The Royal Ontario Museum has a large collection of photographs dating back to the 1930s, but is short on photographs from the 1950s and 1960s. The anniversary committee includes Jennifer Young, Bruce Falls, Ann Falls, Kevin Seymour and Ed Addison.

Federation of Ontario Naturalists delegate Trudy Rising reported that she had been in contact with her counterpart at the FON but they had not yet met.

The next meeting will be held at 7:30 pm on Dec. 13 — one week earlier than usual because of the Christmas holidays — in Room 432 of the Ramsay Wright Zoological Laboratories at the University of Toronto. Members are encouraged to bring Christmas cheer.

SPEAKER:

The speaker was Paul Hebert, a native of Kingston, Ont. who earned his BSc at Queen's University and his PhD at Cambridge. He subsequently carried out postdoctoral fellowships at the University of Sydney and at the Natural History Museum in London. He took up a faculty position at the University of Windsor in 1976 where he remained until moving to Guelph in 1990 where he now holds a Canada Research Chair in Molecular Biodiversity. Over his career, Paul has served as Director of the Great Lakes Institute at Windsor, as Chair of the Department of Zoology at the University of Guelph, and as Chairman of the Huntsman Marine Science Centre in St. Andrews. He is currently Director of the Biodiversity Institute of Ontario and of the Canadian Barcode of Life Network. His research in digital media and evolutionary biology have led to the publication of more than 240 papers and to his election as a Fellow of the Royal Society of Canada.

THE BARCODE OF LIFE

In his early days, Paul Hebert saw himself as a naturalist, somebody who identified species using the traditional methods of size, shape and colour. It was "an analogue world," he said. But there's been a sea change in the way that people view the world. People are moving to systems where species are being identified through their DNA, the digital world that underlies all life.

DNA speciation is a brand-new field — the first paper was written only three years ago — but Hebert said it has already had a huge impact on taxonomy. Digital DNA methods are now being used to differentiate and identify thousands of animals, from apes to butterflies, and these methods promise to identify every species of fungus, plant and animal on earth within a decade, providing automated identification systems that will help conservation efforts and the management of species, especially those that affect human health or economic systems.

Most biologists still use traditional keys to differentiate species, a slow, difficult, awkward and expensive method that Hebert said doesn't do a very good job. The human mind can identify, recall and recognize only about 1,000 species, a far cry from the 100 million or so species on earth.

"We need a new approach to bridge this divide," he said. And digital methods may do the job.

The key to this brave new world are barcodes, the vertical black stripes that adorn every product in the supermarket. These barcodes are a universal system that has proved immensely important in supermarkets. Each of 100 billion different products can be uniquely identified using barcodes, using cheap automated readers. DNA can be used as the basis of a taxonomic barcode. A strand of DNA can be separated into more than one billion different options — four to the 15th power — using a DNA barcode. And that barcode can be simplified into 648 vertical stripes in four colours, enough to identify all the species on earth using an automated reader.

The key to the speciation is the rate of change of DNA. Hebert estimated that the DNA sequence changes by one per cent every million years, or 40 changes for 1,000 base pairs. That number can be confirmed. Hebert referred to the closing of the Isthmus of Panama about three million years ago. A comparison of animals on both sides of the isthmus shows a three-per-cent change over that time.

Hebert has been working for some years on a way to identify and catalogue the DNA of each species, using the cheapest and simplest way possible. He uses mitochondrial DNA because it changes faster than other DNA and he uses just one portion of a gene, an "indicator" that allows him to identify the species in the simplest way possible.

"It's an internal ID system for all animals," he said.

How does he do it? The simplest way is to pull the leg off an insect, extract the DNA from a single cell, replicate that DNA several million times using a polymerase chain reaction and sequence the DNA barcode in a \$500,000 automated machine. The barcode illustration is then filed with a description of the insect, its photograph, GPS geographic data and other pertinent data and compiled along with 100 million other items in a huge reference directory of all the species in the world. Any researcher can tap into that directory to compare and contrast the DNA barcode from a mystery insect with the library of known species.

"Try it," Hebert said. "It actually works."

The barcode turns up some interesting facts. Hebert can take the DNA from a room full of people and find only one basis point of difference. He has take samples from humans all over the world and found a difference of only 2 per cent. Extrapolate those lines back and he predicts that all humans originated from a common root between 100,000 and 200,000 years ago.

