THE 965th MEETING OF THE BRODIE CLUB

The 965th meeting of the Brodie Club was held on March 19, 2002 in Room 462 of the Ramsey Wright Building of the University of Toronto

Chairman: Sandra Eadie
Recording Secretary: Ed Addison
Attendance: 27 members and 5 guests
Guests: Isabel Boardman, guest of Claire and Bernard Muller
Jeff Stewart, guest of Claire and Bernard Muller
Rosemary Addison, guest of Ed Addison
Ron Pittiway, guest of Jean Iron
David Tomlinson, guest of Harry Lumsden

Minutes of the 964th meeting were approved following corrections of Betty Speakman, guest of John Speakman changed from Betty Steadman and removal of member Mary Tasker as identified as a guest. There was no business arising from the minutes. There were no reports from committees and no new business. Ann Fowle was welcomed as a member of the Brodie Club.

Bruce Falls announced that the speaker next month will be Mark Gross. The title of the talk will be 'Aquaculture – Boon or Bust'.

Claire Muller has been receiving FON material but indicated that she is not the FON rep. George Bryant is the rep to the FON for the Brodie Club.

Jock McAndrews announced two lectures: Dr. David Schindler was speaking at the ROM on Wednesday, March 20 at 7:30 P.M. and on Monday, March 25, Dr. Dan Simberloff will be the Carl Atwood Memorial Lecturer speaking at 6 P.M. in Rm. 110 of the Ramsey Wright Building on 'Biodiversity and Invasive Species'.

Jock also announced that the green plant herbarium (vascular plants and mosses) of the ROM is now open and people should phone ahead to arrange visits. In addition, the fungus herbarium has moved from Queen's Park to the ROM.

Oliver Berton will update and send out a membership list of the Brodie Club.

Bill Carrick announced that corresponding member Jon Barlow who is retired from the ROM is now the curator of birds at the Metro Toronto Zoo.

Bruce Falls introduced the speaker Dr. Rudy Boonstra of the Scarborough campus of University of Toronto. Bruce described the connections between Dennis Chitty at U of T, Oxford and UBC and how Rudy completed his Ph.D. with Chitty at UBC.

"What causes the snowshoe hare cycle in the northern boreal forests?"

Lloyd Keith had conducted studies on the 10-year hare cycle in Alberta and John Krebs, Tony Sinclair and Jamie Smith at UBC had been studying aspects of the cycle for some time. However, in 1986, a consortium received a strategic grant to study the cycle in the Yukon from an experimental perspective. This enormous study was conducted in the Kluane area and involved 157 person years of research. Professors and students from UBC, U. of Alberta and the U. of Toronto were involved in the project.

Adult hares weighed approximately 1500 gms. and fed primarily on willows and birches in winter. The food web of which the hares are a part had Canada lynx, coyotes and great-horned owls as major predators and other raptors as minor predators. Major herbivores in the study area were the snowshoe hares (SSH), red squirrels and ground squirrels. There was a wide variety of plants available to the herbivores. Amongst the herbivores, the SSH comprised 40% of the biomass red squirrels and ground squirrels each about 25% (?) and mice and voles approximately 5% (?).

Three types of models were considered for explaining the dynamics within the system: 1) a 'bottom up' model where the nutrients influence plant growth which influences biomass of herbivores which subsequently influences biomass of predators; 2) a 'top down' model' where the carnivores regulate the occurrence and biomass of herbivores which then secondarily influence the biomass of plants which finally influences the availability of nutrients; and 3) a model that is an integration of 1 and 2 above.

Experimental manipulations involved 1) reducing predation, 2) increasing food, 3) changing both 1 and 2, 4) adding nutrients using fertilizer, and 5) excluding SSH. A variety of techniques were used for the experiments. Large 1 km^2 pens were built. Reducing predation was attempted by vigilantly maintaining on a daily basis for 10 years a high voltage fence to discourage entry of predators. The predator exclusion work excluded only mammals. However, the great-horned owls continued to be a considered predator of the hares. Bull moose were all that disrupted the electrified barrier for predators. Food was increased by distributing rabbit chow by snowmobile in winter and by fertilizer spreader behind an ATV in summer. They also spread tons of fertilizer every year by aircraft. They excluded SSH by building a moose and SSH exclosure.

The occurrence and activities of animals on the sites were monitored in a variety of ways including mark-recapture techniques, following animals carrying telemetric equipment, and by tracking animals. Very heavy monitoring was required to obtain realistic kill rates of herbivores by predators.

SSH demonstrated no infanticide and they were not aggressive. SSH populations were high in 1980-81, 1990 and 1997-98 (?). Some manipulations affected SSH

numbers, others did not. Although added fertilizer resulted in a 30% increase in plant growth, there were no noticeable effects of increased fertilizer on the SSH population. The SSH population doubled in response to the exclusion of mammalian predators. There was a threefold increase in SSH with added rabbit chow and when both food was added and the mammalian predators were excluded, there was a 10-11 fold increase in hares. Survival increased by 10% when mammalian predators were excluded and by 20-22% when the predators were excluded and food was added.

Fluctuations in SSH still occurred in the food treatment, indicating that food didn't control the 10-year cycle.

Snow tracking of lynx and coyotes from 1987 to 1995 resulted in about 2232 kms and 1897 kms of tracking respectively. Of 502 lynx kills, 50% were SSH and 35% were red squirrel. Of 189 coyote kills, 47% were SSH and 38% were rodent s.

