6th Annual Meeting
Cornwall, PEI
October 22-25, 2001

Presentation Abstracts

The following are the abstracts from the 6th annual meeting. Abstracts are organized in alphabetical order by first author's last name. Abstracts of the presentations are available in print form through CARCNET.

Special Session: A history of Canadian herpetology, with the "Father and Son" of modern Canadian herpetology.

- Toward a history of 400 years of herpetological inventory and monitoring in Canada: I. Pre-Bleakney 1600-1950 and II. Post-Bleakney 1960-2000. - Cook
- Confessions of a Reformed Herpetologist. - Bleakney

Keynote Lecture:

- New insights into the biology of leatherback turtles (*Dermochelys coriacea*) in the Northwest Atlantic. - James

Presentations:

- Species richness and turnover rate of amphibians in northern Ontario. - Abbott
- The Vermont Reptile and Amphibian Atlas: progress just south of the border. - Andrews
- The effect of handling stress on deformity rate and hatching success in the Common Snapping Turtle, *Chelydra serpentina serpentina*, from Algonquin Provincial Park and Hamilton Harbour, Ontario Canada: do traditional laboratory incubation methods mirror naturally nesting populations? - Ashpole
- Predicting the landscape-scale distribution of red-spotted newt (*Notophthalmus viridescens*) habitat in New Brunswick, Canada. - Betts
- Status of the Oregon Spotted Frog (Rana pretiosa) in Canada. - Bishop
- Global status of amphibian populations and amphibian research initiatives in Canada. - Bishop
- Reproductive status of six amphibian species at Mont St. Hilaire, Québec. - Bol
- What do we know, not know and need to know about the conservation biology of Canadian reptiles? - Brooks
- Turtle population sizes and hatchling success at Point Pelee National Park. - Browne
- Another frog monitoring attempt: Big Rideau Lake *Rana* 1999-2000. - Cook
- BC's Northern Leopard Frogs: Towards recovery. - Cunnington
- Biology and conservation status of the Sharp-tailed Snake, *Contia tennuis* - Cunnington
- The Prince Edward Island Frogwatch Program. - Curley
- Characteristics, movements, and health of a Western Chorus Frog (*Pseudacris triseriata*) population at a breeding pond in southwestern Québec. - Desroches
- Demographics of yellow-spotted salamanders (Ambystoma maculatum) in relation to agricultural land use in Nova Scotia. - Eaton
- Methods for the Induction of Breeding in the Northern Leopard Frog, *Rana pipiens*. - Edginton
- Abundance and distribution of amphibians in selected aquatic habitats of Prince Edward Island. - Field
- The developing frog hypothalamus as a sensor for estrogenic EDCs. - Gallant
- Differences in Size, Pigmentation and Fluctuating Asymmetry in Stressed and Nonstressed Northern Leopard Frogs (*Rana pipiens*). - Gallant

- Reptile health and disease: a Canadian perspective; Santé et maladies chez les reptiles: une perspective canadienne. - Galois
- The Wood Turtle, Glyptemys insculpta, at River Denys: A second population for Cape Breton Island, Nova Scotia - Gräf
- The species richness, abundance, and diversity of amphibians in terrestrial habitat fragments of Prince Edward Island. Hartling
- Nested herpetofaunal assemblages on islands: lessons for conservation. - Hecnar
- Reptilian conservation can brush against, but cannot afford to shake hands with uncertainty: Reasons why long-term life history research must precede wildlife conservation efforts for long-lived reptiles in Canada. - Hollett
- Estimating northern limits in Canadian turtles: a method to estimate historical and potential distribution? - Holt
- Marine turtles and the Canadian Atlantic pelagic fishery: a previously unrecognized potential source of sea turtle mortality. - McAlpine
- Amphibian species richness and distribution in northwestern Ontario: is hydroperiod important? - Robinson
- Species totemization in herpetological conservation. - Schueler
- *Pseudacris triseriata* on the Five-Mile Block (Tobermory, Bruce County, Ontario): 1984-2001. - Schueler
- The Western Chorus Frog - declining but not at risk? - Seburn
- Do we need a National amphibian and reptile database? - Seburn
- Red-sided garter snake (*Thamnophis sirtalis parietalis*) relocation and education project. - Takats
- Current status of the Nova Scotia Herpetofaunal Atlas. - Taylor
- Growth rates and deformities of green frogs and leopard frogs from areas differing in agricultural intensity on Prince Edward Island. - Teather
- Multiple stressor effects on native amphibians. - Thompson
- Comparative phylogeography of the Pacific Northwest: Community history as a guide to conservation science. - Thompson
- Hyla Park: Lessons learned in the establishment of an amphibian conservation area in a semi-urban setting. - Vail
- Painted Turtles (*Chrysemys picta*) of Vermont: an examination of phenotypic variation and intergradation. - Wright

Poster Presentations:

- Analyses of gross morphological deformities of the Common Snapping Turtle (*Chelydra serpentina serpentina*) in Algonquin Provincial Park, Ontario. - Browning
- The effects of UV-B radiation and octylphenol (OP) on growth, metamorphosis and survival in the northern leopard frog (*Rana pipiens*). - Croteau
- Northern leopard frog reintroduction project. - Kendell
- FROGWATCH CANADA: Conservation & education with the Canadian Nature Federation and the Ecological Monitoring and Assessment Network. - Kilvert
- Amphibian and Reptile Monitoring and Management in Alberta. - Takats
- Comparative assessment of techniques for sampling native salamanders in riparian zones of boreal mixed wood forests: Proposed research. - Truant
- Indirect and multiple stressor effects of glyphosate and triclopyr herbicides on native larval amphibians (*Rana pipiens* and *R. clamitans*) in two wetland ecosystems in northern Ontario, Canada. - Wojtaszek

Species richness and turnover rate of amphibians in northern Ontario

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The importance of studies in amphibian population ecology is increasing as evidence of a global decline accumulates. Explaining patterns of species richness, species turnover and spatial dynamics is an important step in understanding and preventing further loss of amphibian species. Although amphibian populations have been investigated in many parts of the world, their status is essentially unknown in the boreal forest biome of Northern Ontario. Our primary goal was to assess the status of amphibians in the Thunder Bay District of Northern Ontario. We repeatedly surveyed 41 ponds from 1999 to 2001 and recorded the presence or absence of amphibian species. Day surveys included walking, wading or dip netting within and around the ponds. Night surveys consisted of listening and identifying calls. In Northern Ontario, species richness and turnover rates were compared using paired *t*-tests. Mean species richness was higher in 2001 than in previous years, and turnover rate was low and stable between 1999 and 2001. Species richness, turnover rate and incidence were estimated and compared with previous studies that were conducted in Southern Ontario. There was no difference in species richness or turnover rate between Northern and Southern Ontario; however, the proportion of the regional species pool present at local sites differed significantly between the two regions. Patterns of regional species incidence also differed significantly between Northern and Southern Ontario. Further study of species richness and turnover in relation to local and landscape characteristics may better define the role of habitat in determining the persistence of amphibian populations.

The Vermont Reptile and Amphibian Atlas: progress just south of the border

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The Preliminary Atlas of the Reptiles and Amphibians of Vermont was published in 1995. A new Atlas will be available this winter. New maps will be visible on our website in November at www.middlebury.edu/herpatlas. Since the Preliminary Atlas, we have had 1,478 contributors add 12,141 new records of 40 native species. Seven species of turtle, 1 lizard, 11 snakes, 10 salamanders, and 11 species of frog have been documented. Currently 15 or more species have been reported from 102 Vermont towns, with a high of 30 reported from one town. Data for The Vermont Reptile and Amphibian Atlas are provided through a collaboration of organized and independent individuals and groups, professionals, paid field staff, and government and non-government organizations with financial support from both the government and the private sector. The mapping unit is the township, based on its relative stability and ease of determination for volunteers. All data are carefully reviewed before being added to the Vermont Herp Database. Distributions of species along this portion of the southern Quebec border are being clarified. Although we have made much progress, there are still gaps that need to be filled, particularly for reptiles.

The effect of handling stress on deformity rate and hatching success in the Common Snapping Turtle, *Chelydra serpentina serpentina*, from Algonquin Provincial Park and Hamilton Harbour, Ontario Canada: do traditional laboratory incubation methods mirror naturally nesting populations?