Now compare humans with Sumatran orangutans and he finds about 20 points of difference in the DNA code. Chimps have 65 differences. Bonobos have 70 differences and gorillas 75. It is clear that humans are closer to orangutans than they are to chimps or gorillas, but the common ancestor lived many millions of years ago.

Looking at the data a different way, Hebert can find clear differences between species that traditional taxonomists may have suspected or missed entirely. There are, for instance, 700 species of bird in North America, including 30 species of sandpiper. Many of them are very hard to tell apart using traditional taxonomic keys, but the differences show clearly using DNA barcodes.

The Solitary Sandpiper is such an example. DNA barcodes show clearly that this species should be divided into two separate taxa, something that many taxonomists have argued for years. Similarly, Hebert argued that the Eastern Meadowlark comprises two distinct species, as does the Warbling Vireo. Extend this discussion and Hebert suggests there are really 14 extra bird species in North American and 500 around the world.

Hebert's team has used the same methods to speciate Australian fish, B.C. lobsters and lepidopterans.

The barcodes also allow the researcher to measure the difference between two species and how long they have been isolated.

Costa Rica has proven to be a particularly useful study area because of the rich diversity of the animals there. An associate is using DNA barcodes to survey the hundreds of Costa Rican Saturniid silk moths and the 500 species of Herperiid skipper moths. Every one can be clearly identified using bar codes.

In Madagascar, there are 1,200 species of ant that can only be distinguished using a large variety of measurements of the head taken using a microscope. DNA barcodes, however, can tell the species apart with far more accuracy and far less time and anguish.

Hebert believes that barcodes can distinguish 99.99 per cent of the animal species on the planet, simply and easily, using automated methods. They have not, however, proved as useful with plants, a problem that Hebert believes can be rectified using a different gene location.

In conclusion, Hebert said DNA bar codes promises to be a valuable tool to differentiate species, using automated methods for a cost of only about \$2 each. This method is independent of age, sex and geography and of life stages. It will work for nematodes and birds and insects and mammals and even species as difficult to separate as sandpipers and vireos, giving the world a brand-new and exciting way to manage dwindling species and curtail pests.

For further details, Hebert recommended the website www.barcodinglife.org

QUESTIONS:

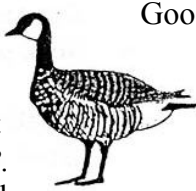
- Hebert compared the DNA barcodes with the Dewey Decimal System used by librarians to catalogue books. Every species is assigned a code, using rules that extend across all animal life.
- Hebert said there is virtually no variation in the barcode across humans, indicating there is "a universal Eve."
- DNA barcodes would have saved millions of dollars if they had been used to identify pests. The zebra mussel and the Asian Long-horned Beetle were misidentified for years, allowing them to spread before action was taken to stop them.
- DNA barcodes can be used to distinguish between the species in such similar groups as white-headed gulls, Eider ducks and the Northwestern and Common Crow (see Yorke Edwards piece below).
- Hebert suggests the Solitary Sandpiper is really two subspecies that were isolated several million years ago. The barcodes "show a clear lineage."
- Hebert's associates are now identifying and separating the 12,000 North American species of lepidopteran. They hope to complete that project early next year.
- Plants are harder to distinguish using these methods, possibly because plants have developed more slowly than animals, leading to fewer differences in their DNA. The solution may be as simple as picking a different gene location.
- DNA barcodes can theoretically be identified by eye without the expensive equipment now being used. But it is far easier and simpler and cheaper to use automated equipment.

The speaker was thanked by Jim Rising.

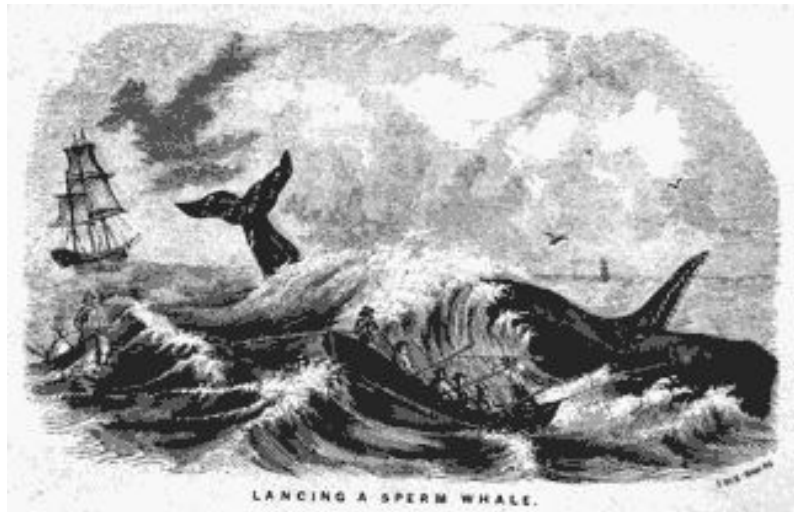
NOTES & OBSERVATIONS:

