THE BRODIE CLUB

ROYAL ONTARIO
MUSEUM OF ZOOLOGY

The 955th MEETING of the BRODIE CLUB
Minutes

The 995th Meeting of the Brodie Club was held on Feb. 20, 2001 at the Ramsay Wright Zoological Laboratories of the University of Toronto.

Chairman: John Speakman
Recording Secretary: Michael Boyer

Guests: Jennifer Thaler and Marc Johnson, guests of Jock McAndrews

Minutes of the previous meeting were approved with one correction by Norman Martin to the effect that the late Reginald James was not a member of the Toronto Ornithological Club.

ANNOUNCEMENTS:
- Marc Johnson was welcomed as a new member of the Brodie Club;
- Bruce Falls asked for support and suggestions from members at large in obtaining speakers for the coming season. He has booked club members John Speakman for "An Arctic Retrospective" on April 17, and Harry Lumsden for "The Russian Far East: Sakhalin and Kamchatka" for May 15;
- Alexandra Eadie informed members that the recently compiled Brodie Archives, including minutes, are available through the library of the Royal Ontario Museum;
- Claire Muller asked members who might have pictures of interest to the Brodie Club to contact her;
- Bill Carrick referred to a communication from The North American Native Plant Society which is promoting a sale of wild flowers at The Civic Garden Centre on May 12, 2001. Members expressed concern that the source of the plant material might be from the wild;
- Carrick also reported on an upcoming ornithology workshop and on the availability of summer bursaries for young naturalists. He can be contacted for further information.

SPEAKER:

The speaker, Dr. Douglas Larsen, was introduced by McAndrews. Dr. Larsen is Professor of Botany at the University of Guelph. He and his research associates lead an active and strenuous life as field ecologists focusing their research on the adaptive strategies of plants living under extreme environmental conditions.

They have worked in various habitats throughout the world, but their current research is centered on cliff ecology, particularly on the Niagara Escarpment, under the aegis of the Cliff Ecology Research Group of which he is the director.

His research work has been widely recognized by his colleagues and peers and by the public-at-large. He is a member of several professional societies, author or co-author of many papers and senior author of the book' Cliff Ecology' by Larsen, Matthes-Sears and Kelly, available from Cambridge University Press, UK 1999.

The Paradox of Great Age in a Short-lived Species: Escarpment Cedar

Dr. Larsen introduced his topic by stating that the title arose as a consequence of an invitation to speak at a symposium on ageing at the University of California at Los Angeles. Though he protested that his field of expertise was far removed from that of the physiology of ageing and that trees are unique in being constructed on a plan vastly different from animals, he was assured that both he and the topic had relevance to the aims and objectives of the conference.

How, he asked, can a species such as the Eastern White Cedar which has evolved as a short-lived *(*+/- 80 years), rapidly growing pioneer of open fen-like habitats become transformed into a remarkably slow-growing and long-lived form under the rigorous conditions of the Escarpment?

As background, he listed some of the well-known, long-aged trees. There are big - as well as old - trees among them: the Coastal Redwoods; Bristle Cone Pines; European Yews; Western Red Cedar and Douglas Fir. The oldest is probably the Bristle Cone Pine at about 4,900 years but the others attain ages well over 1,000 years.

To clarify what we mean by age, the speaker explained the terms "genet' and "ramet'. Because most plants reproduce asexually as well as sexually the genet or genetic individual may, in the extreme, approach the age of life itself. The ramet on the other hand refers to the standing or visible individual. As an example, he described the Creosote Bush of the Mojave Desert. Made up of radiating circles of individual clones connected by underground parts, the genet age was estimated at 12,000 years, while that of the individual clone or ramet was relatively few years old.

He contrasted the habitat and form of both wetland and cliff-side cedars, using magnificent slides of the Escarpment environment. Under normal conditions, the cedar is a short-lived, rapidly growing and medium-sized tree, the dominant plant in cedar swamps. At maturity, the site may become a morass of fallen trunks, their upright branches rooting but gradually replaced by shade-tolerant deciduous trees.

The Escarpment forest is in striking contrast. Cedars cling to the vertical cliff face, dwarfed, often contorted, and of great age. The speaker, emphasized that this ecosystem possessed all the features of an old growth forest - a preponderance of old trees, and rich in the total number of animal and plant species, many of which exist nowhere else. Undisturbed through the long period of human settlement, it is the most ancient forest east of the Rockies.

Individual specimens of the cliff cedars proved to be of great age though small in stature. The oldest tree recorded was 1,890 years old, as determined by counting the microscopically thin growth rings. Another specimen that the speaker brought to the meeting had 1,555 rings, with a trunk of about 30 cm in diameter. It yielded a carbon date of +/- 1,100 years at death, thus establishing the tree's origin at around 3,000 years BP. There was no evidence of weathering or deterioration, but unlike the symmetrically circular stems of wetland cedar, the escarpment plants are highly convoluted and eccentric.