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Over the years, eco-toxicology field research conducted on snapping turtles has supported that both hatching success and deformity rates are sensitive biomarkers of persistent organic pollutants in the environment. In this study, we examined two sites with contrasting levels of contaminants, Hamilton Harbour (heavy industry with moderate to high levels of contaminants) and Algonquin Provincial Park (very low to non-detectable levels of contaminants) and the contribution of handling stress on embryo development. Handling stress can include: the physical removal of developing embryos from a maternally selected nest into an artificial environment; the transportation of embryos to the laboratory; and the incubation of embryos at a constant and very unnatural temperature. We hypothesise that if undisturbed naturally nested embryos develop in the same manner as those under laboratory conditions, then we would predict that their hatching success and deformity rates to be the same. To test this, our study was designed to compare undisturbed predator-protected natural nests with artificially incubated embryos. From both study sites, nests were either undisturbed and protected (N=10, Hamilton Harbour; N=7, Algonquin Park) or collected (N=15 from each site). One-third of collected clutch was redistributed into the following treatments: a predator protected artificial buried nest; and artificial incubation at both a male- and female-producing temperature, 25.0°C or 29.5°C respectively. Comparisons between treatments and the study sites are in progress and will be discussed at the conference.

Predicting the landscape-scale distribution of red-spotted newt (*Notophathalmus viridescens*) habitat in New Brunswick, Canada

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The diversity and complexity of forest ecosystems has motivated many wildlife managers and conservation biologists to rely on the 'indicator species'; approach for the measurement and monitoring 'ecosystem health'; and 'biodiversity';. By managing for a range of indicator species, it is often assumed that other species with similar but less stringent habitat requirements will also be protected. Because amphibians tend to be sensitive to subtle habitat changes at both local and landscape scales, they potentially serve as excellent indicators. Through a review of the existing scientific literature we complied a list of both stand-level and landscape-level habitat requirements for red spotted newt. With the use of a Geographic Information System (GIS) we predicted the distribution of this species in the northwestern region of New Brunswick (the Saint John River Ecodistrict). Our analysis revealed that while many patches are isolated by agricultural development and recent forest harvesting, enough forest currently exists in young age classes to serve as potential 'dispersal habitat'; for this species. Nevertheless, landscape

configuration may be precariously close to a minimum threshold, below which the viability of newt habitat will decline. Such hypotheses need to be tested by collecting more detailed information about the local habitat requirements for a range of amphibian species, and conducting extensive landscape-scale surveys of species that are potentially sensitive to habitat fragmentation.

Status of the Oregon Spotted Frog (*Rana pretiosa*) in Canada

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The Oregon Spotted Frog is COSEWIC listed as endangered in Canada. The adult population is estimated at 348, based on egg mass counts in spring 2001 and an assumption of a 1:1 sex ratio. This represents a slight increase from 298 adults estimated in 2000. Embryonic survivorship from egg to hatching was greater than 75% in 28 of 31 clutches monitored whereas survivorship was less than 25% in 3 of 31 clutches. Eggs died without evidence of a cause. In the past year, approximately 3000 m^2 of new habitat for the Oregon spotted frog and other amphibians was created serendipitously by sculpting a bore hole into a wetland where sediment and gravel was removed to build a salmon spawning channel. By removing the gravel and sediment, reed canary grass (*Phalaris arundinacea*) which is an invasive species of plant, was removed from the edge of a wetland and the site could be designed with a littoral zone and re-planted with native plants condusive to spotted frog habitat. This was a rare case where the creation of sport fish habitat benefited amphibians. A radio telemetry study was initiated on this species to better understand its movement patterns and overwintering locations. To date, adult Oregon spotted frogs moved less than 2 km from the spawning sites where the frogs were caught during breeding season in March 2001.

Global status of amphibian populations and amphibian research initiatives in Canada

Christine Bishop, Ronald Brooks, Brian Craig, Andrew Didiuk, Samara Eaton, David Green, Russ Haycock, Kevin Judge, Donald McAlpine, Martin Ouellet, Bruce Pauli, Danna Schock, Carolyn Seburn, David Seburn, Leonard Shirose and Sara Swanson
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In Canada, four species or sub-populations of species of amphibians are listed as endangered, ten are listed as special concern and one species is listed as threatened. However, even common species of amphibians continue to be stressed by habitat loss throughout Canada. For example, although we do not know why four species have disappeared from the Mont Saint-Hilaire Biosphere Reserve, we do know that re-colonisation from the surrounding fragmented and degraded landscape is impossible. While recent research in Canada examines the impact of contaminants, and disease on amphibians and recovery teams exist for the 'listed' species, there are still only two long-term mark-recapture population studies of amphibians (*Bufo fowleri* and *Rana catesbeiana*, *R. clamitans* and *R. septentrionalis*) underway in Canada. In July 2001, a symposium on global amphibian declines reported updates on amphibian populations throughout the world and the current understanding of chytridiomycosis, ultra-violet radiation

and climate change on amphibians. A highlights of this meeting in the context of the Canadian situation will be presented.

Confessions of a Reformed Herpetologist

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How two boys from Wolfville managed to dominate Canadian herpetology for half a century. Presentation will include world premier of revealing archival photos, and explain how working with sea turtles leads logically to sea slugs.

Reproductive status of six amphibian species at Mont St. Hilaire, Québec

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The breeding and reproductive success of six amphibian species was monitored from April 30 to August 28, 2001 at Mont St.Hilaire, Québec. Twenty-five aquatic sites were visited on a weekly basis to determine where breeding occurred for blue-spotted salamanders (*Ambystoma laterale*), spotted salamanders (*Ambystoma maculatum*), American toads (*Bufo americanus*), gray treefrogs (*Hyla versicolor*), spring peepers (*Pseudacris crucifer*) and wood frogs (*Rana sylvatica*). The aquatic sites included temporary ponds, permanent ponds and a 3 ha lake. Five sites dried up without any breeding occurring. Breeding as determined either by the presence of eggs or tadpoles occurred at 8 sites for *A. laterale*, 13 sites for *A. maculatum*, 3 sites for *B. americanus*, 1 site for *H. versicolor*, 9 sites for *P. crucifer*, and 16 sites for R. sylvatica. Reproductive success as determined by the presence of metamorphs occurred at 3 sites for *A. laterale*, 2 sites for *A. maculatum*, 2 sites for *B. americanus*, 1 site for *H. versicolor*, 6 sites for *P. crucifer*, and 3 sites for *R. sylvatica*. Reproductive failure occurred at the other sites because of pond desiccation. There was no single site where reproduction was successful for all six species. Pond hydro period is an important determinant of reproductive success for amphibian species.

What do we know, not know and need to know about the conservation biology of Canadian reptiles?

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Scientific knowledge of our 45 species of reptiles varies from extensive for a few species such as blue racer, massassauga, black ratsnake and snapping turtle to none as in the smaller snakes, the queen, eastern hog-nosed, night and sharp-tailed snakes. Overall, about half of our reptiles have not been favoured with a single study and we have no data on distribution or

abundance of any reptiles before European settlement and only scattered anecdotal data before 1960.

Recent documents that summarize or describe the biology and conservation of Canadian reptiles rarely acknowledge our scientific ignorance of key aspects of biology relevant to conservation such as population abundance and trends, life-history measures including age at maturity, age-specific mortality rates and genetic structure, and historical distribution and abundance.Instead, the numerous websites, regional faunal compendia and status assessments of the taxon are superficial, repetitive of one another and packed with clichés about ecological integrity, habitat loss, anthropogenic impacts and ecosystem functions of reptiles and advocate restoration based on inadequate data and irrelevant experiences with other taxa.

To conserve our reptiles, we need studies with the following features:

- Long-term with intense mark-recapture and tracking of reproductive and mortality rates.
- Development, to the limited extent possible, of knowledge of historical abundance and distribution.
- Determination of the impact of roads on snake and turtle populations, to test whether any snake or turtle population can survive near well-travelled roads.
- A concerted effort to delete the worst buzzwords (see above) from all discussions of reptile conservation, to use "volunteer monitoring" only under rigorous planning and control and to reduce antipathy to good, hypothesis testing.

Turtle population sizes and hatchling success at Point Pelee National Park

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Turtle populations in Point Pelee National Park, Ontario, are believed to be declining. Possible causes of decline are: predation (mostly raccoon), road mortality, contaminants, isolation, and collection. The last population study was in 1972-1973, so the current status of turtle species is unknown. Turtle species native to the park are snapping, painted, map, musk, Blanding';s, spotted and spiny softshell. Box turtles, wood turtles and red-eared sliders have occasionally been observed but are considered to be introduced. A study in 1997 found predation on turtle nests to be high (87%), however no actions have been taken. The objectives of this study are to determine which species are present, their respective population sizes, and to compare hatchling success in areas of different amounts of contaminants when nests are protected from predation. Sixteen sites were selected and turtles were trapped using baited hoop traps and basking traps for mark and recapture. Three sessions were completed from June to August 2001. Five species have been found: painted, snapping, Blanding';s, map and musk turtles. The spotted turtle is believed to be extirpated (last sighted 1990). Preliminary results indicate that populations have a top heavy age-structure. Snapping and painted turtle populations still appear to be large, however they are male biased.