- John Speakman demonstrated a combination bird nest he found in one of his Purple Martin houses. It appeared that a wren had taken over a swallow's nest — or perhaps the other way round — perforated the egg and built its own nest on top. It appeared to have used sticks to keep out the larger swallow. The observation sparked a considerable discussion, with some members suggesting the swallow came later and took over an existing wren's nest. Several

members noted that wrens and other bird species do sometimes destroy other birds' eggs that get in their way.

- Seymour saw a Common Snipe on the previous weekend. It was a late sighting, probably because of the unnaturally warm weather this year. Eadie said later that the Common Snipe has recently been renamed as the Wilson's Snipe.
 - Hussell reported that two Cackling Geese were banded at Thunder Cape Bird Observatory (TCBO) in early October, the first banded at TCBO. He referred to Ken Abraham's recent article (OFO News 23 (1): 2-6) on Cackling Geese to help the non-birders in the club. In 2004, he said, the American Ornithologists' Union split the Canada Goose (*Branta canadensis*) into two species, a large-bodied group of seven subspecies that retained the name Canada Goose (*B. canadensis*), and a small-bodied group of four subspecies that gained the name Cackling Goose (*B. hutchinsii*). *B. h. hutchinsii* was formerly known as Richardson's Canada Goose. Note that the new species name (Cackling Goose) was formerly applied only to the southwest Alaskan breeding subspecies of "Canada Goose" (then named *B. canadensis minima*). That subspecies is the smallest of all Canada and Cackling subspecies. Three of the four subspecies of Cackling Goose breed in Alaska (north, southwest and Aleutians) but the fourth nests in the low to high Arctic to the north and northwest of Ontario and Manitoba, on the western Hudson Bay coast, Southampton Island, on southwestern Baffin Island, and probably in tundra areas of the eastern and central Arctic to about 110° W longitude (Victoria Island). They are regularly found in James Bay and northwestern Ontario during migration. Cackling Geese seen in Ontario are unlikely to be any subspecies other than *B. h. hutchinsii*. Banding recoveries confirm that many of them are from the breeding population on southwestern Baffin Island.
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- McAndrews mentioned two books that he had come across. One was *The Pacific Coast* by member Fred Bodsworth. It was one of *The Illustrated Natural History of Canada* series published in 1970. The other book was *People & Land Through Time* by Emily Russell.
 - Jean Iron reported a group of large white-headed gulls feeding on construction sites in Markham. They included a Thayer's Gull, Iceland Gulls, Glaucous Gulls and Lesser Black-backed Gulls. She also saw five Cackling Geese on one pond.
 - Guest Melissa Rose reported seeing a Peregrine Falcon two days earlier near the corner of Yonge and Bloor in downtown Toronto.
 - Addison saw what appeared to be a rare white-morph raptor at the south end of Bruce County, white all over with light gray on top of the wings. It appeared to be a raptor but could have been a Snowy Owl out of its element.
 - Speaker Paul Hebert has seen a large number of wingless lepidopterans in his light trap. They appeared to be egg-laden females. Males typically fly into the trap, but the wingless females crawl up. He said he has identified 898 lepidopteran species in his two-acre yard near Guelph.
 - Bruce Falls referred to a recent paper on singing mice. The authors used songbird technology to record the ultra-high frequency vocalizations of mice. They artificially lowered the sound frequency to audible levels and analyzed the vocalizations with a bird sonogram. They found that mouse songs are remarkably similar to that of songbirds, with reproducible, syllabic dialogues, unique to the individual, sometimes two seconds long.