The amplitude of the cycles for SSH and lynx was an approximate 7-8 fold difference between highs and lows for lynx and 20-40 fold difference for SSH. There was a lag period of about 1 year between the SSH and the lynx cycling. For example, SSH started decreasing in 1990-91 and lynx in 1991-92. In the years of decline only approximately 10% of lynx survived. Factors affecting lynx numbers included emigration, reproductive failure, other predators (coyotes and wolverine), and just dropping dead in a highly emaciated condition.

When SSH are abundant , 100% of lynx feed on SSH. However, in 'bad times', only some of the lynx shift to alternate prey species (mainly red squirrels – mice and voles are trivial in the diet) for food. Coyotes seem to shift to eating mice and voles much more efficiently than do lynx during the years of decline in SSH.

When SSH are increasing, the great-horned owls are also increasing in number. However, once the decline in SSH is occurring, young owls disappear and breeding ceases.

Populations of red squirrels do not cycle and there are no secondary cycles in mice and voles, wolverines, weasels, magpies or spruce cones.

When SSH are increasing, individual females will have about 4 litters annually with a total of about 18 young. However, during the decline, only 2 litters are produced. There is no evidence that parasites and diseases affect this decline in reproduction and starvation in adult SSH is rare. In the first year of the decline approximately 90% of the SSH are die, thus driving the population down.

Rudy has focused on the potential for stress to be a significant factor in initiating the dramatic decline in SSH. Measuring occurrence of cortisol and glucose in the blood at varying stages in the cycle, Rudy feels that the data are consistent with the hypothesis of the SSH being chronically stressed during the periods of the

decline. However, the association between hare cycles and stress has not been demonstrated to be a cause-effect relationship, only an association.

Rudy spoke of synchrony in cycles of hares among different areas. Within North America, there appears to be three major areas synchronous within them but asynchronous between them. These areas are 1) Alberta, Saskatchewan, Manitoba and NW Ontario, 2) the Yukon and Northwest Territories, 3) the eastern range. At such a large spatial scale, it is speculated that some aspects of weather influence the timing of the SSH cycles and that at the higher resolution, local scale, that predation is the primary influence.

In summary, Rudy indicated that:

1) predators seem to drive the SSH cycle through predation and stress
2) starvation of SSH does not occur; there is no shortage of food
3) populations of red squirrels are not affected by numbers of SSH but are affected by availability of spruce cones
4) plant growth does not affect herbivore abundance, and
5) red squirrels and ground squirrels kill young hares.

Questions and Comments

Why do large numbers of hares aggregate together? This occurs in Arctic hares, but not SSH. It may well be a predator avoidance behaviour.

How might weather be an influencing factor? We don't know but wonder about the impacts of snow hardness, perhaps making it difficult for the hares 'to hunker down' at night and in very cold weather.

Did you check for the influence of solar cycles on SSH cycles? Tony Sinclair did so and found some degree of 'connection – sometimes they were in phase, sometimes they were not in phase. There was added discussion about the appropriateness of implying an association between hare populations and solar cycles when they get out of phase at times.

Perhaps behaviour is causal rather than the cycle being a response to other factors. Rudy indicated that they have observed no evidence of this although it appears that this aspect of potential influence has not been as exhaustively studied as other potential influencing factors.

Would disease be a factor in the fluctuations? That does not appear to be the case.[However, there was no reference to specific studies within this program.]

Are surviving SSH smarter? Yes, that clearly seems to be the case since they are much more difficult to trap.

Is there less reproduction because the survivors are getting older? That is clearly possible.

Do hares lose weight when under stress? With no food, they die in 4 days. To get energy, SSH catabolize muscle because there can't store energy elsewhere. When the population is in decline, SSH will lose 150 gms of muscle mass.

The SSH on Manitoulin Island have shown no evidence of a 10-year cycle during the past 40 years. Rudy replied that SSH cycles seem to attenuate on the southern parts of SSH distribution. Although there are no lynx on Manitoulin Island, predation is likely compensatory with Great-horned owls and coyotes being the primary predators.

It was suggested that one manipulative technique for assessing the effects of predation would be to introduce lynx into enclosures.

There were additional questions and lively discussion.

Jim Bendall thanked the speaker.

Observations

Oliver Bertin displayed a mount of a least bittern and recounted observing ring-billed gulls killing a sparrow on the wing near the Globe and Mail building in Toronto.

Harry Lumsden reported that despite a very mild winter this year that breakup did not occur until March 17. The earliest breakup in the past 32 years at Harry's house was in 1991.

David Tomlinson reported that ravens are apparently breeding/nesting on the clicks at Mono Cliffs in Mono Township near Orangeville. David indicates that the previous most southerly record of nesting ravens was near Markdale.

Ann and Bruce Falls observed/photographed an ovenbird feeding beneath a Norway spruce at Wilkett Creek Park in North Toronto. It had been seen there previously by others.

Norma Martin reported on the reclamation of a heavily polluted site at Deloro, north of Hwy. 7 near Marmora. The cleaning up of this mine site has been occurring for 5 years. They are now removing water from mine shafts, treating it and storing it in lagoons. The water is then being transported to a site N of Montreal where it is being made into concrete which is then dumped. The cleanup has yet to address the mine itself.

Sandra Eadie noticed many rose-winged parakeets free flying in England. There is now a huge colony of this recent invader. First breeding in Britain apparently occurred in 1969. The population is now estimated at 5,000.