Toward a history of 400 years of herpetological inventory and monitoring in Canada: I. Pre-Bleakney 1600-1950; II. Post-Bleakney 1960-2000

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I. During 1600-1758 only anecdotal comments were recorded on the amphibians and reptiles. After the 1758 (tenth) edition of Linnaeus's *Systema Naturae*, which provided a stable nomenclature, the defining and naming of amphibians and reptiles native to Canada, because they are also abundant and widespread to the south, was first based on U.S. specimens. Lists of species in the Maritimes, Ontario and Quebec using these names came from local naturalists, in the west from staff of the boundary surveys whose collections went to the British Museum. United States biologists soon came north, Agassiz from Harvard College to Lake Superior in 1850, Kennicott of the Smithsonian Institution to the Hudson Bay Territories in 1859 Preble of the United States Biological Survey to the Mackenzie region in 1908. Meantime, in 1843 the Geological Survey of Canada was created and soon included a museum that was to become the National Museum of Canada in 1927. Its first staff naturalist, John Macoun, was appointed in 1882; his first amphibian and reptile specimens were sent to the United States for identification but those from 1885 were retained in Canada. Clyde Louis Patch was hired as taxidermist in 1913, and added herpetologist in 1918. Provincial museums had begun in Nova Scotia, New Brunswick, and British Columbia in the 1800s, in the prairie provinces in the early 1900s, and in Ontario as the Royal Ontario Museum in 1914. In the 1920s Eugene Bernard Shelly Logier was hired as an artist at the Royal Ontario Museum, founded in 1914, and eventually became herpetologist later in the decade. In the 20th century comprehensive guides to provincial herpetofaunas began to appear, Logier for Ontario in 1937 (amphibians) and 1939 (reptiles), and Carl for British Columbia (1943, 1944) and Melancon for Quebec (1950). The first list of all amphibians and reptiles known for Canada by was by E. B. S. Logier and G. C. Toner (1942) followed by a an annotated list by Mills (1948). Yet to come in the 1950s was Logier's Frogs, toads and salamanders of eastern Canada in 1952, and Snakes of Ontario in 1958, and Logier and Toner's Checklist for Canada with the first spot distribution maps did not appear until 1955, and Logier's Snakes of Ontario in 1958. Patch had died in 1952, the amphibians and reptiles of Canada he had begun as early as the 1920s uncompleted, and although he left distribution files and a curated collection of some 5,000 specimens no manuscript was included.

II. In 1961 Logier and Toner published a revision of their checklist, and Logier retired from the Royal Ontario Museum. The Toronto group of the herpetologically inclined formed the previous year the Canadian Amphibian and Reptile Conservation Society to promote a better public feeling for these vertebrates. They published my first Canadian list of endangered species in 1964. Barbara Froom wrote popular treatments of Canadian snakes, turtles and amphibians. At the National Museum of Canada, I carried on field surveys in Manitoba, Saskatchewan, Alberta, and eastern British Columbia (1959-1970), and the museum funded expeditions in central Quebec by David Gordon and central British Columbia by Don Rivard in the mid-1970s, and Fred Schueler began his surveys in 1972, extending them from Newfoundland to Queen Charlotte Islands in B.C. and depositing substantial collections of amphibians and reptiles in the National Museum. Bleakney had doubled Patch's National Museum collections from 7,000 to 14,000 specimens, from 1959 to 1991 the National collections grew to 133,000 specimens, 89% Canadian material. I published a guide to the amphibians and reptiles of Saskatchewan in 1966, the analysis of P.E.I. in 1967, and an introduction to amphibians and reptiles of Canada in 1984. Gorham wrote a guide for New Brunswick in 1970, Preston for Manitoba in 1982, Gilhen for Nova Scotia in 1984, Green and Campbell (amphibians), and Gregory and Campbell (reptiles)

wrote new guides to the B.C. in 1984, and finally Russell and Bauer in Alberta in 1992. Although the Manitoba Museum appointed a herpetologist (Bill Preston) in the late 1960s and the Royal Ontario Museum (Bob Murphy) and New Brunswick (Don McAlpine), all have either had to dilute their herpetological responsibilities with responsibilities for other fields as well (Preston and McAlpine) or have had interests primarily outside Canada (Murphy). Meanwhile, universities began to appoint herpetologists who have made major contributions to Canadian studies particularly in life history in the last quarter of the 20th century, and with the advent of growing concern of endangered species and declines in others provincial wildlife departments and the federal Environment Canada began to fund studies, and particularly Atlases, notably the Ontario Herpetofaunal Summary and the Quebec Atlas project. Monitoring projects involving the public have been sponsored by government departments and non-governmental organizations such as the Metropolitan Zoo in Toronto and the Ecomuseum in Ste-Ann-de-Bellevue. The first national Canadian herpetological society, CARCS, faded and the Association of Canadian Herpetologists arose in the 1980s followed by the Canadian Amphibian and Reptile Conservation Network in the 1990s. In 1958, Bleakney had posed 8 "unsolved problems" in Canadian herpetological zoogeography, over 40 years later, a few have been clarified, but many remain to be studied in greater depth.

Another frog monitoring attempt: Big Rideau Lake *Rana* 1999-2000

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The Rideau River flows north to Ottawa from the height of Land between Lake Ontario and the Ottawa River drainages in southeastern Ontario and has been the focus of a multidisciplinary study by the Canadian Museum of Nature. *Rana* were sampled at two upper locations with the assistance of staff and summer students from the Big Rideau Lake Association for three years (12 days in 1999), 18 in 2000, and 22 in 2001), split equally each year between MacDonalds Island and Port Elmsley. Primary objectives were to (1) assess estimation of mark-release of frog population sizes using previously inexperienced collectors in diurnal surveys of open river habitat over varying numbers of days and p aticipants, (2) to survey these populations for incidence of malformed frogs; (3) to generate representative weights, body and tibia lengths, eye and tympanum diameters as a baseline for comparison with past and future sampling at these localities and elsewhere, in part to detect departures indicative of populations in difficulty. Of six species of *Rana* which occur in eastern Ontario, *R. catesbeiana*, *R. clamitans*, and *Rana pipiens* were common at both study sites. Because large river edge habitats were sampled, only a single *R. sylvatica* was taken. Absent were *R. septentrionalis* which occurs in creeks draining into the Rideau and adjoining watersheds to the north of the study area, but apparently never in the main Rideau River, and *R. palustris* which is restricted largely to woodland streams and adjacent habitat southwest and north of the Rideau Lakes sites; former Ottawa populations were likely extirpated by the 1920s. In 1999, 2000, 2001: 182, 170, 70 individuals of the three study species were injected with PIT tags, and 398, 231, 909 only toe-clipped. Analysis of data is incomplete but recaptures in the three years were only 28, 76 (9 first marked in 1999), and 279. Deformities were rarely noted: eye missing (1), limb missing (1), and naturally shortened toes (3), all likely due, like other wounds, to failed predation. Adult Bullfrog size distribution at the study sites may be suggestive of unexploited populations. Mean size of breeding Green Frogs may be less here and elsewhere when they occur with Bullfrogs elsewhere where the latter are absent.

BC's Northern Leopard Frogs : Towards recovery

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Since the 1970';s, Northern Leopard Frogs (*Rana pipiens*) have declined across the western extent of their range. Prior to their decline, Leopard Frogs could be found in the productive marshes of the Kootenay and Columbia River systems of BC. By the early 1990';s they were thought to be extirpated from the province altogether. In 1996, a survey for amphibians found a population of Leopard Frogs still surviving in the Creston Valley, and further surveys concluded that BC';s entire population is confined to a single wetland compartment in the Creston Valley Wildlife Management Area. The population is extremely small (fewer than 20 breeding females), and may be susceptible to diseases. In 2000, several individuals were killed by chytrid fungus (*Batrachochytrium dendrobatidis*). In 2001, 8 of 12 egg masses contained dead embryos infected with the water mold *Saprolegnia spp* and the bacteria *Aeromonas hydrophilla*.

In 2000, the Columbia Basin Fish and Wildlife Compensation Program initiated a recovery project to secure the existing population and increase their distribution and abundance. A provincial recovery team was established in 2001, and progress was made on developing a formal recovery plan. A small-scale captive rearing program was initiated in 2001, and approximately 500 froglets were raised from eggs that were not killed by the bacteria or fungus. Based on the success of this effort, the captive rearing facility will be expanded in 2002. The frog';s habitat use is also being studied, with the objective of identifying potential areas for reintroduction.

Biology and Conservation Status of the Sharp-tailed Snake, *Contia tenuis*

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The Sharp-tailed Snake (*Contia tenuis*) is a small, rare snake that has only been found at eight locations in BC. All but one of these locations are from Southern Vancouver Island and the Gulf Islands, and these places typically face south, in or near small openings in Douglas-fir/Arbutus forests. The snakes are rarely seen at most of these sites, and in general, very little information is available on the distribution and size of Canadian populations. Because relatively small numbers of Sharp-tailed Snakes have been found in only a few locations in BC, in one of the most densely populated areas of the province, they are at risk of extinction in Canada. They have been placed on the BC Red List, and have been listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada. A recovery team has recently been formed to develop a recovery strategy for Sharp-tailed Snakes in BC. Planned recovery activities will focus on landowner stewardship and gathering more information on population size and distribution.