- Abraham saw several dragonflies hunting insects on the previous weekend, north of Toronto. They appeared to be Green Darners, a migratory species that sometimes hangs on until late in the year.
- Jim Rising observed a dozen Evening Grosbeaks the previous weekend at his cottage south of MacTier.
- Iron reported the sighting of a highly emaciated Pomarine Jaeger in Barrie. It was migrating south over Lake Simcoe, following the normal migration route of Pomarine Jaegers, when it landed on the bay in Barrie, and after about two weeks became tangled in a fishing hook and line, was rescued, but died two days later in a wildlife rehab centre.
- Bodsworth reported having picked up an exhausted, emaciated Long-tailed Jaeger in his garden at Port Burwell on Lake Erie in the 1930s. The bird died and its skin is in the ROM collection. He wondered if jaegers, which are known to reach the Great Lakes after flying overland from James Bay, are prone to exhaustion.
- Bertin recommended two books: *The Cruise of the Cachalot* by Frank Bullen, a long-forgotten classic written after an around-the-world whaling expedition in 1875. It is a fascinating, lively book with very interesting natural history on a variety of whales, giant squids and other species, written from the whaler's perspective. The other book is *Indian Fishing: Early Methods on the Northwest Coast* by anthropologist Hilary Stewart, published by Douglas & McIntyre, 1977, paperback 1982. Stewart describes the methods the West Coast Natives used to hunt halibut, salmon, sturgeon and herring, with hundreds of line diagrams and photographs. She shows how the natives used handmade line, nets, hooks, spears and weirs to catch fish, methods that were more successful than those used by the white explorers, early settlers — and modern grad students!



LANCING A SPERM WHALE.

The meeting adjourned at 9:40 pm.

NEXT MEETING:

The next meeting will be held at 7:30 pm on Dec. 13 — one week earlier than usual because of the Christmas holidays — in Room 432 of the Ramsay Wright Zoological Laboratories at the University of Toronto. Members are encouraged to bring Christmas cheer.

The speaker will be Prof. Dan Brooks from the UofT Department of Zoology, who will speak on "*Conserving Natural History: The Importance of Maintaining Instruction in Natural History.*" He recently gave a talk to The Brodie Club on his studies in Costa Rica.

Those Western Crows

By Yorke Edwards
Our Western Correspondent

When I was about 12 years old, I started to use a note book for recording birds, and the first was an English sparrow. Second, were crows flying high over the city, going north to fields with vanishing snow.

Now, in Victoria, I daily see crows that live near the sea, the smaller western crows that are very different from those in the rest of Canada. Once the Ornithological Union was about to decide that crows, east and west, were one species, so Allan Brooks, the famed bird artist, went east from BC to tell the Union that there are two kinds of crows that have very different habitats, behaviours and sizes. The western crow is smaller than the other and lives only near British Columbia's ocean shores plus only a few miles into the shores of both Washington State and Alaska.

The crows in Victoria live in two different ways. In summer, they nest alone in city trees and a few go north to nest in trees of farms. In winter, they are quite unusual, eating daily in the city then flying miles north in a crowd to sleep. They go as one long and growing crowd of hundreds flying up from the city, then over farms. But they don't all sleep together. Every evening, they fly to farms where small groups keep going down to trees below. There they chatter loudly until sleep. At dawn they fly back, a growing crowd to the city, dropping in groups to their daily eating areas below.



Victoria is a city of trees and many crows nest high in them. Some nest in the downtown, in small, sidewalk trees on the grassy edges and beside the parked cars on the main streets. Crows sometimes nest in small trees that are just a few yards from the store fronts. Some hunt for dropped food near large food stores, among the endless moving cars and people, hunting on both sidewalks and roads. Each day, some crows arrive at noon to visit outside luncheon places, while others wait for students to eat beside the large store's parking areas with their grassy edges and the usual lunch remains.

Those crows are wise birds. When we look over our rocky sea shore, we sometimes see a crow flying straight up, then dropping something onto the rocks below. It flies high up with a limpet in its shell, then drops it to break below. Three or more drops open the hidden meal. Wise birds.

A local newspaper warned people on its front page that a crow knocked the hat off a frightened lady as she walked by. A year later, I was thumped on my shoulder in the centre of town. In both cases, the adult bird had a youngster. Later, twice, there was an adult with youngsters on our fence. I walked by them in my previous clothing with the same large book in my hand, all just as before. They only watched me. Y

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