Dr. Larsen presented evidence to suggest that selection for longevity under natural conditions is rare. By taking data from the literature on the standing biomass of various ecosystems and dividing by the estimated annual production, the turnover rate can be used as an approximation of the average age of the species contributing. Ages varied from 25 years for complex and relatively stable forest systems to ages of only a few hours for unstable microbial environments. The average for all systems was estimated at 0.5 years.

Although trees are considered the oldest of living things they are not uniformly so. From other studies of 60 species of deciduous trees, the mean age was 248 years and none of those studied reached ages of a 1,000 years or better. In contrast among conifers, 60 species yielded a mean age of 594 years and six species attained ages of over 1,000 years.

Studies carried out by the research group established that no genetic differences existed between the two cedars, implying that environmental factors in some way contributed to the enhanced longevity of the cliff forms. Shared characteristics of some long-lived species such as Bristle Cone Pine, Yews and the Cliff Cedar included extremely low rates of cambial cell division and suppressed enlargement of the derivatives, coupled with sectored growth patterns he attributed to partial cambial mortality. This accounted for the eccentricity or abnormal shape of the tree stems.

In some interesting and well-illustrated experiments on in-situ cliff cedars, exposed fibrous roots with their tips severed were immersed in coloured dyes for short periods. When the bark was removed from the stems, the path of translocation was clearly revealed by the narrow, stained, vertical columns with no apparent evidence of lateral communication. This unique hydraulic architecture was previously unreported, in any number of prior experiments by others.

Thus random stem segments deprived of minerals and water due to the death of their associated roots and unable to attain them from adjacent columns would themselves cease to function and eventually die. The rigidly confining conditions of the root environment on cliff faces, would in themselves exacerbate root mortality.

The speaker concluded his talk by proposing that the longevity of cliff cedar as well as some other conifers is attained by the apportionment of growth-controlling factors to random segments of the stem arising from root mortality, with each segment behaving like a ramet embedded in a virtually indestructible matrix of dense wood.

Some factors that contributed to this phenomenon included: low endogenous death rates; tolerance to physical extremes; growth rates which yield wood of high density and specific gravity; extreme resistance to pathogens and decay organisms; sites with low-pathogen presence; and repressed root environments.

Dr. Larsen ended on a serendipitous note saying that at the UCLA conference certain similarities were pointed out between his hypothesis of ageing in cliff cedar and those that relate to the vascularization of cancers in animals.

QUESTIONS.

- Falls asked whether this interpretation of longevity represented something of a numbers game in which, as an example, sextuplets would enhance the survivorship and hence the longevity of a given genome. Dr. Larsen replied that a more apt analogy would be provided if the sextuplets sprang sequentially from some part, say the head;
- The speaker, in response to several queries about the age of trees, replied that estimating age from the relationship between size and age was a very inexact science and many inferred ages were highly suspect;
- Muller referred to some white pines she had seen damaged by porcupines in which the continuity of the stem was disrupted. This and other examples, Larsen pointed out, are indicative of the normal response of trees to injury, lateral translocation bridging the gap;
- McAndrews drew attention to the great longevity of cedar wood from wetland habitats when used as cedar rail fencing;
- Johnson enquired about the nature of resistance to decay being related to its chemical constituents. Larsen replied that they appear to be important but have not yet been studied in cedars;
- Several members asked questions about similar phenomena in other stressed environments such as alvars, Black Spruce bogs, tundra and oak barrens. In answer, cliff habitats throughout the world seem to engender longevity in a variety of species, the speaker citing the existence of old woody sunflowers on cliff formations in New Zealand. It seems likely other extreme habitats would function in the same way;
- Speakman asked why such a distinctive process should occur in cedar. The speaker replied he didn't know, but presumably as cedar evolved in a wet environment no strong selection for lateral translocation was necessary;
- A member enquired whether growth rings could be re-absorbed or lost. Apparently they can't, but it seems plausible that growth could be nil in some years.

The speaker was thanked by Paul Aird for a most interesting and stimulating presentation.

MEMBERS' OBSERVATIONS.

- Ron Scovell reported an observation he hadn't seen in many years of birdwatching - a Red-tailed Hawk drinking from his bird bath;
- Aird informed members of an outbreak of bovine tuberculosis in Michigan. Fear was expressed for the state's deer and elk populations;
- McAndrews made reference to a new book by Mayor, 'The First Fossil Hunters,' available from Princeton University Press. It explores, among other things, the possible origin of mythological animals such as the gryphon from fossil finds of dinosaurs or other animals;
- Johnson said he would be raising aphids as part of a research project, rearing 20,000 from a single parent, asexually. It showed just how pervasive cloning is in nature;
- Bernard Muller drew attention to two books by the eminent physicist, Roger Penrose entitled 'The Emperor's New Mind and Shadows of the Mind,' both dealing with the evolution of consciousness. He would like to share observations on this esoteric subject.

In the absence of further observations, the meeting was declared closed by the chairman.

NEXT MEETING:

The next meeting will be held on March 20 at 8 pm in Rm 432 of the Ramsay Wright Zoological Laboratories of the University of Toronto The speaker will be Brodie Club member Bill Crins, who will talk on 'Hover-flies in Ontario (Syrphidae)'

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