The Prince Edward Island Frogwatch Program

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Prince Edward Island: Frogwatch (http://www.gov.pe.ca/frogwatch/index.php3) is a collaborative effort between the Environment Canada EMAN network and the PEI Provincial Government website with promotional input from the Canadian Nature Federation (CNF). The basic premise is that amphibians are good indicators of environmental health, it is easy to learn the calls of frogs and toads, and therefore the general public can make a contribution to ecological monitoring by participating in this program. The CNF made a big effort in the spring of 2000 to promote this program and others like it in each of the Provinces. In Prince Edward Island, the Frogwatch web site was not constructed until late spring 2000, so a second effort to promote the program was undertaken in 2001 by the authors. The CNF Frogwatch poster was mailed to each of the schools in the Province, accompanied by a letter from the Minister responsible for the environment which invited schools to book a demonstration session. After overcoming some problems , we were able to speak to over about 750 students at 10 schools, and to stimulate the interest of Science programmers within the school system. Currently 135 persons are registered with PEI Frogwatch. Results may be viewed by logging on to the website.

Characteristics, movements, and health of a Western Chorus Frog (*Pseudacris triseriata*) population at a breeding pond in southwestern Québec.

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We studied a population of Western Chorus Frogs (*Pseudacris triseriata*) at a breeding pond in southwestern Québec. A total of 951 captures of 842 adults was made between 19 April and 28 May 2001, using a 225 meter-long drift fence surrounding the pond. Frogs were measured, weighed, examined for diseases and deformities, marked, and released. The majority of individuals (97.1% or 540/556) arrived from day 0 to 7, with a peak (57.9% or 322/556) at day 3. Almost all frogs (99.5% or 393/395) left the pond from day 15 to 39, with a peak on day 15 (44.1% or 174/395). The sex-ratio was biased in favor of males (489 males: 353 females). For males (*N*=54) and females (*N*=49) that were recaptured, the mean duration in the breeding pond was 24.2±10.3 days and 20.2±9.7 days, respectively. Including frogs caught after the breeding season, a total of 864 adults was examined (499 males and 365 females). Females were slightly larger (SVL=25.48±0.08mm, *N*=365; weight=1.08±0.02g, *N*=197) than males (SVL=24.66±0.07mm, *N*=498; weight=0.95±0.01g, *N*=253). The tibia length was correlated with the SVL for both sexes (r^2=0.711, *N*=503, p< 0.001). Overall, 54 (6.3%) presented body scars or traumatic digit amputations and 22 (2.5%) had minor anomalies such as brachymely, syndactyly, or eye color variant (black eyes). Chytridiomycosis was diagnosed in 54 of 142 (38.0%) adult *P. triseriata* sampled during the breeding period. Chytrid infection is enzootic in this apparently healthy population and has not yet been associated to any cases of disease or mortality.

Demographics of yellow-spotted salamanders (*Ambystoma maculatum*) in relation to agricultural land use in Nova Scotia

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We investigated the sex ratios, age structures and snout-vent lengths (SVL) of yellow-spotted salamander populations breeding in eight ponds in an agricultural area of Nova Scotia (Annapolis Valley). Salamanders were live-trapped in spring 1997 as they approached breeding ponds, using drift fences and side-flap pail-traps. Animals were sexed, measured, and a toe was collected for aging purposes. Of 835 salamanders captured, age was determined for 183 using skeletochronology. For all salamanders from all ponds, the sex ratio was highly skewed in favour of males (220 females/615 males) and breeding females had longer average SVL than males (mean +/- SD: 88.1 +/- 6.3 mm, 76.2 +/- 5.9 mm, respectively). For aged salamanders, the median age of breeding females (5 years, range: 1 - 9) was greater than males (4 years, range: 1 - 14). Land use within 100 m of each pond was determined for the previous nine years. The agricultural intensity around each pond was ranked based on pesticide use patterns for the different crop types present. A mean agricultural intensity score was determined for each pond, and ponds were grouped into 4 low-agricultural-intensity ponds and 4 high-intensity ponds. There was a significant difference in sex ratios between the four high-agricultural-intensity ponds and the four low-intensity-ponds, with high-intensity ponds having a higher proportion of females (34%) than in the low-intensity ponds (23%). Male salamanders were significantly younger in high-intensity ponds than in low-intensity ponds; a similar trend in female ages was not significant. Salamanders in high-intensity ponds had longer SVL than those in low-intensity ponds; the difference was larger for females than males. SVL of all male salamanders increased with age, and males in high-intensity ponds were longer than males of the same age from low-intensity ponds. Breeding female SVL did not increase with age. It is not possible to conclude from this study if agricultural land use was the direct cause of the differences observed. Pesticide use could be more toxic to smaller salamanders. However, this is only one of the possible mechanisms through which agricultural land use could account for the differences observed in age structures, body sizes and sex ratios.

Methods for the Induction of Breeding in the Northern Leopard Frog, *Rana pipiens*

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The development of a laboratory breeding program for *Rana pipiens* would decrease the reliance of researchers on natural populations and seasonal work. There are currently two methods for the induction of breeding in *Rana pipiens*. The first method, Rugh (1962), involves artificial fertilization using injected pituitaries, egg stripping from the female and the removal of testes in the male. The second method, Savage (1999), involves unnatural hibernation, the injection of leutinizing hormone-releasing hormone followed by fertilization through amplexus or unnatural fertilization following the Rugh (1962) method. To test the effectiveness of the Savage (1999) method, we used 13 males and 15 females over a year and a half. During unnatural

hibernation, there was high death among the males but only 20% death in the females. Eggs were produced by 50% of the surviving females but only three pairs successfully amplexed and produced fertilized clutches. In an attempt to increase the efficiency of egg production and fertilization another method was employed. This method used a temperature and photoperiod regime in the hibernation quarters to simulate conditions in the field. No males were hibernated but were still actively calling when injected. All females survived hibernation and 80% (4/5) of the females laid eggs using this method with a 20% fertilization rate. This method is currently being repeated to determine its rate of success.

Abundance and distribution of amphibians in selected aquatic habitats of Prince Edward Island

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No comprehensive surveys of amphibian populations of Prince Edward Island have been conducted since 1981. The objectives of this study were to determine if the abundance and distribution of amphibians were correlated with specific pond characteristics and to compare the effectiveness of five methods in assessing species abundance and distribution. We sampled 18 ponds, 13 inside PEINP and five in regions outside the park across PEI during the breeding season of 2000. Seven of the nine amphibian species found on PEI were detected at these sites. Species richness was negatively correlated with both water temperature and conductivity. Auditory surveys were the most efficient method of monitoring anuran presence in aquatic habitats while visual surveys were the most effective method of monitoring urodele presence in aquatic habitats. While this study provided information on general abundance and distribution of amphibian populations on Prince Edward Island, studies should be continued in order to determine if amphibian populations on PEI are stable.

The developing frog hypothalamus as a sensor for estrogenic EDCs

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The recent decline of worldwide amphibian populations has been attributed to various biotic and abiotic factors. Habitat fragmentation, ultraviolet radiation, disease and toxic chemicals all have the potential to impact on the aquatic environment, making it difficult to discern a cause and effect relationship behind amphibian declines. The influence of toxic chemicals on amphibian biology can often result in outright mortality, repressed reproductive ability or deformities. One particular group of substances, endocrine disrupting chemicals (EDCs), can upset delicate hormonal interactions that control growth and reproduction. Exposure to EDCs can be especially detrimental during development since the hypothalamo-pituitary axis and hormonal pathways controlling metamorphosis begin to form during the early larval stages and continue to change through to adulthood. Examining the changes in gene expression of the developing hypothalamus may provide clues regarding the target pathways and mechanisms of action of a particular chemical or hormone, for example estrogenic pollutants. A correlation between

changes in hypothalamic function as measured through multiple gene expression profiles and a disruption in metamorphosis would provide a powerful and novel diagnostic tool for detecting EDCs. We propose to use this multilevel approach to study developmental changes in sensitivity of leopard frog tadpoles to estrogenic chemicals.

Differences in Size, Pigmentation and Fluctuating Asymmetry in Stressed and Nonstressed Northern Leopard Frogs (*Rana pipiens*)

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We compared a range of anatomical features of northern leopard frogs (*Rana pipiens*) collected from areas where deformity rates were low (~2% - nonstressed regions) and high (~40% - stressed regions) to determine if one or more of these characters might be useful in detecting developmental stress. Deformed individuals from stressed regions were significantly lighter than normal frogs from the same area and from nonstressed regions. Body length, head width, femur length, and forelimb length were also significantly shorter in deformed and normal individuals from the stressed region than in individuals from nonstressed regions. Despite being smaller, deformed individuals had significantly larger pigment spots. Fluctuating asymmetry in femur length, femur spot area, femur spot number, and tibio-fibula length was significantly greater in deformed frogs than in normal frogs from the stressed population and the nonstressed group. Of these, however, only femur spot number provided a data set suitable for fluctuating asymmetry analysis (R-L values have a normal distribution, no directional asymmetry, no size-dependent asymmetry). There were no significant differences found among the three groups for fluctuating asymmetry in forelimb length, eyespot area, lateral spot number, and lateral spot area.

Reptile health and disease: a Canadian perspective

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Diseases are becoming an important issue in reptile population declines and they have been incriminated worldwide in some dramatic epidemic events. Emerging infectious diseases are also of concern, some having been associated with the introduction or translocation of species. Unfortunately, information on diseases in wild reptile populations is rather limited. We have reviewed the existing international literature, which includes 79 published reports on abnormalities, diseases, and mortalities in Canadian reptile populations. The Canadian accounts include 15 snake and 9 turtle species; no health information was found for any of the 6 native lizard species occurring in Canada. Information was fragmentary and consisted mostly of reports of endoparasitism, color mutations and variations, and road mortality events. Extremely little information was available on the prevalence of infectious agents and their impact at the population level. Considering the precarious status of most Canadian reptile species, there is an

urgent need for baseline information on their health status in order to establish sound conservation programs. Such information would allow improved population management of reptile species by diminishing the risk of disease propagation in vulnerable populations.

Santé et maladies chez les reptiles: une perspective canadienne.
Les maladies deviennent une préoccupation majeure dans le déclin des populations de reptiles. Elles ont été incriminées dans des cas d';épidémies sévères à travers le monde. Les maladies infectieuses émergentes sont également préoccupantes, certaines ayant été associées à l';introduction ou à la relocalisation de certaines espèces. Malheureusement, l';information disponible sur les maladies des populations naturelles de reptiles est plutôt limitée. Nous avons passé en revue la littérature internationale qui inclut 79 rapports publiés sur des anomalies, maladies et mortalités dans des populations de reptiles au Canada. Les données canadiennes concernaient 15 espèces de serpents et 9 de tortues. Aucune information n';a été trouvée sur la santé des 6 espèces natives de lézards présentes au Canada. L';information rassemblée était fragmentaire et comprenait principalement des rapports sur des parasites internes, des mutations et variations pigmentaires, et des cas de mortalité routière. Très peu d';information était disponible sur la prévalence d';agents infectieux et de leurs impacts au niveau des populations. Considérant la situation précaire de la plupart des espèces de reptiles au Canada, il y a un besoin urgent de données de base sur leur santé afin de mettre en place des programmes de conservation judicieux. Ces informations nous permettront d';améliorer la gestion des populations de reptiles en diminuant le risque de propagation de maladies dans des populations vulnérables.

The Wood Turtle, *Glyptemys insculpta*, at River Denys: A second population for Cape Breton Island, Nova Scotia

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The Wood Turtle, *Glyptemys insculpta*, population at River Denys, Inverness County, Cape Breton Island, Nova Scotia, was unknown to science until the summer of 1999. Andreas Gräf photographed a hatchling at McLennan Brook on 17 September 1999, and three adult males between 14 and 19 September 2000. John Gilhen photographed two adult females at South Side

River Denys on 18 June 2001. He also located a predator excavated nest and empty egg shells on a stony-gravel bank at the outflow of McLennan Brook and found one sub-adult male at the edge of a hay field on 19 August 2001. These observations, as well as one nesting site and five basking sites identified by Stephen M. Sober along the main branch of River Denys, confirm a natural breeding population of Wood Turtles exists in the River Denys Watershed.

The species richness, abundance, and diversity of amphibians in terrestrial habitat fragments of Prince Edward Island

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Habitat fragmentation often has negative effects on the abundance and diversity of wildlife species. The abiotic and biotic characteristics of a habitat also affect the ecology of the species residing within a habitat. In this study, I investigated the relationships between the species richness, abundance, and diversity of amphibians with physical, abiotic, and biotic factors characterising specific sites. Another goal of this study was to provide information concerning the current status of amphibian species inhabiting terrestrial habitats on Prince Edward Island, as research concerning this taxa is scarce in this province. Eleven sites located in the central region of Prince Edward Island were sampled from May 1st to August 15th 2000, and in five of these sites sampling was extended until September 30th. Drift-fence/pitfall arrays were used to sample amphibians. Cover boards and time-constrained searches were also used with the intention of providing additional information on urodeles, in particular red-backed salamanders. The drift-fence/ pitfall arrays were found to be the most efficient sampling technique. Although all nine amphibian species known to occur on Prince Edward Island were sampled, the maximum species richness per site was seven. Amphibian abundance was found to be correlated with fragment perimeter, and species richness was negatively correlated with pond area. Amphibians occurred more often than expected in areas with canopy. My results on the population status of amphibian species generally confirmed the findings of previous studies.

Nested herpetofaunal assemblages on islands: lessons for conservation

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For centuries, studies of islands have taught us much about biology and they continue to enlighten us. Amphibians and reptiles of the Laurentian Great Lakes form a widely distributed and highly overlapping diverse assemblage of species. Islands in the Great Lakes differ in aspects of their geography, geology and climate, but share a common post-glacial history. Our goal was to document and explain the patterns of nestedness across a variety of spatial and taxonomic scales. We studied amphibian and reptile assemblages (47 species) occurring on 107 landbridge islands among four archipelagoes (Lake Erie, St. Lawrence, Georgian Bay, Apostle) in the Great Lakes. We constructed presence-absence matrices from four recent surveys and quantified nestedness using the temperature (*T*), departures (% *PN*), and Wilcoxon methods. Islands supported diverse assemblages resembling mainland source pools and were significantly nested across the entire basin, all archipelagoes, and all taxa, but did not differ among archipelagoes. The degree of nestedness differed (most to least) among classes (reptiles, amphibians), orders (snakes, turtles, frogs, salamanders) and species. Nestedness and species richness were strongly associated with area but not isolation. The similarity of insular and mainland faunas indicate that the entire basin shares virtually the same species pool. Differences in nestedness among taxa appear to be related to differences in basic biology, natural history, and ecology. Our results suggest that preserving large islands instead of equivalent areas of small islands would be a more effective conservation strategy and results of island studies may be applicable elsewhere in the Great Lakes basin.

Reptilian conservation can brush against, but cannot afford to shake hands with uncertainty: Reasons why long-term life history research must precede wildlife conservation efforts for long-lived reptiles in Canada

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The management of wildlife for conservation can be generally described as "human efforts to maintain wild creatures". Conservation is challenged to understand and maintain the preexisting infrastructure (biology and ecology) that is vital to the persistence of wild creatures. The relatively long lives and somewhat unique life-histories of many reptiles describe the foundation of the natural infrastructure that should guide reptilian conservation efforts. However long-term life-history research of reptiles is rather scarce. What are the costs and benefits of long-term research to conservation in general and why might the benefits of long-term research outweigh the costs for reptilian conservation efforts.

Estimating northern limits in Canadian turtles: a method to estimate historical and potential distribution?

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Development rate of embryos in many turtle species is positively correlated with incubation temperature. We developed a growth model that shows that developmental stage, *s*, is largely a function of accumulated heat units within a nest, $u(t)$, and time since oviposition, t ($s=k_0 + k_u u(t) + k_t t$). The model uses developmentally staged snapping turtle (*Chelydra serpentina*) and painted turtle (*Chrysemys picta*) embryos collected from Algonquin Park, Ontario. The growth model explains 87.1% of the variation in developmental stage for snapping turtles ($n=129$, $p<0.0001$) and 82.3% ($n=102$, $p<0.0001$) in painted turtles. A growth model can be used to determine the developmental factors limiting species'; distribution. We tested the hypothesis that the distribution of turtles in Ontario is limited by incubation temperature in all Canadian turtle species. We predicted that the northern limits are dependent on the average amount of heat available over the growing season. Predicted and actual range limits were similar. This preliminary study suggests that with better data on development times and environmental temperatures we could provide useful guidelines for future conservation and restoration of reptile populations.

New insights into the biology of leatherback turtles (*Dermochelys coriacea*) in the Northwest Atlantic

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The leatherback turtle (*Dermochelys coriacea*) is a giant marine reptile with an impressive geographic range. While the most northerly nesting beaches for leatherbacks in the Atlantic are found along the coast of Florida, these turtles spend much of their time at higher latitudes, including waters off Atlantic Canada. The leatherback is considered critically endangered globally (IUCN, 2000) and endangered in Canada (COSEWIC, 2001). Since 1998, a program in Nova Scotia has involved commercial fishers in marine turtle research and conservation initiatives. This work has yielded new information on the biology of leatherback turtles in the northern part of their range, including an improved understanding of local and long-distance movements. This research has also necessitated a reconsideration of the importance of Canadian waters to this species.

Marine Turtles and the Canadian Atlantic pelagic fishery: a previously unrecognized potential source of sea turtle mortality

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Three species of marine turtles occur in Canadian east coast waters; the loggerhead, *Caretta caretta*, Kemp's ridley, *Lepidochelys kempii*, and the leatherback, *Dermochelys coriacea*. Until relatively recently, marine turtles in Canadian waters were often considered extralimital wanderers. However, it is now clear Canadian waters and nearby areas outside the 200 mile limit provide important seasonal habitat for significant numbers of loggerehead and leatherback turtles. Preliminary information also suggests that in some years significant numbers of leatherbacks and juvenile loggerheads are being taken incidentally by Canadian and foreign longliners, operating both inside and outside the Canadian 200 mile limit. Here I review new information on sea turtle distribution in relation to the Canadian Atlantic pelagic fishery, consider the results of a recent meeting on sea turtle by-catch in the Canadian Atlantic fisheries, and suggest that conservation of sea turtles in Canadian waters could be enhanced through Canadian participation in the recently ratified Inter-American Convention for the Protection and Conservation of Sea Turtles.

Amphibian species richness and distribution in northwestern Ontario: is hydroperiod important?

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Understanding amphibian distribution is of fundamental importance if we wish to prevent the decline of species. Amphibians are often categorized as either 'temporary'; or 'permanent'; pond species where the major respective stresses are desiccation and predation. Because these processes are opposing, species richness should be greatest in 'semi-permanent'; sites. A hypothesized cause of amphibian decline is climate change and drought. Under this scenario, species richness would be expected to be greatest at permanent sites, which may act as 'sources';. Do certain types of breeding areas support more species than others? Are certain species more common in one type of breeding area than another? Our goal was to answer

these questions by investigating amphibian species richness and distribution in different water body types in the Boreal forest in Northwestern Ontario. We surveyed 32 temporary, 30 semi-permanent and 31 permanent water bodies to determine which amphibian species were present. We found that the average species richness of the temporary sites was significantly lower than both semi-permanent and permanent sites, but species richness did not differ between semi-permanent and permanent sites. However, certain species are more common in one type of site than others. For example, *Rana clamitans* occurred at 81% of permanent, 20% of semi-permanent and 0% of temporary sites. Whereas *Pseudacris triseriata* occurred at 60% of semi-permanent, 50% of temporary, but only 3% of permanent sites. On the other hand, *Pseudacris crucifer* was nearly ubiquitous, while *Rana pipiens, Notophthalmus viridescens and Ambystoma laterale* were rare at all site types. Our results suggest that the traditional desiccation/ predation stress model is not supported in boreal amphibian assemblages. However, for conservation of individual species it is important to identify site characteristics that affect survival of populations.

Species totemization in herpetological conservation

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The reporting of scientific research downplays the emotional content of the subjects studied, but once we begin to use scientific results to try to change other people's behaviour, we've got to both acknowledge our emotional involvement with our subjects, and then try to use that involvement to try to evoke an echo of our commitment to our beasts among those who would otherwise kill or ignore them or degrade their habitat. I suggest that it may clarify our thinking and educational activities to compare the empathy of the specialist with the creature studied, with the 'totem' concept of shamanic cultures. I will discuss three sorts of herpetological totems:

Personal totems are those species we've worked most intensely with and understand most clearly, so that we feel compelled to know everything that is done with them, and eventually become, in an inversion of the old shamanic relationship, the species' protector and advocate against human ignorance and destruction. In an era when children often have severely restricted exposure to wild herps, one goal of education must be to facilitate the totemic experiences that will make naturalists of previously TV-bound youngsters.

Conceptual totems: We need to identify the ecological and evolutionary lessons that are most clearly taught by particular species, and push these in educational programmes as emblems or totems of these processes - Leopard Frogs represent landscape-wide habitat connections, Jefferson's complex *Ambystoma* represent species-level complexity, Greensnakes represent cryptic coloration, and Rattle Snakes represent dependence on limited hibernacula - but this has to closely follow the most recent research to keep from becoming repetitious and silly.

Locality (including seasonal) totems: may be either regional totems - especially characteristic and vulnerable species that characterise a whole region, as neotenic *Ambystoma tigrinum* do for the Okanagan, or species that use particular sites in particular seasons, like winter Mudpuppies below the dam at Oxford Mills. In Canada many of our populations persist only because of peculiar juxtapositions of habitat patches, and much of our conservation effort goes into raising public awareness of what goes on at particular sites: road crossings, breeding

congresses, foraging areas, and hiberncaula, and protecting these from wanton or unwitting destruction. There's plenty of room for improving our own understanding of the environmental triggers of seasonal activity, and in the course of doing so, communicating the possibility and joy of observing these activities to narrowly focused, bird-&-flower-struck naturalists and the non-naturalist public.

Pseudacris triseriata on the Five-Mile Block (Tobermory, Bruce County, Ontario): 1984-2001

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Despite a scattering of records from the 1970's, and George Toner's 1963 assertion that *P. triseriata*, the Striped Chorus Frog, was the most abundant amphibian on the Bruce Peninsula, on the outer Bruce Peninsula in the 1980's and 1990's this species seems to have been confined to a small area southeast of Tobermory, the 'Five-Mile Block.' This is the only place on the outer peninsula where the concession system is completed as a closed block of roads, and much of the area was farmed in the first half of the 20th century. My surveys in 1984, 1990, and 1992 found the species throughout the block, but in 1997 I heard only 3 choruses, and in a detailed survey in 1999 John Francis heard only a single doubtful call. In 2001 a survey of all the sites where the species had been heard did not find any. This may be exemplary of the general decline of Chorus Frogs in southern Ontario and the St Lawrence Valley: a general lowering of water levels by building-up and gravel extraction, coupled with secondary succession and successive dry years, seems the most likely explanation for the extinction of this population.

The Western Chorus Frog – declining but not at risk?

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The Western Chorus Frog (*Pseudacris triseriata*) has recently been designated Not at Risk by COSEWIC, despite having declined significantly in Quebec. Although it is widespread in Ontario, we provide b circumstantial evidence of declines. We analyzed the status of the Chorus Frog using volunteer monitoring data. Over 5000 records were obtained, spanning the period 1858-2000. Chorus Frogs were reported from 30 UTM grid blocks (100 x 100 km) and 780 grid squares (10 x 10 km). Only 31% of squares have records from the last five years. We used Spring Peeper data to control for the possibility that lack of recent records may indicate a lack of observers not a genuine decline. On that basis, an average of 10% (range: 0-50%) of squares per block have potential absences. Four out of five of the blocks (17MT, MU,MV,MA) with the highest ratio of potential absences are contiguous, stretching along the eastern shore of Lake Huron.

Do we need a National amphibian and reptile database?

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We conducted a survey of amphibian monitoring and atlas projects to assess the potential for a national approach to compiling and/or analyzing amphibian occurrence data. Thirty-three programmes were surveyed and twenty have responded to date. The oldest atlas programme (Ontario) is 18 years. The modal age of volunteer monitoring programmes is 1 year (max. 9). Although all provinces and territories have at least one monitoring programme (FrogWatch), three of the four longest running ones are based in Ontario. For this reason it was deemed premature to start national analysis of trend data. Only four provinces have atlas programmes although several others are compiling some atlas type data. Most respondents were interested in participating in some type of national project and urged that it include reptiles. We therefore propose that CARCNet undertake a National Historical Data Compilation Project. The goal of such a project would be to compile geographically referenced, historic records of all amphibians and reptiles in Canada up to and including the year 2000.

Red-sided garter snake (*Thamnophis sirtalis parietalis*) relocation and education project

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In 1998, a red-sided garter snake (*Thamnophis sirtalis parietalis*) relocation project was initiated in the Stony Plain area, west of Edmonton. The goal of the study was to determine whether snakes would overwinter when relocated from one hibernaculum to another. A total of 1190 garter snakes were captured and relocated to a den 6 miles away that contains about 8 700 snakes (located in an old gravel pit). All captured snakes were scale-clipped, measured and weighed, and all snakes > 45 cm snout-vent length were PIT (Passive Integrated Transponder) tagged. Thirty percent of the relocated snakes returned to the new den the following year. Marked snakes from the gravel pit den showed a 32% return rate. None of the relocated snakes returned to, and no new snakes were observed at, their previous den site at the completion of the project (spring 2001). Data analyzed showed the new den to contain a normal distribution of sizes, with the 41-50 cm size class having the highest number of snakes. Relocated adult female snakes also showed evidence of breeding (cloacal plugs). Overall the project was very successful, and showed that snakes can be relocated successfully to another occupied den. Education projects included talks, posters, field trips, media releases, and another snake den management program (in Fort Assiniboine, Alberta). A Snakes of Alberta poster was released and will also increase public knowledge about snakes and their ecology.

Current status of the Nova Scotia Herpetofaunal Atlas

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The Nova Scotia Herpetofaunal Atlas is a 5 year project that was initiated to assess the distribution and abundance of reptiles and amphibians through the efforts of volunteers. The volunteers are now in their third year of data collection and have submitted a total of 2684 records in 343 map squares across Nova Scotia. Submissions have increased each year, starting with 340 records in 1999 and growing in number to 1119 in 2000, and 1225 in 2001. I will discuss the project';s methodology, present the results so far, and discuss the probability of meeting project goals. Our web site is http://landscape.acadiau.ca/herpatlas/

Growth rates and deformities of green frogs and leopard frogs from areas differing in agricultural intensity on Prince Edward Island

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In Prince Edward Island, approximately 50% of the land is devoted to agricultural production. The most important crop, potatoes, requires repeated (often 10-15) applications of pesticides throughout the summer and fall. If amphibians are particularly sensitive to such chemicals, then we would predict differences in growth rates and / or deformity rates in areas of high and low agricultural intensity. We present the preliminary results of a three year study examining the potential relationship between amphibian health and land use patterns on PEI. There is limited evidence suggesting that agriculture may be affecting the growth and development of green and leopard frogs.

Multiple stressor effects on native amphibians

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An overview of an ongoing collaborative project examining effects of multiple stressors on native amphibians will be presented. The research focuses on herbicide contamination, acidity and food deprivation as potential concomitant and interactive stressors relevant to amphibians in small Canadian forest wetland ecosystems. Direct, indirect, interactive and sublethal effects have been examined through four tiers of investigation ranging from highly controlled laboratory toxicity tests, through field mesocosm studies to operational monitoring. Tier I studies provide concentration-response data for two herbicides of interest as well as comparative assessment of life-stage and species sensitivity for *Rana pipiens, Rana clamitans, Bufo americanus* and

Xenopus laevis. Tier II experiments examine interactions between pH, food deprivation and herbicide stressors for both zooplankton and most sensitive life stages of amphibian larvae. Tier III studies involve replicate mesocosms deployed in two different wetland systems to study effects of the two herbicides on plankton population dynamics and caged amphibian larvae under varying natural site conditions. Finally, operational monitoring studies quantify the range of real-world exposure concentrations resulting from aerial applications of herbicides to forest regeneration sites where small wetlands may be over-sprayed, adjacent or protected by vegetative buffers. Key findings from different tiers of study and their value in risk assessment and protection of native amphibian species will be discussed.

Comparative phylogeography of the Pacific Northwest: Community history as a guide to conservation science

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Palaeoecological techniques, such as carbon dating and pollen analyses, aid in reconstructing a time-indexed chronology of ecology of the geologic past. Community formation can now be confidently reconstructed by comparing palaeoecology with the modern geographic overlay of species, genes and their frequencies. Syntheses of palaeoecology and nested statistical geographic analysis of haplotype phylogenies enable explicit tests of biogeographic hypotheses. Such research falls under the discipline of phylogeography, which has revolutionized conservation science and practices. A comparative overview of phylogeographic research in the Pacific Northwest, with a focus on unpublished research on long-toed salamanders, will be presented in the context of conservation methodological debates. The Pacific Northwest experienced a great recession of Pleistocene glaciers that opened a wave of ecological succession mediated by geographic barriers and prescribing northward dispersal corridors. Such corridors are readily reflected in patterns of herpetofauna distribution as these organisms share characteristic life histories that leave a historical genetic signature in their place of residence. The Pacific Northwest has recently been the focus of intensive study in this context. A comparative examination of this research identifies the nature of historical community development and prescribes the boundaries that were significant in this regard. The explicit criteria to identify these boundaries are discussed, offering a practical approach to the use of evolution as a guiding principle in conservation management. Evolutionarily cognizant management regimes have been developed including Evolutionary Significant Units (ESU';s), which addresses genetic diversity, and frameworks that consider adaptive diversity. A new approach, the historical recapitulatory methodology, will be presented with suggestions that it serve as a new guiding principle of conservation science and that it replace the endangered species concept.

Hyla Park: Lessons learned in the establishment of an amphibian conservation area in a semi-urban setting

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Hyla Park was established by the Nature Trust of New Brunswick in 1995 to protect the most northeasterly North American population of the gray treefrog, *Hyla versicolor*. The Nature Trust manages the site under a long-term lease with the local municipality of Fredericton. The site, consisting of about 9 hectares of wetland in south-cental New Brunswick was previously threatened. It is probably the first conservation area in Canada specifically set aside to protect an amphibian. The habitat at Hyla Park is highly disturbed. Most ponds have formed in now heavily vegetated low areas from which topsoil and gravel were removed in the past for construction purposes. However, this history of previous activity at the site has left a network of roads and trails that have proven useful to the Trust in providing public access to the Park. With volunteer assistance, considerable refuse has been removed from the site, a network of interpretive tails and signage have been installed, and an educational video about the site has been produced. The site is now used regularly by local naturalists groups and school classes interested in wetland ecology, and some scientific research has been carried out at the Park. While the Park has provided more educational opportunities than anticipated, the commitment demanded of volunteers to ensure the success and continuing maintenance of the site has also proven greater than expected. Although vandalism of signage and ATV traffic continue to be problems at Hyla Park, some local residents have taken a protective interest in the gray treefrog and threats to wetlands in the area generally.

Painted Turtles (*Chrysemys picta*) of Vermont: an examination of phenotypic variation and intergradation

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The Painted Turtle, *Chrysemys picta* Schneider (family Emydidae), has been divided into four subspecies (with differing morphological characteristics), two of which intergrade in the Northeastern United States. The intergradation of *C. p. marginata* (Midland Painted Turtle) and *C. p. picta* (Eastern Painted Turtle) has been well studied in some areas, but has been poorly studied in Vermont, an area that could contribute important information on this species and the process of intergradation. Turtles were trapped and released from three different watersheds in Vermont, and others were examined from collections at the Carnegie Museum of Natural History from within the center of the ranges of the two parent subspecies to investigate the hypotheses that Vermont';s turtles are intergrades, and that the amount of influence from each subspecies differs with drainage in Vermont. For the external characteristics of scute disalignment, scute border width, and plastral figure, many of Vermont';s turtles were determined to be significantly different from typical *C. p. marginata* and *C. p. picta*, and were intermediate to them, strongly suggesting that they are intergrades. Samples from the southeast corner of the state were determined to be *C. p. picta*.

Poster Presentations

Analyses of gross morphological deformities of the Common Snapping Turtle (*Chelydra serpentina serpentina*) in Algonquin Provincial Park, Ontario

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Current literature on reptile deformities suggests that a higher rate occurs at sites contaminated by various pollutants than in those without. This leads to the assumption that contaminants are related to the development of gross morphological deformities. Toxicological studies involving the common snapping turtle (*Chelydra serpentina serpentina*) in Southern Ontario typically use Algonquin Provincial Park as a control site. It has been documented in the literature, that the rates of hatchling deformities in turtles at this site are quite low (< 5%), representing a normal background level. However, a recent study looking at hatchling deformity rates over a five year span indicated that there is a high level of variation between years, anywhere between 6 and 31%. Toxicological studies have focused on hatchling deformity rates for logistical convenience, however, it might be more meaningful to know the adult population rate to interpret a more accurate biological effect of contaminants. In this study, we have determined the background adult snapping turtle deformity rate in Algonquin Park, as well as examined the effect these deformities have on the survivorship of the turtles. In addition, the potential for a genetic cause of transmission of deformities between mothers and hatchlings was investigated. This was accomplished by statistical analyses of a comprehensive database collected over a thirty-five year period.

The effects of UV-B radiation and octylphenol (OP) on growth, metamorphosis and survival in the northern leopard frog (*Rana pipiens*)

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Recent increases in UV-B radiation and the presence of various estrogenic pollutants in the aquatic environment are considered as contributing factors to the decline in amphibian populations observed worldwide since the 1960s. It has been shown that exposure of developing amphibians to ambient or enhanced levels of UV-B radiation induces morphological deformities and reduces survivability. OP is a toxic metabolite of alkylphenol polyethoxylate present in industrial effluents and has demonstrated significant estrogenic activity in fish and mammals. Our study examined the effects of short-term and long-term exposure of *Rana pipiens* tadpoles to environmentally relevant levels of UV-B radiation (7 and 14 mW/cm2) and OP (1ng/L and 1 mg/L), alone and in combination. Tadpoles exposed to 1ng/L OP for 11 days immediately post-hatch resulted in a significant reduction ($p<0.05$) in body weights at forelimb emergence (Gosner Stage 42). In the long-term experiment, all tadpoles exposed to UV-B radiation throughout the entire larval period had retarded development and increased weight ($p<0.05$); metamorphosis in these groups was never initiated. A high level of abnormalities has been observed in treatments for both experiments, consisting mainly of abdominal bloating and lordosis. The incidence of deformities observed in exposed tadpoles was 2-7 fold higher than the control groups. A separate study focused on the effect of early exposure to OP on

amphibian growth and survival. Newly hatched tadpoles exposed for 14-days to 0.25-0.75 mg/L OP were significantly larger ($p<0.05$) than the vehicle–exposed controls (0.01% EtOH). In a comparison between the toxicity of OP and estradiol, exposure to 0.75 mg/L E2 after 14-days resulted in 70% mortality whereas exposure to the same concentration of OP resulted in 100% mortality after 1 day. These results indicate that early exposure to UV-B and/or OP can disrupt normal growth and development of *R. pipiens* tadpoles.

Northern leopard frog reintroduction project

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The northern leopard frog (*Rana pipiens*) was once a common and widespread amphibian found throughout central and southern Alberta. During the late 1970s, the leopard frog experienced a dramatic decline in distribution and numbers over much of its historic range in Alberta. The leopard frog is designated as *Threatened* under Alberta';s Wildlife Act and is listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as *Special Concern* in Alberta. Known distribution data indicate the leopard frog is currently extirpated from the upper head waters of the Red Deer River drainage and entirely absent from the North Saskatchewan River drainage.

In 1998, the Alberta Fish and Wildlife Division began to explore the feasibility of reintroducing leopard frogs into formerly occupied habitats in the upper Red Deer River and North Saskatchewan River drainage basins in Alberta. With little ability to naturally disperse back into historic parts of its range, a pilot reintroduction project was initiated in 1999 at the Raven Brood Trout Station near Caroline, Alberta. The project involved the captive rearing of leopard frogs from egg stage of development to metamorphosed frog, in two man-made outdoor ponds at the trout station.

The primary objective of the project is to re-establish leopard frogs in the headwaters of the Red Deer River and North Saskatchewan River drainages, consequently allowing natural downstream dispersal along these watersheds. Over a three year period more than 4500 young of the year leopard frogs have been released into historic habitat in the upper headwaters of the Red Deer River near Caroline, Alberta. In 2001, 750 young frogs were released at a new pilot release site in the upper headwaters of the North Saskatchewan River near Rocky Mountain House, Alberta. All captive reared leopard frogs were marked using a Visible Implant Elastomer (VIE) tagging system that allowed unique marking schemes to be used to assess the success at each release site and monitor the dispersal of released frogs.

On 19 June 2001, three leopard frogs that were released in previous years were located within the study area near Caroline, marking the first occurrence of leopard frogs in that area in nearly 50 years. At least 10 individual leopard frogs have been observed or captured to date within the study area and calling activity was recorded. Evidence of the overall success of the project, at the first release site, may be realized in the spring of 2002 when previously released frogs that have reached sexual maturity will have the opportunity to breed for the first time.

FROGWATCH CANADA: Conservation & education with the Canadian Nature Federation and the Ecological Monitoring and Assessment Network

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Several different amphibian survey protocols are currently accessible by North Americans through the Internet. However, the key to valuable conservation efforts lies in the collection of reliable monitoring data. CNF and EMAN have developed the Frogwatch Teachers' Resource Guide to facilitate the involvement of non-scientists by advocating amphibians as important indicator species. We believe that public awareness of global environmental issues is enhanced when groups or individuals make a commitment to engage in observing phenology in their community. The Frogwatch program is intended to foster nature appreciation among Canada's youth. By providing educators with tools such as lesson plans and activities, carefully guided field trips, and access to current scientific resources -- CNF and EMAN aim to forge a critical link between backyard conservation and the role of science in a natural setting. In collecting monitoring data on a national scale by a variety of local programs and over a variable number of years comes the need to develop national protocols. Given the magnitude of this situation we need to initiate clear protocols on the monitoring, reporting and structuring of data. If data systems are centralized and can cross query one another this will help to insure that data is used to a maximum extent while minimizing interpretation errors. This would systematically simplify the assessment of anuran trends in regard to population size, diversity or as indicators of ecosystem health.

Amphibian and Reptile Monitoring and Management in Alberta

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Amphibians and reptiles have existed for about 400 million years, long before humans were a part of the landscape. They are an important component of ecosystems and since they are environmentally sensitive, declines in their populations may be indicators of problems in the ecosystem. In Alberta, most of the long-term monitoring is conducted through the Alberta Amphibian and Reptile Monitoring Program (cooperative between Alberta Conservation Association and Alberta Sustainable Resource Development). Projects include volunteer monitoring, RANA (Researching Amphibian Numbers in Alberta), call surveys, snake den inventory, monitoring, and management. Over 250 people are involved in the volunteer monitoring program, and seven RANA sites are also being intensively monitored throughout of the province (Beaverhill Lake, Cypress Hills, Hinton, Kananaskis, Lesser Slave Lake, Meanook, and Saskatoon Island). Information is being collected on distribution, abundance, trends, and phenology of herpetiles. Management efforts include snake relocation, den and wetland management, and information distribution. Educational materials include Teacher's, Guides, herpetile posters, identification manuals and amphibian call tapes.

Comparative assessment of techniques for sampling native salamanders in riparian zones of boreal mixed wood forests: Proposed research

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Efficient standardized sampling techniques are essential for providing consistent data on amphibian populations. A variety of techniques (e.g. cover boards, drift fences, and pitfall traps) have been used in previous salamander studies, however, direct comparative assessments of these sampling techniques in terms of efficiency, variability, influencing factors, logistics and costs are generally lacking. Optimal techniques may vary with species, site and climatic factors and to our knowledge no comparative information pertinent to monitoring salamanders in boreal mixed-wood forests currently exists. This project will comparatively assess selected techniques in relation to the aforementioned criteria and will provide pre-treatment data for a four-year study designed to investigate the effect of differential harvesting in riparian zones on resident salamander populations. Potential study sites in the Chapleau/Folyete region near Timmins and alternative sites near White River Ontario are currently being evaluated. Species that may be encountered along riparian zones in these areas include: Blue-spotted salamander (*Ambystoma laterale*), Spotted salamander (*Ambystoma maculatum*), Four-toed salamander (*Hemidactylium scutatum*), Eastern newt (*Notophthalmus viridescens*) and Red-back salamander (*Plethodon cinereus*). Four different sampling techniques have been selected for comparison. Drift fences and pitfall traps will be set up near breeding sites and will be used when appropriate weather conditions are met. Artificial cover objects will be used, and both wood and paving stones will be studied. Night encounter surveys will be conducted when weather is ideal for sampling salamanders, and will involve sampling along transects. Breeding site surveys will allow for examination of salamander communities when salamanders are most conspicuous. Salamanders will be marked (for mark/recapture studies) using a Visible Implant Fluorescent Elastomer (VIE) tagging system. Electronic tracking to establish home range and local migration patterns may also be attempted. It is the goal of this study to increase knowledge regarding salamander populations in riparian zones of boreal mixed-wood forests and to determine appropriate sampling techniques for salamander species in northern Ontario. This study is funded principally by the Ontario Living Legacy Trust and involves collaboration among industry (Domtar Inc.), academia (University of Guelph) and government (Canadian Forest Service) institutions.

Indirect and multiple stressor effects of glyphosate and triclopyr herbicides on native larval amphibians (*Rana pipiens* and *R. clamitans*) in two wetland ecosystems in northern Ontario, Canada

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The effects of glyphosate (VISION) and triclopyr (RELEASE) on larvae of *Rana pipiens* and *R. clamitans* were investigated using in situ enclosures. Single application of either herbicide spanned environmentally realistic concentrations and relevant toxicological endpoints for

selected aquatic biota. At 96 hours post treatment, complete tadpole mortality was observed in all VISION and RELEASE treatments exceeding expected environmental concentrations in both wetland ecosystems. Mortality due to RELEASE was higher for both species in the more acidic (pH ~ 6), eutrophic wetland. In contrast, *R. pipiens* showed greater mortality due to VISION treatment in the neutral (pH ~7), mesotrophic wetland. Recovery from the sublethal effects of RELEASE was both site and species dependent. Tadpole growth appeared to be suppressed in RELEASE treatment concentrations exceeding 1.28 mg acid equivalent/L. Dissolved oxygen levels decreased with increasing herbicide concentration in both wetland systems, indicating impacts on the phytoplankton community in both systems. Results to date indicate concentration-dependent lethal and sublethal effects, differential species sensitivity and differential herbicide toxicity which vary depending upon the wetland system. Tadpole response may result from herbicide treatment via either direct or indirect mechanisms (e.g. anoxia, food deprivation) and/or multiple stress interactions (e.g. pH x herbicide).